

Aid Inflows and the Real Effective Exchange Rate in Tanzania

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Abstract

Tanzania is well placed to receive a significant increase in aid inflows in coming years. Despite the potential for the additional aid inflows to raise income levels in the country, increasing them may bring about structural changes in the economy that may be unwelcome. One such change is an appreciation of the real exchange rate that leads to a contraction of traditional export sectors and a loss of export competitiveness. This paper employs a reduced-form equilibrium real exchange rate approach to explain movements in Tanzania's real effective exchange in recent decades. Particular attention is paid to the relationship between aid inflows and the real effective exchange rate. The authors find that the long-run

behavior of the real effective exchange rate is influenced by terms of trade movements, the government's trade liberalization efforts, and aid inflows. Positive terms-of-trade movements are associated with an appreciation, periods of improving trade liberalization are associated with a depreciation, and increases in aid inflows are associated with a depreciation in the real effective exchange rate. Although the last result is non-standard, it is not empirically unique and does have theoretical underpinnings. A detailed analysis of this relationship over the last decade shows that the Bank of Tanzania's response to aid inflows is likely the main reason for the finding.

This paper—a product of the Economic Policy and Debt Department, Poverty Reduction and Economic Management Network—is part of a larger effort in the network to strengthen the Bank's capacity to analyze the implications of scaled-up aid inflows. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at frowe@worldbank.org.

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Introduction

The international donor community is being encouraged to deliver on its commitments to scale up its official development assistance (ODA) in low income countries (LICs). The G-8 Summit in Gleneagles agreed that the G-8 group of countries and other donors would increase ODA to Africa by US\$25 billion per year by 2010, which would represent a doubling of aid to Africa compared to 2004 levels. While aid to Sub-Saharan Africa has risen, the rate of increase is well short of that needed to achieve the Gleneagles commitments (World Bank 2007). Within Sub-Saharan Africa, aid inflows have and are expected to continue to be channeled to relatively well governed, good performing countries. With recent average annual real GDP growth of 6.0 percent (2000-06) and governance indicators that are improving relative to its neighbors, Tanzania has received a large fraction of aid inflows to Africa and may well receive a significant increase in coming years.

Despite the potential for additional aid inflows to raise income levels in Tanzania, increasing aid inflows may bring about structural changes in the economy that may be unwelcome. One such change is an appreciation of the real exchange rate that leads to a contraction of traditional export sectors and a loss of export competitiveness. A real effective exchange rate (REER) index is often monitored to detect possible changes in international competitiveness and is used to inform monetary and exchange rate policy, especially in times of aid surges. Unless the underlying causes for movements in an REER index are satisfactorily understood conclusions regarding changes in competitiveness based simply on appreciations or depreciations of the REER are incomplete.

This paper will examine how the REER has responded to internal and external macroeconomic developments over recent decades and pay particular attention to the relationship between aid inflows and the REER. We find that the long-run behavior of the REER is influenced by terms of trade movements, the government's trade liberalization efforts and aid inflows. Positive terms-of-trade movements are associated with an appreciation of the REER, periods of improving trade liberalization are associated with a depreciation of the REER, while increases in aid inflows are associated with a depreciation in the REER. While the last result is non-standard, it is not empirically unique and does have theoretical underpinnings. A detailed analysis of this relationship over the last decade shows that the Bank of Tanzania's response to aid inflows is likely the main reason for the finding.

I. Measuring the Real Effective Exchange Rate (REER)

In a small-open economy the real exchange rate may be its most important relative price measure and can be used as a key indicator of the economy's external competitiveness. There are numerous ways to measure the real exchange rate and the choice of measure depends on the analytic question under investigation and data availability to empirically measure it. The analytic framework used to derive the real exchange rate in this paper is the two-sector dependent economy framework developed by Salter (1959) and Swan (1960). In this framework the relative domestic price of non-traded to traded goods *within* the country is the real exchange rate. It is the relative price that achieves internal balance in the domestic supply and demand of nontraded and traded goods and captures the *internal* relative price incentives in an economy for producing or consuming tradable or nontradable goods (Hinkle and Nsengiyumva 1999). This measure has particular appeal in the low-income country (LIC) context and has been widely used in empirical real exchange rate studies (e.g. Van Wijnbergen (1985), Edwards (1989) and Elbadawi and Soto (2005)).

In principle, the domestic price indices of tradables and nontradables should be used to construct the *internal* RER, but these series are typically not available in LICs. In practice, the *internal* real exchange rate is measured using the foreign WPI and the domestic CPI. The foreign WPI multiplied by the nominal exchange rate proxies the home country's tradable goods price, while the domestic CPI is a proxy for nontradable prices in the home economy.² A key drawback in using the CPI as a proxy for nontradables prices is that the greater the weight of traded goods in the CPI implies a greater divergence in the proxy to nontraded goods prices. An important drawback in using foreign WPI is that it is unlikely to track fluctuations in a LIC's exports prices, especially commodity prices. It may, however, do better tracking import prices and nontraditional exports. One alternative is to calculate a domestic tradables price index by taking a weighted average of the foreign price of importables (P_{Md}) and exportables (P_{Xd}) multiplied by the nominal exchange rate as in equation one.³

² One direct measure includes using expenditure data from nation accounts to measure the ratio of domestic prices of goods actually exported and imported and the price of domestically produced and consumed goods (Devarajan, Lewis and Robinson 1993). Another direct measure attempts to split sectors of production into tradable and nontradable categories and then calculate implicit price deflators.

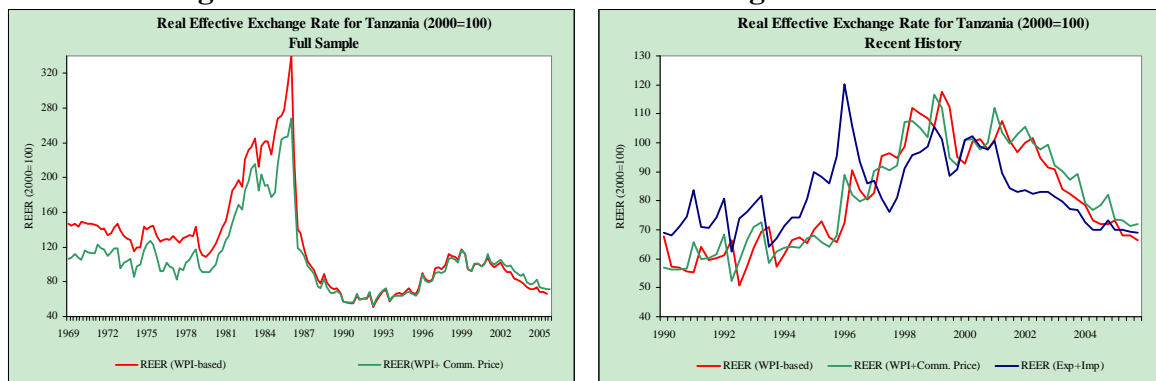
³ This measure of the internal real exchange rate implicitly assumes that import prices and export prices move together so that they can be aggregated into one tradable goods price. If the price of imports and export diverge then the measure will be less likely to appropriately capture the price incentives of producing or consuming tradables. In this case, it may be more appropriate to consider separate internal RER indices, one using exports prices and the other using import prices. In this way, the incentives in the exportable or the import-substituting sectors are better represented by the separate indices.

$$(1) \quad RER = E_{dc} \cdot [P_{Md}]^\alpha \cdot [P_{Xd}]^{(1-\alpha)} / P_{Nd}$$

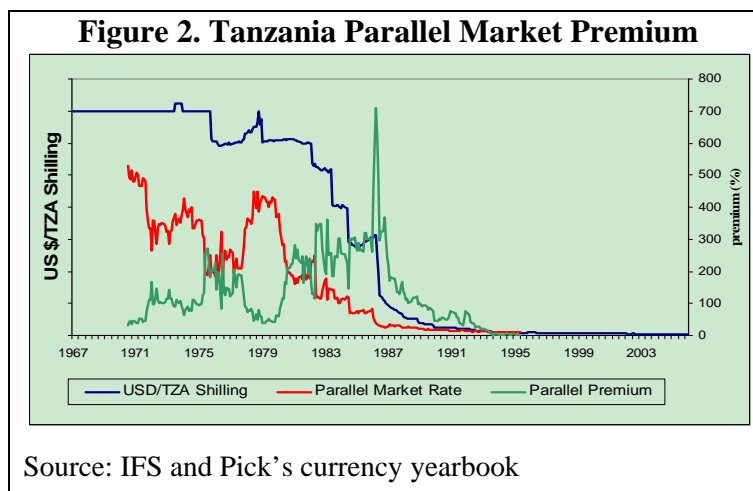
where E_{dc} is units of domestic currency per unit of foreign currency, P_{Md} and P_{Xd} are price indices of importables and exportables respectively, P_{Nd} is domestic nontradables price index, and α is the share of importables in total tradables.

In the sections that follow the internal real exchange rate is measured using foreign wholesale price indices to proxy tradable prices and Tanzanian CPI index to proxy nontradables. We choose this measure for two reasons. The first is data availability and the second is that a careful analysis of the various measures of the REER showed that all suitable candidates were very strongly correlated over the sample and the empirical results that follow are not sensitive to various measures (Figure 1 and Annex 1). We did, however, augment our preferred measure to allow for the parallel nominal exchange rate.

Figure 1. Tanzania: Real Effective Exchange Rate Measures



Many LICs either have had or still have parallel markets for foreign exchange, where an exchange rate determined by the market (either legally or illegally) coexists with a pegged or managed exchange rate. Using the officially managed nominal exchange rate only in the calculation



of an REER could be a misleading indicator of economy-wide price incentives in the LIC as the official rate is most times overvalued. Tanzania has had a parallel exchange rate for much of its post-independence history, with the parallel exchange premium peaking at

over 700 percent in 1986. The parallel premium gradually declined to less than 10 percent 1993 and the exchange rates were unified in 1994 (see Figure 2). In the next section, empirical results using an REER using a weighted average of the parallel and official nominal exchange rates are presented.⁴

A final consideration in the construction of an REER index is the choice of a weighting scheme. Moving beyond a two-country framework necessitates consideration of the range of trading partners to include in the real exchange rate index and how they should be weighted. There are two key issues that must be addressed when choosing a weighting scheme. The first is choosing the appropriate weights, either export weights, import weights, or both. We use export and imports or total trade flows as weights given that external competitiveness consists of both export and import competitiveness. The second issue concerns the choice between fixed or flexible weights over time. As trading patterns change over time, a real exchange rate index using fixed weights may provide a misleading picture of the net effect of movements in particular bilateral exchange rates, and thereby competitiveness. We use flexible weights as Tanzania's trading partners have changed quite significantly over time (Annex 1). However, using either fixed or flexible weights does not materially alter any of the results that follow.⁵

II. Explaining the Behavior of Tanzania's Long-Run Equilibrium REER

i) The long-run equilibrium REER

Tanzania's REER has been characterized by dramatic swings in recent decades. The 40 percent appreciation over the 1990s and subsequent sharp depreciation since 2000, are relatively modest movements compared to fluctuations in the 1980s. Even large movements in the REER provide only limited guidance on changes in Tanzania's competitiveness. Understanding the underlying factors that explain the movements in the REER is necessary before conclusions on external competitiveness can be drawn. A depreciation of the REER may result from a decline in the terms-of-trade which would not signal a gain in competitiveness, but a restoration of it. Alternatively, an appreciation of the REER may be justified by productivity improvements in the tradables sector, which would not imply a loss of competitiveness. To understand if Tanzania's competitiveness has improved or worsened relative to any point in time it first must be understood if its REER is overvalued or undervalued. To make statements about the degree of misalignment of the REER it is necessary to have an understanding of an equilibrium value of the REER. It is appreciations and depreciations of the REER relative to an equilibrium value that signal a loss or gain in Tanzanian competitiveness.

A standard definition of the equilibrium value of the REER is the relative price of tradables to nontradables that is consistent with the dual objectives of internal and

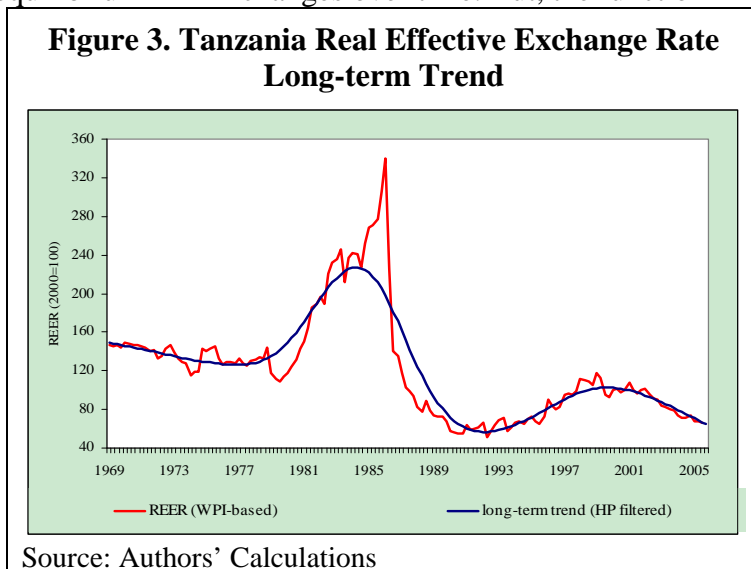
⁴ Jorgensen and Paldam (1986) justify the use of an average of the two rates on the basis that misalignments in the parallel and official rates tend to be in opposite directions (the parallel rate being undervalued while the official rate is overvalued) and policy shocks such as large devaluations often move the rates in opposite directions.

⁵ More detail on the weighting schemes can be found in Annex 1.

external balance, given specific values of relevant macroeconomic variables that influence internal and external balance (Montiel 1999, Edwards 1989). Internal balance is when the nontradables market clears in the current and futures periods. External equilibrium is attained when the current account balance is compatible with long-run sustainable capital flows. Concretely, an equilibrium REER is an unobservable variable that would prevail from real macroeconomic factors acting upon foreign exchange markets without interruption. Because an equilibrium REER is unobservable it must be estimated by identifying fundamental macroeconomic factors that are theoretically expected to act upon foreign exchange markets.

Estimating the equilibrium REER as a function of macroeconomic variables that vary over time implies that the equilibrium REER changes over time. But, the function

between the REER and the fundamentals is fixed over the time period of analysis. This approach is well supported theoretically (Edwards (1989), Montiel (1997) and Elbadawi (1990), (1994)) and is particularly relevant in a case where the REER is found to be nonstationary. Figure 3 displays the long-run component of Tanzania's REER, which shows significant changes over the sample period. The aim of the next section is to identify the



macroeconomic variables that explain these long-term movements. This reduced-form equilibrium real exchange rate approach is one of a number of complementary approaches that can be used to assess real exchange rates. Others include the macroeconomic balance approach, the external sustainability approach and in the LIC context, the PPP approach.⁶ IMF (2006) and Hinkle and Nsengiyumva (1999) compare and contrast the various methods for real exchange rate assessments.

ii) Recent macroeconomic developments

The recent macroeconomic history of Tanzania can be broadly grouped into three periods – 1970-1986, 1987-1995 and 1996-2005. The first period was marked by an increasing role of the state in the domestic economy and the pursuit of an import-substituting strategy aimed at creating a new brand of African socialism. Donors were

⁶ This approach is common in LICs when data availability is an issue. It involves identifying a base year for which the economy under consideration is judged to be in both external and internal balance and choosing the REER that prevailed in that year as the estimate of the equilibrium REER. This approach implies that the equilibrium REER does not change over time and assumes that the values of fundamental macroeconomic variables that influence internal and external balance do not change over time.

initially quite supportive of the inward looking reform program and aid flows reached almost 15 percent of GDP in 1979. During the early 1980s and leading to the 1986 balance of payments crisis, macroeconomic conditions deteriorated sharply as a result of the unsustainable economic program and commodity price shocks. Prices for Tanzania main commodity exports – cotton, coffee and cloves – which made up about 57 percent of export revenues at the time, declined by almost 15 percent over the period 1979-87. Consequently, real GDP growth declined sharply, while consumer price inflation took off averaging over 30 percent annually. Large imbalances in the country's fiscal and external accounts emerged. Responding to a balance of payments crises in 1986, the shilling was devalued by more than 50 percent. During the pre-crisis period aid inflows declined to just under 10 percent of GDP by 1985.

The immediate post-crisis period was characterized by government attempts to open up the economy, liberalize the foreign exchange market and reduce the role of the state in the domestic economy. The reform program was supported by an IMF ESAF and a structural adjustment program with the Bank. These programs and other donor inflows drove aid inflows to a peak of 25 percent of GDP in 1992. From 1987 to 1991, real GDP growth averaged 4.6 percent and fiscal policy improved markedly despite falling commodity prices (mainly coffee prices) and inflation remaining close to 30 percent. The foreign exchange market was liberalized and the premium on the shilling in the parallel market all but disappeared by 1993. However, structural reforms waned and commitment to macroeconomic stability diminished over the years 1992-1995. Lack of fiscal control and large scale tax exemptions implied that the earlier fiscal gains were rolled back. The emerging fiscal imbalances led authorities to increase customs duties to compensate for shortfalls in domestic tax revenues. In response, the IMF, the Bank and other donors cut back on flows, which once again declined to about 10 percent of GDP.

The decade spanning 1996-2005 was marked by steady progress in implementing macroeconomic reforms, resulting in robust growth rates and a significant decline in inflation. The authorities signaled their renewed commitment to reform with the signing of another ESAF with the IMF in 1996. A premium was placed on macroeconomic stabilization, while a key component of the structural reform program was trade liberalization, especially in the agriculture sector (World Bank 2007, IMF 2005). The first half of this period was characterized by average annual real GDP growth of 4 percent, while consumer price inflation fell from 27.4 percent to 6.0 percent. Prices for Tanzania' key commodity exports rebounded and remained strong during this period as well. The second half of the decade was even more impressive, with annual average real GDP growth of 6.5 percent and inflation falling to 5 percent by 2005. Since 2000, the government's commitment to macroeconomic and structural reform emphasizing the importance of restricting the role of the state in the economy has coincided with another surge in aid flows, with the aid-to-GDP ratio over 12 percent in recent years

Tanzania' recent economic history has been shaped in large part by donors' response to its successive economic reform programs, each of which placed an emphasis on trade reforms. As a primary commodity exporter, exogenous changes in the prices of its key commodity exports have also played an important role in its economic evolution.

Given these broad features of Tanzania’s economic history we focus on aid, trade and the terms-of-trade as the key explanations of the long-run behavior of real effective exchange rate. These three factors are standard among the macroeconomic economic fundamentals cited in the literature as determinants of REERs in LICs. The next section explains the relationship between each of these factors, among others, and Tanzania’s real effective exchange rate.

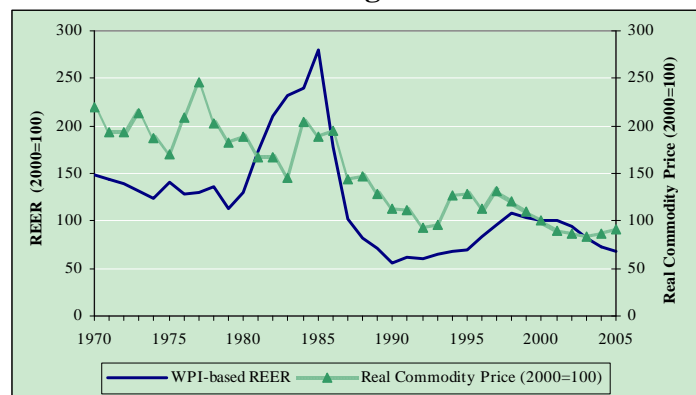
iii) Possible factors affecting the long –run equilibrium REER

Terms of trade

Tanzania’s export revenues are heavily dependant on international commodity prices. On average, well over half of its export earnings over the last thirty years have been comprised of primary commodities – coffee, tobacco and cotton being the most important. While the principal commodity exports have changed over time, it remains a primary commodity exporter. Revenues from Tanzania’s top three commodity exports – fish, coffee, and cashew nuts, - accounted for 31% of non-gold exports in 2005. International commodity prices are volatile and when they change relative to Tanzanian import prices the equilibrium path of the REER will be affected. An increase in the international price for Tanzania’s commodity exports will increase real incomes in the export sector, resulting in an increase in the demand for nontraded goods. An appreciation of the REER will follow unless there is a substitution effect from domestic goods to foreign goods, in which case the REER may depreciate.

Following Cashin et al (2002) we use a measure of Tanzania’s real commodity prices as a proxy for its terms of trade. The index is a geometric weighted average of Tanzania’s nine largest commodity export prices deflated by the World Bank’s index of manufactured exports (MUV).⁷ In principal, the price of all exports rather than simply commodity exports, over the price of all imports, rather than a generic industrial country export deflator, should be used to measure terms of trade. However, concerns about the data quality and the

Figure 4. Term of Trade and Real Effective Exchange rate



Source: Authors’ calculation

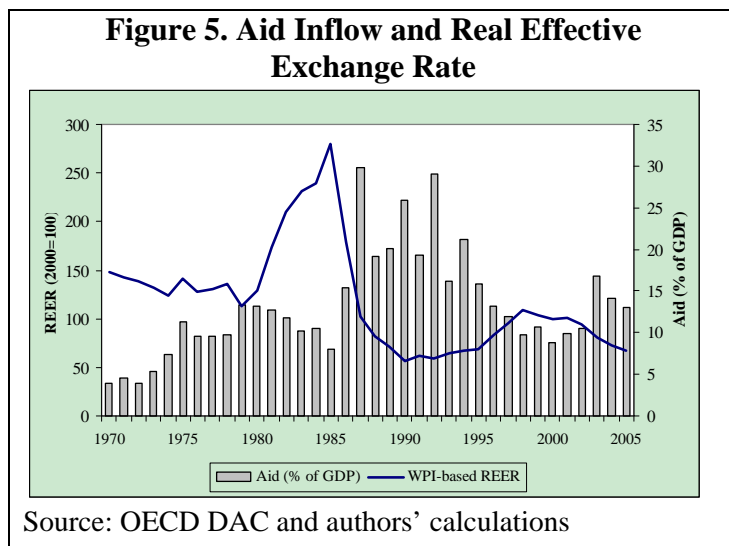
⁷ The index is a weighted average of export prices of manufactured goods for the G-5 economies (the United States, Japan, Germany, France, and the United Kingdom), which is generally accepted as proxy of price index of developing country manufacture imports. We augment the measure to incorporate oil prices in the measure, as oil imports make up about 17% of Tanzanian imports in 2000s on average.

availability of Tanzania's export and import prices make the real commodity price index our preferred measure of Tanzania's ToT.⁸ Like many other African countries, Tanzania has experienced a secular decline in their terms of trade over the sample period, which broadly corresponds to the long-term trend decline in the REER (Figure 4).

Aid flows

Tanzania has received large and sustained aid flows for much of the last thirty years. Even when aid inflows decreased in the early 1980s, Tanzania received higher aid inflows than most SSA countries (Ndulu and Mwase 2005). Following the reformist government's move to market-based economy in 1985, aid flows surged to over 25 percent of GDP by 1992. When commitment to further economic reform weakened in the early to mid-1990s, aid flows again declined, but remained higher than most other SSA countries at almost 10 percent of GDP (Muganda 2004). Since 2000, the government's commitment to macroeconomic and structural reform emphasizing the importance of restricting the role of the state in the economy has coincided with another surge in aid flows, with the aid-to-GDP ratio over 12 percent in recent years (IMF 2005).

Aid inflows that are spent in the local economy will contribute to an increase in the demand for both tradables and nontradables.⁹ When tradable goods' prices are fixed by international prices it is nontradables prices that would tend to increase. The pressure of expanded liquidity on domestic demand and prices of nontraded goods would lead to a real exchange rate appreciation. Figure 5 indicates that no such relationship appears to be present in Tanzania. In fact, the series are highly negatively correlated, i.e. a depreciation



(appreciation) of the REER is associated with an increase (decline) in aid flows.

The 'equilibrium' relationship described could be muted or nonexistent for a number of reasons. There may be no change in the REER if aid is spent entirely on imports, implying no impact on money supply or aggregate demand in the local

⁸ The correlation coefficient between the real commodity price index and the ratio of Tanzania's export and import prices taken from the IMF's World Economic Outlook (WEO) database is 0.84 over the period 1980 to 2004.

⁹ To make local purchases, foreign exchange would need to be converted into local currency that would expand the money base, fuelling the increase in demand.

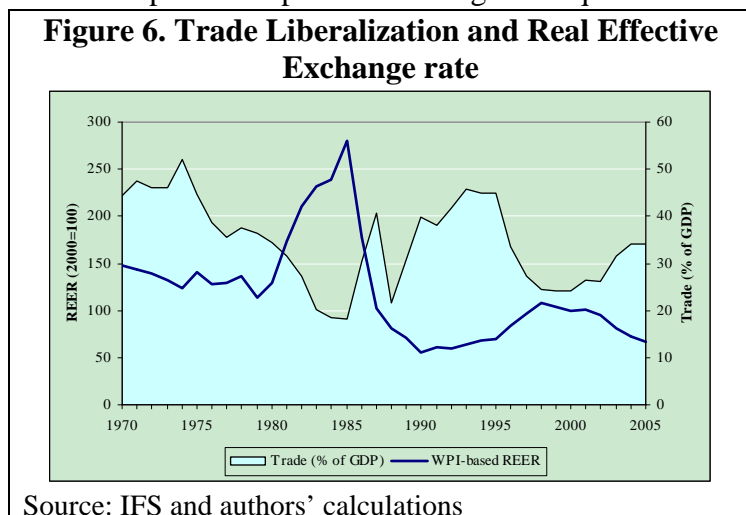
economy. Alternatively, if the economy receiving the inflow is characterized by unemployed resources then the increase in demand generated by the aid inflow may not lead to an increase in nontradable prices. Import purchases and unemployed resources can explain why there may be a muted or no response in the REER to an aid surge, but they do not explain the observed negative relationship in Tanzania. There are numerous theoretical explanations for this relationship, but a proper multivariate framework that accounts for the nonstationarity of these series and controls for other factors is necessary before this relationship can be taken seriously. The empirical section that follows will do this.

Trade liberalization

Economic reforms introduced by the Tanzanian authorities from 1986 included a move away from the policies of import substitution undertaken in the 1970s. During 1980-86, nontariff barriers covered more than 50 percent of imports, and the average simple tariff rate was about 40 percent. By 1999, nontariff barriers were largely confined to restrictions on imports of petroleum products and the simple tariff rate was between 15 and 20 percent (Kanaan 2000). During the 1990s, the marketing and export of traditional export crops was decontrolled and the commercial role of the parastatal crop authorities was scaled back, resulting in the increase in the producer prices of food. The system of export and import licensing was abolished and the requirement of registration of exporting companies eliminated by 1994. The maximum tariff rate has been lowered and the number of tariffs has been reduced from six to three. Moreover, import surcharges imposed in 2001 on imports from other East African countries were gradually reduced or eliminated (IMF 2005).

Trade liberalization can have an important impact on the long-run ‘equilibrium’ REER. The lowering of import tariffs, for example, will decrease the domestic price of imported goods increasing the demand for imports and the volume for imports. At the same time (assuming perfect substitutability) a decrease in demand for nontradables will result. In equilibrium, the price of nontradables will decrease resulting in a depreciation of the real exchange rate. The ratio of

total trade to GDP is a commonly used measure of trade liberalization as it captures the assumption that a more liberal trade regime means higher trade volumes. Figure 6 presents this measure of trade liberalization and Tanzania’s REER. As expected, there appears to be a strong inverse relationship between the series for the entire sample,

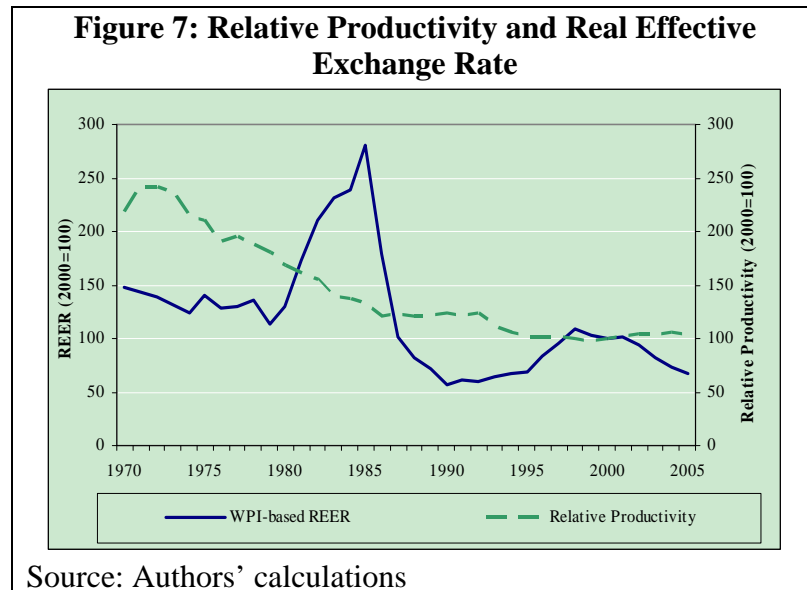


implying that trade liberalizing reforms have contributed to periods of REER depreciation.

Relative productivity differentials

Perhaps the best known explanation for the behavior of long-run ‘equilibrium’ exchange rates is relative productivity differentials, the so-called Balassa-Samuelson effect. The Balassa-Samuelson effect rests on the assumption that productivity gains in the tradables goods sector are greater than productivity gains in the nontradables sector. The effect can be understood to work both within and across countries, with the same resulting impact on the real exchange rate. Within a country, an increase in productivity in the traded goods sector will lead to an increase in wages in both the tradable and nontradable sectors. Consequently, there is an increase in nontradables prices and an appreciation of the real exchange rate. If PPP in tradable goods holds across countries, stronger productivity gains in the tradables sector in one country relative to another implies a stronger increase in the relative price of nontradables. The result is an appreciating real exchange rate for the country with the higher relative productivity gain.

A striking feature of the Tanzania growth experience over the last thirty years is that it appears to be uncorrelated with the investment rate (World Bank 2002). Indeed, several periods were characterized by high investment rates and low growth, implying declining productivity of investment. Devarajan, Easterly and Pack 1999, note that value added per worker in the manufacturing experienced a sustained decline between 1975 and 1990. Poor productivity



performance relative to its key trading partners is consistent with the observed long-term trend decline in Tanzania’s REER (Figure 7). However, recent reforms aimed at increasing efficiency and investment appear to be bearing fruit as relative productivity in Tanzania appears to have halted its long-term decline.¹⁰

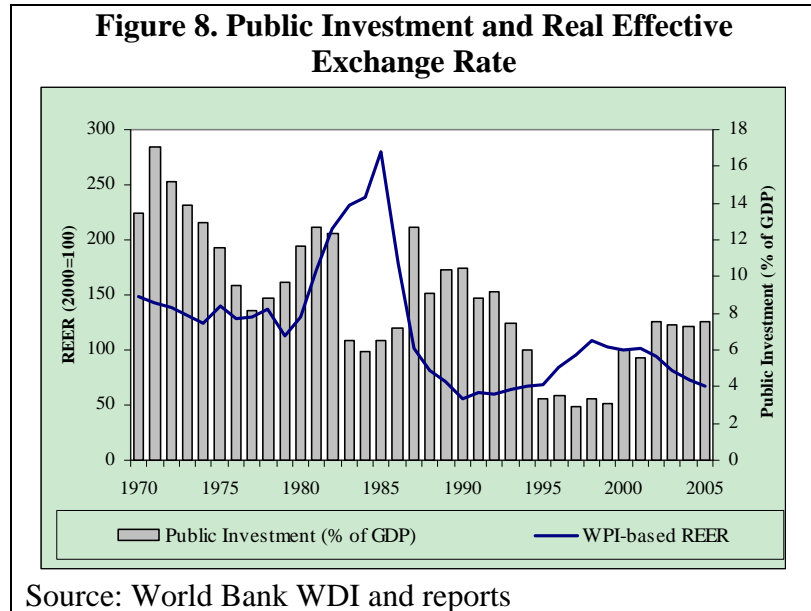
¹⁰ There are a number of measures that proxy relative productivity, but due to data limitations we use the ratio of real GDP per capita in the seven largest trading partners to real GDP per capita in Tanzania. An area for further work would be to develop some measures for productivity in different sectors of the economy to proxy the relative productivity growth differentials between tradables and nontradables within Tanzania.

Government expenditures

The final factor that we consider to explain movements in the long-run equilibrium REER is a change in the level of government expenditures. An increase in spending on traded goods generates an increase in demand for imports that results in a trade deficit, requiring a real exchange rate depreciation to maintain external balance. In the LIC context, an increase in government investment is likely to capture spending on tradables. Alternatively, an increase in government spending on nontradables is likely captured by consumption expenditures, which is expected to generate an increase in the relative price of nontradables. If the increase in government spending is financed by government borrowing that require subsequent tax increases to finance, aggregate demand may be muted relative to the initial increase. It is the allocation of government expenditure across sectors in the economy is a fundamental determinant of the long-run equilibrium real exchange rate, not unsustainable fiscal policy financed by excessive credit creation. The latter can cause a short-run deviation from the long-run equilibrium real exchange rate, i.e. a misalignment, but it is not considered a driver of the long-run equilibrium exchange rate.

Public expenditures in Tanzania have increased significantly in recent years, contributing to rapid GDP growth (World Bank 2006). Importantly, the composition of those expenditures has been increasingly toward public investment. Given the high import content of public investment, a rise in the share of investment in aggregate spending is a good proxy for a shift in public spending to tradable goods. This compositional shift is consistent with the recent depreciation of the REER (Figure 8). Tanzania's

budget is heavily financed by aid inflows for much of the sample under consideration (e.g. 40 percent in 2004) which makes it particularly difficult to disentangle the individual contribution of both aid inflows and government expenditures to movements in the REER in the same empirical specification. The issue of multicollinearity, which is not only limited to the aid and government expenditure variables, is addressed in the next section.



III. An Empirical Specification of Tanzania's Long-Run Equilibrium REER

This section presents the results of an estimated model of Tanzania's long-run equilibrium REER (EREER). It is the first step in a two-step procedure that aims to distinguish between movements in the REER that are consistent with persistent movements in economic variables that affect the REER and temporary movements in the REER that may be explained by short-lived events like monetary policy. This approach will allow the estimation of the long-run equilibrium exchange rate, the degree of misalignment of the actual REER relative to the estimated equilibrium value, and the estimated speed of the actual REER's adjustment to equilibrium. An error-correction model is employed to achieve these results. We use a modified version of Engle and Granger's (1987) two-stage error-correction procedure to estimate the long-run relationship between the EREER and its fundamentals and the short-term dynamics affecting the REER.

The first stage of Engle and Granger (1987) involves estimating a cointegrating relationship by OLS. We modify this stage by estimating the cointegrating relationship using Phillips and Hansen's (1990) Fully Modified (FM) method. Although the OLS estimators are consistent and highly efficient, they are biased in small samples making inference based on parameter estimates unreliable. The Phillips and Hansen (1990) FM estimator applies a semi-parametric modification to the standard OLS procedure that corrects for autocorrelation of the OLS residuals as well as endogeneity of the regressors. The result is parameter estimates that are asymptotically optimal, making inference more reliable. There are alternative approaches to achieving reliable parameters estimates, such as Johansen's (1995) maximum likelihood estimator using a vector error-correction mechanism specification, but it requires more data observations than are available in the present analysis to be effectively implemented. We present the results of both OLS and FM-OLS methods below.

The first step in the first stage of Engle and Granger (1987) is to determine the order of integration of the variables, which identifies if the chosen variables are non-stationary. Annex 3 Table 1 presents the results of Augmented Dickey-Fuller (ADF) tests for unit roots and the Phillips- Perron test, which shows that all variables are nonstationary in levels and stationary in first differences, i.e. integrated of the first order $I(1)$, over the entire sample period 1970-2005. The results support the notion that the series are integrated processes that can be exploited to uncover a long-run equilibrium relationship.

i) Cointegration results

The following model is estimated by OLS and Phillips and Hansen's (1990) FM-OLS over the period 1970-2005:

$$REER_t = \beta_0 + \beta_1 TOT_t + \beta_2 TRADE_t + \beta_3 INV_t + \beta_4 Pr od + \beta_5 AID_t + \varepsilon_t$$

REER is the real effective exchange rate as measured as the nominal effective exchange rate multiplied by the ratio of foreign wholesale prices to Tanzanian CPI. A variety of measures of the REER (see Section II) including a measure that incorporates the parallel exchange rate will be used to test the robustness of the results. TOT is the terms of trade measured as Tanzania's real commodity price index. AID is net aid inflows taken from the OECD's DAC database.¹¹ We also include net private capital flows in the measure to capture total public and private capital inflows. Trade is a measure of trade liberalization and is proxied by the ratio of exports plus imports to GDP. PROD is a relative productivity measure aiming to capture Balassa-Samuelson effects and is measured as the ratio of real GDP per capita in Tanzania relative to its major trading partners. INV is government investment expressed as a percentage of GDP.

ADF tests indicate that the error term in our OLS regressions is stationary, indicating that there is a long-run cointegrating relationship between the REER and the fundamental macroeconomic variables chosen (Table 1). The preliminary results suggest that the terms of trade, aid and trade liberalization are strongly significant determinants of Tanzania's long-run equilibrium exchange rate (Table 1, column (1)). The sign of the parameter estimate on the government investment variable is not as expected, although it is insignificant at conventional levels. The coefficient on the relative productivity measure is also insignificant, but this is likely the result of measurement error. It is also the case that the relative productivity measure is highly correlated with the terms of trade measure. We ran the specification alternately excluding the relative productivity measure and the terms of trade measure and found that by excluding the ToT measure the relative productivity measure remained insignificant. On the basis of this result we dropped the relative productivity measure from the specification.¹²

Dropping both the investment and the relative productivity measures from the original specification does not significantly alter the parameter estimates on the remaining variables or the overall goodness of fit of the model. Column 2 reports the results of the more parsimonious specification. This specification was re-run using the parallel nominal exchange rate in the REER index.¹³ The signs and the significance of

¹¹ The debt relief component of this measure is adjusted to better reflect the annual cash flow of HIPC debt relief which purges the DAC's measure of the possible over recording of debt relief in a single year due to the practice of some DAC reporting creditors to record debt relief as stock of debt reduction operation rather than a flow of debt service reduction.

¹² Better proxies for relative productivity differentials in the tradable and nontradables sectors are required before further testing on this variable can be undertaken.

¹³ The parallel nominal exchange rate is incorporated into the REER by taking a weighted average of the official and parallel rates by assuming that the share of transactions in the parallel market is 80 percent when parallel premium is highest and the share of parallel market trade decline proportionally with (square

each of the variables remain unchanged. The parameter estimates on the terms-of-trade and the trade liberalization variables decline, while the estimate on the aid inflows variable increases somewhat. A similar pattern is observed with the FM-OLS estimators.

Table 1. Tanzania: Long-Run Cointegration Estimation Results

Variable	OLS (1)	OLS (2)	OLS- Parallel Rate ^{1/} (3)	FMOLS- (4)	FMOLS- Structural Break (5)	FMOLS- Parallel Rate ^{1/} (6)
Log (ToT)	0.68*** (0.23)	0.73*** (0.13)	0.30*** (0.09)	0.80*** (0.17)	0.84*** (0.15)	0.31*** (0.08)
Log (Open)	-0.80*** (0.17)	-0.73*** (0.12)	-0.44*** (0.08)	-1.08*** (0.16)	-0.95*** (0.15)	-0.57*** (0.07)
Log (Invest)	0.11 (0.15)					
Log (PROD)	-0.00 (0.48)					
Log (Aid)	-0.29** (0.14)	-0.30*** (0.09)	-0.43*** (0.06)	-0.26** (0.13)	-0.31** (0.15)	-0.46*** (0.06)
_Cons	4.71*** (1.46)	4.41*** (0.90)	5.77*** (0.62)	5.18*** (1.17)	4.69*** (1.23)	6.24*** (0.53)
No. of obs	36	36	36	36	31	36
Adjusted R ²	0.77	0.77	0.80			
D-W Stat.	1.23	1.22	1.97			
Residual ADF test	-3.92	-3.89	-5.74			
LC (P-value)				0.09	>=0.20	0.11
MeanF (P- value)				<=0.01	0.09	<=0.01
SupF (P- value)				<=0.01	<=0.01	<=0.01

Notes: Standard errors are in parentheses. * indicates significance at the 10% level, ** indicates significance at the 5% level and *** indicates significance at the 1% level.

1/ REER is calculated incorporating parallel exchange rate. The share of parallel varies with the size of parallel market premium.

A key result is that the inverse relationship between aid inflows and the REER observed in the bivariate context holds in the multivariate specification. The statistically significant inverse relationship between aid inflows and the equilibrium REER is somewhat unexpected, but the finding is not unique (Nyoni 1997: Tanzania, Ogun 1995: Nigeria, Sackey 2001: Ghana, Ouattara and Strobl: CFA Franc Zone). Nevertheless, we think this relationship deserves careful consideration before any policy conclusions are drawn. We consider three possible avenues that may be leading to a spurious relationship between aid inflows and Tanzania's REER. The first is multicollinearity between aid flows and our measure of trade liberalization. The second is that the specification may not be adequately capturing the possibility that the aid inflows generate positive supply side responses in the economy that may overwhelm the expected demand side effects.

root of) parallel premium. While somewhat arbitrary, this definition does reflect discussions with Bank of Tanzania officials.

The third is that our results may be unduly influenced by the period in the run-up to and including the balance of payments crisis in 1986. We address each in turn below.

ii) Robustness checks

The openness proxy used to capture trade liberalization and the aid inflows variable are highly correlated over the 1980-2004 period (correlation coefficient 0.79), possibly suggesting that trade liberalization efforts in Tanzania have been rewarded with higher aid inflows. Mwase and Ndulu (2005) state that, “Tanzania’s evolving relationship with donors illustrates the endogeneity of the perceived state of the policy environment to the prevailing global development paradigm.” For much of our sample, the prevailing global development paradigm had trade liberalization as a key component. To see if our results were being affected by this relationship we ran a separate bivariate regression of trade liberalization on aid inflows and put the residuals from this regression in the general specification. This instrumental variable represents an aid inflows measure purged of any trade liberalization influence.¹⁴ The parameter estimates on both the aid inflows and the trade liberalization variables are virtually unchanged.¹⁵

The inclusion of the government investment spending directly in the specification is one way of capturing the notion that aid flows could be generating positive supply-side responses in the economy that are deflationary. Including the investment spending measure should reduce the amount of variation in the REER that is explained by the aid inflows variable and attribute it to the investment spending variable.¹⁶ However, the results above indicate that public investment spending is not a significant determinant of the REER. Alternatively, we test if the negative relationship between aid inflows and the REER may be working through indirect channels. We include a measure in the general specification that interacts aid inflows with an estimate of Tanzania’s output gap. An equilibrium real exchange rate appreciation would only be expected when the economy is running close to, at or above capacity in the presence of high and rising aid inflows.¹⁷ The results of including the interaction term (not shown) indicate that its parameter estimate is not significant at conventional levels and its inclusion in the baseline specification does not affect the parameter estimates of either the aid inflows variable or the others in the specification.

We re-ran the parsimonious specification with a structural break to be confident that the results are not being influenced by the balance of payments crisis in 1986 when the devaluation of the shilling coincided with a surge in aid inflows. Chow test results indicate that a structural difference exists in the parameter estimates between the periods 1986-90 and the rest of the sample. Column 5 in Table 1 shows the parameter estimates when the data points over the period 1986-90 are excluded from the sample. The results

¹⁴ Ganger-causality tests show that trade liberalization Granger-causes aid inflows and not vis versa.

¹⁵ Simply adding more data can also rid the specification of this multicollinearity, which is confirmed by the results of expanding the dataset back to 1970.

¹⁶ Also, investment spending is a strong proxy for government spending on tradables, which could result in a decrease in the relative price of nontradables and therefore REER depreciation.

¹⁷ See Mwanza 2004 for an analytic framework that relaxes some standard assumptions of the core “Dutch Disease” model to illustrate this point.

are virtually unchanged, giving some assurance that the relationship between aid inflows and the REER is not being driven by the 1986 crisis.¹⁸ Lastly, we estimated the specification incorporating the parallel exchange rate into the REER measure. The signs of the coefficients do not change and all three variables remain highly significant. However, the coefficients on the terms of trade and the trade liberalization variables decline somewhat.

iii) Elasticity estimates

The results from the FM-OLS (with a structural break) estimation are preferred when interpreting the elasticities given by the long-run parameter estimates (Column 5). Given the uncertainty surrounding the correct incorporation of the parallel nominal exchange rate in the REER measure we present the elasticities as ranges. On the basis of these results, the long-run relationship between Tanzania's REER and its terms of trade, net aid inflows and trade liberalization can be identified as follows:

- The terms of trade parameter estimates suggests that a 1 percent increase in Tanzania's terms of trade leads to an approximately 0.3 to 0.8 percent increase in the REER. This positive relationship suggests that the income effect of terms of trade increase dominates the substitution effect.
- The parameter estimate on the aid variable indicates that 1 percent increase in aid inflows (as a share of GDP) is associated with a 0.3 to 0.5 percent depreciation of the equilibrium REER.
- The parameter estimate on the openness proxy capturing trade liberalization suggests that an improvement in trade liberalization captured by a 1 percent increase in Tanzania's trade to GDP ratio will result in a 0.6 to 1.0 percent depreciation of the equilibrium REER.

To be confident in the interpretation of the long-run elasticities it is important that the parameter estimates are stable over the sample period. We test for parameter stability using the *Lc* and *MeanF* tests proposed by Hansen (1992). Both tests have the same null hypothesis of parameter stability. The results indicate that we can not reject the null hypothesis of parameter stability over the sample period at all conventional significance levels.

iv) Possible explanations for the Aid-REER relationship

There is a growing body of theoretical research that shows an REER depreciation in the presence of increasing aid inflows. A number of models focus on supply-side impacts of aid inflows. They suggest that aid inflows may induce a rapid supply-side

¹⁸ As an additional check, we re-ran a similar parsimonious specification on a quarterly dataset beginning in the first quarter of 1998 and the aid inflows REER relationship remained unchanged. Although, the aid inflow variable and the trade liberalization variable are defined differently than in the annual dataset, so the results are not directly comparable.

response in the economy that more than offsets the demand responses. Similarly, aid that is targeted at easing supply bottlenecks in the economy could have a deflationary impact that could dominate the upward pressure on the price of nontradables due to the initial aid inflow (Hjertholm, Laursen and White 1999).¹⁹ Such a situation may well describe circumstances in Tanzania, particularly in the years following 1986 when the underground economy resurfaced generating a large supply response to the increased availability of goods (Mwase and Ndulu 2005).

Adam and Bevan (2003) develop a computable general equilibrium (CGE) model that simulates the impacts of a permanent increase in aid-financed public infrastructure investment. Under a scenario where the increase in investment spending induces a productivity gain that is concentrated in the nontradables sectors and there is a high subsistence element in food consumption a depreciation of the real exchange rate results. Adam (2003) also presents evidence from a simulation exercise that shows a real exchange rate depreciation over the medium-term in response to aid inflows. It is less clear that productivity gains are at work to create the inverse relationship in Tanzania, given the secular decline in productivity over the last 30 years.

Devarajan et. al. (2007) present a CGE model that introduces explicitly the implications of intertemporal choices that attempt to smooth aid flows. Their model also includes the evolution of trade shares and elasticities to explore the impact of trade liberalization and globalization in the macroeconomic dynamics of scaled up aid. The authors simulate an increase in foreign official grants by 2 percent of output permanently and find that dynamically optimal decisions in investment and consumption will result in a real exchange rate depreciation. For investment to increase in the face of aid inflows, the returns to the firm must improve. A real exchange rate depreciation is required to cause the forward depreciation of the real exchange rate and in turn increase the market discount rate affecting supply behavior. A depreciation also increases the demand-side discount-rate, postponing consumption immediately, but causing an increasing growth rate in consumption over time. Like standard CGE models, consumption, investment and output increase with aid inflows, but optimal intertemporal behavior on the part of consumers and producers requires real exchange rate depreciation in this model. Attempts to smooth aid inflows hold perhaps the most convincing argument for the inverse relationship between aid inflows and the REER found in Tanzania, especially in recent years. The final two sections of the paper explore this possibility in detail.

Other possible explanations for the relationship include ‘tied’ aid and exchange rate regime changes. If a donor provides aid that is conditional upon the recipient country to import from that donor and the value of the imports is greater than the original aid inflow then the real exchange rate could depreciate.²⁰ Lastly, donors may provide aid to support the change in an exchange rate regime, which in many cases would mean a strong

¹⁹ In this case, output would grow faster than money supply growth.

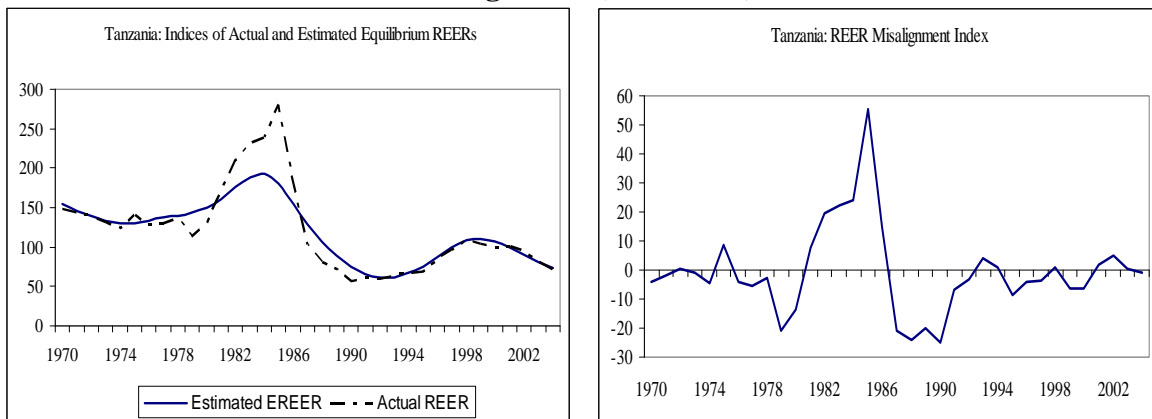
²⁰ This explanation is put forward by Nyoni 1998 when he finds a negative and significant relationship between aid flows and Tanzania’s REER. While this explanation may describe aid flows in the 1970s and 1980s it is not clear that the same explanation is relevant for recent history.

devaluation of the nominal exchange rate.²¹ The empirical results suggest that this last explanation is not driving the relationship in Tanzania, but the tie aid story holds some promise. In general, it is likely that a number of these factors are working together – tie aid, the easing of supply bottlenecks and aid inflow smoothing, - to produce the observed inverse relationship over the entire sample.

v) The estimated equilibrium REER and misalignment

The long-run equilibrium relationship estimated above allows for the calculation of an annual estimate of Tanzania’s equilibrium REER (EREER). The estimated EREER is a function of the long-term or permanent components of the explanatory variables and the parameter estimates from the preferred specification in table 1 above. To get the permanent components of the explanatory variable we apply an HP filter to each series. It is also necessary to make a constant term adjustment to ensure that the sample period means of the estimated EREER and the actual REER are equal. Figure 9 shows the actual REER and the estimated EREER over the period 1970-2005. The EREER shows significant variations over the sample period, reflecting the changes in the structural conditions in Tanzania as well as significant changes in external factors like its terms of trade. Both the EREER and the actual REER move together quite closely over the period, but there are periods of significant and sustained deviations.

Figure 9. Tanzania: Indices of Actual and Estimated Equilibrium REER and Misalignment (1970-2005)



The second panel in Figure 9 depicts the estimated degree of misalignment between the estimate EREER and the actual REER. Temporary changes in the explanatory variables in our long-run specification and other short-term factors like monetary policy explain divergences between the estimated EREER and the actual REER. The misalignment index coincides quite closely with what are generally considered periods of overvaluation and undervaluation of Tanzania’s real exchange rate. The REER was undervalued for much of the 1970s. A series of devaluations and price controls implemented by the National Price Commission meant that the REER

²¹ Devaluation policy should not affect the equilibrium real exchange rate over the long term, but it can exert an influence that can last for a significant period of time.

depreciated by almost 30 percent over the decade. From 1980 the actual REER appreciated sharply in the run-up to the 1986 balance of payments crisis and was overvalued for much of this time, reaching a high of 55 percent in 1985. In the post-crisis years 1988-1990 the index illustrates the typical over-shooting of the nominal exchange rate that occurs after crises episodes with the REER being undervalued for this period. From the mid- 1990s the REER has largely been close to equilibrium.

IV. Short-term Dynamics of the REER: An Error Correction Model

i) Short-term dynamics

Tanzania's REER has exhibited significant fluctuations and some sustained deviations around the estimated equilibrium REER (Figure 9). The purpose of this section is to specify a model of the REER that captures short-term dynamics that explain movements around the long-term equilibrium REER, the second step in the Engle and Granger two-stage procedure. The existence of a long-term equilibrium value of the REER does not mean that the observed REER has to be permanently equal to the equilibrium value. The observed REER can display short-term, even medium-term deviations from equilibrium and may be driven by short-term changes in fundamentals or policy variables.

Monetary and other policy variables may play a particularly important role in explaining REER movements in the case of a fixed exchange rate regime, where such policies must be consistent with the fixed rate regime. For example, excess domestic credit expansion will put pressure on domestic prices, resulting in a temporary real appreciation of the REER, or an REER misalignment. However, in the absence of a change in fundamentals to support excessive credit expansion there will be pressure to devalue the nominal exchange rate. Policy variables will also impact the REER under a flexible exchange rate regime if domestic prices and nominal exchange rates adjust to shocks at different speeds. The short-run specification below will attempt to isolate the short-term factors influences deviations around the long run EREER.

Given Tanzania's aid dependency over the sample we also consider more closely the policy reaction to aid inflows in the short-run specification. The central bank's policy response to aid inflows that are spent domestically by the government may mitigate a real exchange rate appreciation in the short-run. The central bank may respond to aid inflows by selling foreign exchange to remove from circulation the increase in the money base spent by the government.²² Another possibility is for the central bank to curtail inflation and real exchange rate appreciation by selling Treasury bills.²³ In this case, rising interest

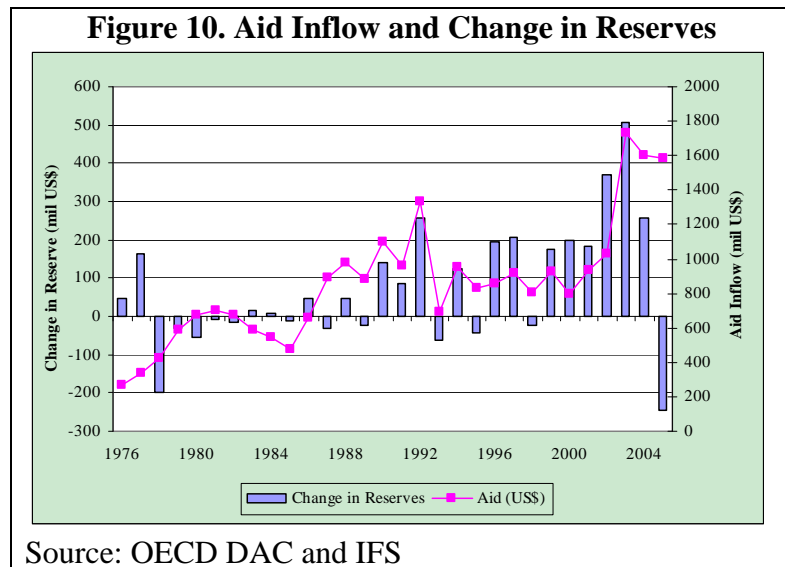
²² Although, there would still be real exchange rate appreciation in this case due to the initial overall rising aggregate demand and an appreciation of the nominal exchange rate associated with the sale of foreign exchange.

²³ The sale of T-bills would reduce the money supply and raise domestic interest rates.

rates and the reduction in the money supply mitigates rising inflation and aggregate demand, thereby muting REER appreciation.²⁴

Alternatively, the government may decide to build up reserves in the central bank. The government may do this because it is concerned about potential loss of competitiveness or as form of insurance against future shortfalls in aid inflows. While the level of aid inflows to Tanzania has been relatively high over the entire sample period they have been subject to wide fluctuations. The average annual level of net aid inflows jumped from 10 percent of GDP over the 1970-86 period to 24 percent over the 1987-94 period before falling to 15 percent over the 1995-2004 period. Moreover, annual aid disbursements have been unpredictable as donor commitments differ significantly from actual disbursements. One possible response to the volatility of aid inflows is for the central bank to build reserves during aid surges and draw down reserves when aid flows decline.²⁵ Such a strategy would tend to depreciate (appreciate) the nominal and, in the short run, the real exchange rate in the presence of an aid surge (decline), all else equal.

Figure 10 shows the relationship between net aid inflows and reserve accumulation in Tanzania over our sample. There appears to be no relationship between the series until 1990, at which point changes in BoT reserves become highly correlated with net aid inflows (correlation coefficient 0.73). Since 1995, reserve accumulation has been dramatic, increasing from



1.5 months of imports to 6.5 months of imports in 2004. The reserve accumulation combined with significant unemployed resources in the economy may be explaining part of the negative relationship between aid inflows and the REER, especially in recent years. The short-run specification below will include changes in BoT reserves to capture this possible influence on the REER over the short-run.

ii) Tanzania's REER: An error correction model

Stage two of Engle and Granger (1987) consists of running a short-run specification of the REER which includes changes in the key explanatory variables

²⁴ If capital market is free from controls, rising domestic interest rates may actually attract international capital flows and appreciate the currency (IMF 2005).

²⁵ Improving tax revenues is also an option, but the ratio of tax revenues to GDP has been virtually constant over the last thirty years at less than 14 percent.

identified in the long-run cointegrating relationship and other policy variables that are considered to influence the short-run dynamics of the REER. The key policy variables included in the model are excess credit (defined as the growth of base money in excess of nominal GDP growth) and the change in Bank of Tanzania reserves. It also includes the lagged residuals from the preferred long-run specification to capture the speed of adjustment of the REER to its equilibrium value (i.e. the error correction term). Table 2 presents the results of the ECM, a number of which are worth highlighting:

- The growth rate of aid inflows has a negative and significant short-run impact on the REER, echoing the result obtained in the long-run relationship.
- The short-run impact of the trade liberalization proxy on the REER is also similar to the results obtained in the long-run specification. However, it appears that the short-run effects of changes in the TOT are insignificant.
- Including changes in the Bank of Tanzania (BoT) reserves in the specification renders the aid variable insignificant, implying that BoT reserve policy in reaction to aid inflows may be an explanation for the inverse relationship between aid inflows and the REER in the short-run.

The key parameter in the ECM is the error-correction term measuring the speed of adjustment of the actual REER to its equilibrium value. When a gap between the real exchange rate and its equilibrium value arises, the real exchange rate will tend to converge to its equilibrium value. Depending on the cause of the gap, the adjustment requires that the real exchange rate either moves progressively to a new equilibrium level, or returns from its temporary deviation to the original equilibrium value. The parameter estimate on the error-correction term suggests that it takes less than two years for a deviation in the REER to return halfway to its equilibrium level. This result is similar to the speed of adjustment estimates found in Edwards (1989), but is longer than the Baffes et al (1998) estimates found for Burkina Faso and the Ivory Coast. The rather long half-life of the return to equilibrium is likely influenced significantly by the apparent extended period of undervaluation during the 1970s.

The ECM was re-run using the REER that incorporates the parallel nominal exchange rate. The results (Column 3 and 5) are generally similar to those found using the REER based on the official nominal exchange rate. An important difference is the estimated speed of adjustment to equilibrium. Incorporating the extra market information associated with the transactions in the parallel market indicates that the REER moves more quickly to equilibrium than the REER based only on the official nominal exchange rate. The estimated parameter on the error correction term implies that it takes roughly less than a year for the REER to return halfway to its equilibrium value.

Table 2: Error-Correction Model Results: 1970-2005

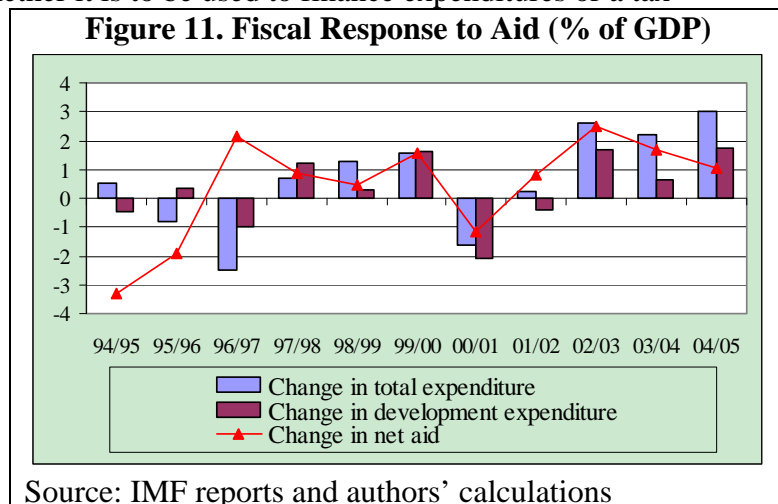
Variable	(1)	(2)	(3) ^{1/}	(4)	(5) ^{1/}
Error Correction Term	-0.37** (0.17)	-0.30*** (0.147)	-0.78*** (0.21)	-0.29** (0.14)	-0.69*** (0.17)
Δ Log (Open)	-0.42** (0.19)	-0.36** (0.16)	-0.53*** (0.16)	-0.36** (0.16)	-0.51*** (0.12)
Δ Log (TOT)	0.12 (0.21)	0.08 (0.17)	0.14 (0.18)	0.23 (0.19)	-0.03 (0.14)
Δ Log (Aid)	-0.20 (0.14)	-0.22* (0.13)	-0.26* (0.17)	0.15 (0.13)	-0.13 (0.12)
Δ Log (Invest.)	0.03 (0.12)				
Δ Log (Prod)	-0.76 (0.63)				
Δ Log (Reserves)				-0.08* (0.04)	-0.14*** (0.03)
_Cons	-0.03 (0.03)	-0.01 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.01* (0.02)
No. of obs	35	35	35	35	35
Adjusted R ²	0.35	0.37	0.52	0.42	0.70

1/Independent variable incorporates parallel exchange rate.

V. The Policy Response to Aid Inflows

This section builds the ECM results in the previous section to focus specifically on the policy response to aid inflows over the period 1995-2005. We undertake an accounting exercise in the spirit of the IMF (2004) to look for additional evidence that the policy response to aid inflows helps explain the negative and significant relationship between the REER and net aid inflows over this period. When aid flows into Tanzania the authorities must decide whether it is to be used to finance expenditures or a tax

reduction. Following the IMF (2004) the spending of aid is defined as the widening in the government's fiscal deficit before aid that accompanies the increase in aid. The first thing to note about these series is that there has been a steady increase in the amount of net aid financing that is recorded in the budget (Annex 3 Table A4). This has the effect of showing up



as a steady increase in net aid inflows in the fiscal accounts over the entire period 1995-

2005. It is clear, however, that increases in net aid inflows are largely being spent in the economy as increases in net aid inflows are accompanied by a widening of the before aid fiscal deficit (Annex Table 2). A strong correlation between net aid inflows and fiscal expenditures is also apparent (Figure 11). This result is consistent with IMF (2004) which found that over 90 percent of incremental aid flowing into Tanzania was spent over the period 2000-05.

It is the interaction between monetary policy and fiscal policy in response to aid inflows that determines the macroeconomic impact of aid, including the potential impact on the real exchange rate. Monetary policy can react to the spending of an increase in aid inflows in three ways. The Bank of Tanzania can allow the money supply to increase, aggregate demand to increase and the price of nontradables to increase, resulting in a real exchange rate appreciation. Alternatively, the BoT could sterilize the increase in the money supply by selling foreign exchange, again resulting in an appreciation of the real exchange rate.²⁶ Lastly, the BoT could opt to curtail inflation and real appreciation of the real exchange rate by selling treasury bills.

The accounting evidence suggests that rather than selling foreign exchange to permit the increase in net imports that an aid increase allows, the BoT choose instead to build reserves in the face of increasing aid inflows. At the same time, it issued T-bills to sterilize the aid flows that were spent in the economy. The stock of liquidity paper (T-bills) increased from 56 billion Tza shilling (less than one percent of GDP) in 1999 to 454 billion Tza shillings (3.7 percent of GDP) by end-2004. The annual average nominal T-bill rate declined from 10 percent in 1999 to 3.5 percent in 2002 before climbing to 8.3 percent in 2004. In this way, inflation was kept in check, while the policy of building reserves supported a nominal depreciation of the shilling over the entire period 1995-2005.

Table 3 is a summarized balance of payments presentation for Tanzania over the period 1995-2005. It isolates how much of the non-aid current account balance is covered by net aid inflows and how the change in gross reserves responds to net aid's over- or under-coverage of the CA deficit. For example, in 2000 net aid inflows were \$60 million greater than the recorded CA deficit, while the accumulation of reserves was \$197 million. This accounting suggests that the Bank of Tanzania did not sell the additional foreign exchange to finance additional net imports, but rather built up reserves in an amount that was greater than the excess aid inflow. Subsequent years over the period 2000-2004 show a similar response. In 2001, net aid inflows actually fell short of covering the non-aid CA by \$53 million, yet reserves were accumulated by an additional \$186 million. Other thing being equal, this reaction would create pressure for a nominal depreciation, and in the short run, a real depreciation. The bottom panel of Table 3 shows

²⁶ This response describes what the IMF (2004) calls the absorption of aid inflows. Absorption is defined as the extent to which the non-aid current account deficit widens in response to an increase in aid inflows. It aims to measure the quantity of net imports financed by an increase in aid, which represents the real resource transfer of resources enabled by aid (IMF 2004). Aid that is spent and not absorbed is similar to increasing government expenditures in the absence of aid. The difference is that international reserves are higher.

the cumulative increase in each component over the entire period. The cumulative change in net aid inflows marginally exceeded the cumulative increase in the non aid current account (\$91 million), while gross reserves were accumulated by over \$1 billion.

The accumulation of reserves in this amount over the period 2000-05 is consistent with a real exchange rate depreciation. However, the BoT's reserve policy over the 1995-1999 period is not consistent with the REER appreciation observed. Despite a period of accumulation of reserves (\$ 0.4 billion) the REER appreciated sharply. The reserve policy is consistent, however, with the observed depreciation of the nominal exchange rate over this period. There are a number of reasons why the BoT may have wanted to increase reserves over this period. Over the period 2000-05, it could have been done as a response to a surge in aid inflows resulting from a concern about a potential loss of competitiveness or as form of insurance against future shortfalls in aid inflows. It is equally plausible that BoT aimed to build up reserves for prudential reasons and was a continuation of a trend that started in the mid-1990s. Gross reserves covered only 1.5 months of imports in 1995 and were built up to 6.5 months of imports by end-2004. Regardless of the BoT's motive for building reserves the effect was the same: it supported a nominal depreciation of the shilling, and over the period 2000-05 a real depreciation.

Table 3. Balance of Payments 1994-2005

	1995	1996	1997	1998	1999	2000	2001	2002 ^{2/}	2003 ^{2/}	2004 ^{2/}	2005 ^{2/}
	Years of REER Appreciation					Years of REER Depreciation					
Levels (millions US\$)											
Net aid flow	727.53	698.42	967.74	627.65	795.92	937.31	754.64	667.10	876.29	1140.26	1405.16
Non-aid current account balance	-1008.64	-578.20	-784.88	-1230.33	-1194.69	-877.30	-808.26	-818.8	-795.1	-984.7	-1324.30
Change in Reserves (- = increase)	57.25	-209.45	-182.14	20.91	-175.41	-197.41	-186.38	-333.44	-348.16	-218.62	-128.49
<i>Potential REER Impact (-=expected depreciation)</i>	-223.86	-89.23	0.72	-581.77	-574.18	-137.41	-240.00	-485.12	-267.00	-63.10	-47.63
Non-aid capital account balance 1/	223.86	89.23	-0.72	581.77	574.18	137.41	240.00	485.12	267.00	63.10	47.63
Percent of GDP											
Net aid flow	13.84	10.75	12.59	7.49	9.21	10.32	7.99	6.83	8.52	10.08	11.60
Non-aid current account balance	-19.19	-8.90	-10.21	-14.68	-13.83	-9.66	-8.56	-8.38	-7.73	-8.71	-10.93
Change in Reserves (- = increase)	1.09	-3.22	-2.37	0.25	-2.03	-2.17	-1.97	-3.41	-3.38	-1.93	-1.06
<i>Potential REER Impact (-=expected depreciation)</i>	-4.26	-1.37	0.01	-6.94	-6.65	-1.51	-2.54	-4.96	-2.59	-0.56	-0.39
Non-aid capital account balance 1/	4.26	1.37	-0.01	6.94	6.65	1.51	2.54	4.96	2.59	0.56	-0.39
Cummulative Changes (millions US\$)											
	1995-1999					2000-2005					
Net aid flow	3817.26					5780.75					
Non-aid current account balance	-4796.74					-5608.50					
Change in Reserves (- = increase)	-488.84					-1412.50					
<i>Potential REER Impact (-=expected depreciation)</i>	-1468.32					-1240.25					
Non-aid capital account balance 1/	1468.32					1240.25					
Changes (millions US\$)											
Δ Net aid flow		-29.11	269.32	-340.09	168.27	141.38	754.64	-270.21	121.65	473.16	528.87
Δ Non-aid current account balance		430.44	-206.68	-445.45	35.64	317.39	-808.26	58.52	13.13	-165.97	-529.17
Δ Change in Reserves (- = increase)		-266.70	27.31	203.05	-196.33	-22.00	-186.38	-136.03	-161.78	114.82	219.67
<i>Potential REER Impact (-=expected depreciation)</i>		134.63	89.95	-582.49	7.59	436.77	-240.00	-347.71	-27.00	422.02	219.37
Δ Non-aid capital account balance 1/		-134.63	-89.95	582.49	-7.59	-436.77	240.00	347.71	27.00	-422.02	-219.37
Changes (% of GDP)											
	1995-1999					2000-2005					
Δ Net aid flow		-3.09	1.84	-5.11	1.73	1.11	7.99	-3.50	0.52	3.25	3.09
Δ Non-aid current account balance		10.29	-1.31	-4.46	0.85	4.17	-8.56	1.28	0.83	-0.33	-3.21
Δ Change in Reserves (- = increase)		-4.31	0.85	2.62	-2.28	-0.14	-1.97	-1.24	-1.41	1.48	2.32
<i>Potential REER Impact (-=expected depreciation)</i>		2.89	1.38	-6.95	0.29	5.13	-2.54	-3.45	-0.05	4.41	2.20
Δ Non-aid capital account balance 1/		-2.89	-1.38	6.95	-0.29	-5.13	2.54	3.45	0.05	-4.41	-2.99

Source: IMF Staff Reports.

1/ Includes errors and omissions.

2/ Original data available in fiscal year, converted to calendar year by taking average

Conclusions

This paper examined how Tanzania's REER has responded to internal and external macroeconomic developments since 1970. A long-run cointegrating relationship was developed to explain the long-run relationship between the REER and fundamental macroeconomic variables. An error-correction specification was employed to better understand the short-run dynamics of Tanzania's REER. As Tanzania appears to be a likely candidate to receive an increase in its already significant aid inflows, a special emphasis was placed on the relationship between the REER and aid inflows. **A key conclusion of this work is that we can find no evidence that net aid inflows to Tanzania have led to an appreciation of the REER.** Indeed, the evidence suggests that aid surges are associated with depreciations in the REER both in the short-run and the long-term. This result, while somewhat counterintuitive, is not unique. Moreover, there are plausible explanations for such a result and in the case of Tanzania it appears that:

- Before full import liberalization in Tanzania, aid was used to finance imported inputs to ease constraints to domestic production, helping to raise output through increased levels of capacity utilization (Nyoni 1998). This description is particularly relevant in the years following 1986 when the underground economy resurfaced generating a large supply response to the increased availability of goods (Mwase and Ndulu 2005). These factors are likely at work in the early years of the sample.
- As borne out in the ECM results and supported by the accounting exercise, it appears that the BoT, whether a result of fears of loss of competitiveness, as insurance against future aid inflow shortfalls, or a desire to target a specific prudential level of reserves is building gross reserves that is consistent with a depreciation of the real exchange rate. This policy response to aid inflows seems particularly strong in recent years.

Other important conclusions reached along the way to producing the results on the relationship between aid inflows and the REER are:

- The long-run cointegrating relationship indicates that, in addition to aid inflows, the terms of trade and trade liberalization exert a significant influence on the level of the REER. The REER appreciates (depreciates) with an improvement (decline) in the TOT and depreciates (appreciates) with a more open (closed) trade regime.
- Incorporating the parallel nominal exchange rate in the measure of Tanzania's REER is important when considering the historical evolution of the REER. Incorporating the parallel rate into the econometric analysis did not fundamentally change the results obtained with the official rate.

- Relative to our estimates of the equilibrium REER, Tanzania's actual REER was undervalued for much of the 1970s, sharply overvalued in the run-up to the balance of payments crises in 1986 and has recently been near equilibrium.
- Using an error correction model to capture the short-run dynamics of the REER indicates that it takes slightly less than 2 years for the REER to return halfway to its equilibrium value.

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Annex 1.

I. The Real Effective Exchange Rate in Tanzania: Concepts and Issues

This annex discusses key concepts and issues that arise when measuring the real effective exchange rate (REER) in a low-income country (LIC) like Tanzania. It explores the concepts of the *external* real exchange rate and the *internal* real exchange rate and documents the data issues involved in constructing indices to measure both. The section first considers a two-country world to highlight the *real* component of the REER. It is followed by a discussion that considers the construction of an REER index in a multi-country world and thereby focuses on the *effective* component of the REER.

i) The real component of the REER

A country's bilateral real exchange rate is typically defined as the product of the nominal exchange rate and the relative price levels between the two countries. It is a broad summary measure of the prices of one country's goods and services relative those of another country or group of countries. In a small-open economy the real exchange rate may be its most important relative price measure and may be used as a key indicator of the economy's external competitiveness. For example, an appreciation of the real exchange rate may reflect an increase in the domestic cost of producing goods implying that a country is now producing goods less efficiently than before, relative to the rest of the world. Defining the real exchange in these terms gives the *external* real exchange rate and derives from purchasing power parity (PPP) theory.

Relative PPP holds that the nominal exchange rate is proportional to the ratio of domestic and foreign price levels as in equation one:²⁷

$$(1) \quad E_d = \left(\frac{P_d}{P_f} \right) \cdot k$$

E_d is the nominal exchange rate defined as units of domestic currency per unit of foreign currency. P_d and P_f are the domestic and foreign price levels respectively and k is the real exchange rate, which in this formulation is a constant. If relative PPP does not hold for all goods in the domestic and foreign price levels then the real exchange is not a constant and any movements in the RER represent deviations from relative PPP. In this case, the real exchange rate is given by equation two:

$$(2) \quad RER_d = \left(\frac{P_f}{P_d} \right) \cdot E_d$$

²⁷ Absolute PPP states that the real exchange rate should be constant and equal to one.

In practice, the home and foreign price levels are measured by respective consumer price indices (CPI).²⁸ CPI measures cover the price of both traded and non traded goods and they can diverge significantly if productivity growth in both sectors differs.²⁹ In such circumstances, the real exchange rate may be better measured using a tradables price index, which is typically proxied for by relative wholesale price indices (WPI) or producer price indices (PPI) in both the home and foreign country. This measure may be appropriate when considering the relative price that achieves external balance in the trade in goods and services and would be a better measure to use if the aim is to better understand a country's external competitiveness. However, an important drawback with these measures is that there is considerable variation in the composition of the price baskets across countries, making implications for competitiveness less clear if the relative prices of different products are being compared. The use of export price indices in both the home and foreign country is also an option, but they are even more liable to compositional differences, especially in low incomes countries where commodity prices make up a large share of the export price index.³⁰

The distinction between the price of tradables and nontradables is not only an important measurement issue, it underpins a second strand of real exchange rate indices which are based on real trade theory in the context of open economy macroeconomic models.³¹ In these models the relative domestic price of non-traded to traded goods *within* the country is the real exchange rate and the increase in the relative price of non-traded goods is a real exchange rate appreciation. This result gives rise to the concept of the *internal* real exchange rate, which is the relative price that achieves internal balance in the domestic supply and demand of nontraded and traded goods. It captures the internal relative price incentives in an economy for producing or consuming tradable or nontradable goods (Hinkle and Nsengiyumva 1999).

The *internal* real exchange rate is the more appropriate measure of competitiveness in low income countries where international market share (i.e. external competitiveness) in the face of given international prices is a question of domestic price incentives and profitability in the production of tradables in the home country alone. If a country is a price taker in world markets then that country's goods are either competitive at the prevailing world price or they are not. If they are, internal competitiveness is what matters, i.e., that domestic producers have an incentive to produce tradable goods over nontradables. In this context, internal and external competitiveness are one and the same and the internal real exchange rate is functionally proportional to the external real exchange rate.

²⁸ GDP deflators may also be used to measure home and foreign prices and are theoretically supported by the Mundell-Fleming open economy model. See Hinkle and Nsengiyumva 1999.

²⁹ The problem is magnified the heavier is the weight of nontraded goods such as consumer services in the CPI basket.

³⁰ Please see Harberger (2005) for a critique of these so-called 'symmetric' measures of the real exchange rate.

³¹ These measures of the real exchange rate are supported by the two-sector dependent economy framework developed by Salter (1959) and Swan (1960) and used by Van Wijnbergen (1985), Edwards 1989) and Elbadawi (1994).

The relationship between the *external* and *internal* real exchange rate can be expressed as a function of the relative price of tradables between the home country and the foreign counterpart, the relative price of nontradables in the home country, and the relative price of nontradables in the foreign country. Assuming that PPP holds for tradables, equation three defines the real exchange rate as the relative price of nontradables between the two countries.

$$(3) \quad RER_d = \frac{(P_{Nf} / P_{Tf})^\alpha}{(P_{Nd} / P_{Td})^\alpha}$$

N = nontradables

T = tradables

α = weight of nontradables in home country aggregate price index

a = weight of nontradables in the foreign country in aggregate price index.

If the relative price of nontradables in the foreign country is unchanging then movements in the home country's real exchange rate is a function of its own relative price of nontradables. Introducing the nominal exchange rate requires assuming that PPP holds in tradables so that the domestic currency price of tradables is equal to the foreign currency price of tradables multiplied by the nominal exchange rate. Assuming PPP in this instance restates the above, i.e, that the LIC is a price taker in world markets. Equation four is a special case of equation three and a measure of the home country's internal real exchange rate:

$$(4) \quad RER_d = E_d \frac{P_{Tf}}{P_{Nd}}$$

In principle, the domestic price indices of tradables and nontradables should be used to construct the *internal* RER, but these series are typically not available in LICs. In practice, the *internal* real exchange rate is measured using the foreign WPI and the domestic CPI. The foreign WPI multiplied by the nominal exchange rate proxies the home country's tradable goods price, while the domestic CPI is a proxy for nontradable prices in the home economy.³² A key drawback in using the CPI as a proxy for nontradables prices is that the greater the weight of traded goods in the CPI implies a greater divergence in the proxy to nontraded goods prices. An important drawback in using foreign WPI is that it is unlikely to track fluctuations in a LIC's exports prices, especially commodity prices. It may, however, do better tracking import prices and nontraditional exports. Additionally, the WPI measure will be a poor proxy for tradable

³² One direct measure includes using expenditure data from nation accounts to measure the ratio of domestic prices of goods actually exported and imported and the price of domestically produced and consumed goods (Devarajan, Lewis and Robinson 1993). Another direct measure attempts to split sectors of production into tradable and nontradable categories and then calculate implicit price deflators.

prices if the ratio of export to import prices (terms of trade) are volatile. One alternative is to calculate a domestic tradables price index by taking a weighted average of the foreign price of importables (P_{Md}) and exportables (P_{Xd}) multiplied by the nominal exchange rate as in equation five.

$$(5) \quad RER = E_{dc} \cdot [P_{Md}]^{\alpha} \cdot [P_{Xd}]^{(1-\alpha)} / P_{Nd}$$

;where α is the share of importables in total tradables.

This measure of the internal real exchange rate implicitly assumes that import prices and export prices move together so that they can be aggregated into one tradable goods price. If the price of imports and export diverge then the measure will be less likely to appropriately capture the price incentives of producing or consuming tradables. In this case, it may be more appropriate to consider separate internal RER indices, one using exports prices and the other using import prices. In this way, the incentives in the exportable or the import-substituting sectors are better represented by the separate indices. We consider all three measures of the *internal* real exchange rate in the following section.

An alternative approach to measuring the real exchange departs from the focus on international price competitiveness and instead considers international cost competitiveness. Relative unit labour cost indices are often used as indicators of international competitiveness as they provide a broad measure of the domestic costs of production. Labour is the relatively immobile factor in a country's production process, implying labour costs are likely to diverge across countries and play a disproportionately important role in competitiveness. Defined in this way, the real exchange rate reflects the incentives to reallocate non-labour resources internationally and domestically. Unit labour costs are subject to significant measurement error and are published with long lags even in OECD countries. These drawbacks preventive us from measuring Tanzania's real exchange rate using unit labour cost indices.

ii) The effective component of the REER

Moving beyond a two-country framework necessitates consideration of the range of trading partners to include in the real exchange rate index and how they should be weighted. In principle, a country's REER measure should include all trading partners that compete with domestic producers either directly or indirectly through third markets. In practice, data limitations in availability and quality tend to restrict the number of countries that can be considered. As long as a significant majority of a country's trade is accounted for in the partners chosen, the impact on the REER index due to excluded partners should be marginal.

There are two key issues that must be addressed when choosing a weighting scheme. The first is choosing the appropriate weights, either export weights, import weights, or both. This choice is clearly dependent on the choice of RER that is used. If separate internal RERs for export and import prices are used then weights should be export and

imports, respectively. If the composite measure described in equation 5 is used then both export and imports or total trade flows should be used, given that external competitiveness consists of both export and import competitiveness.³³ In practice, the weight capturing the trade flows between the home country and country *i* is equal to the sum of imports and exports to country *i* as a proportion of the home country's total trade flows. Bilateral trade weights of this sort fail to capture indirect competition from trading partners in third markets, thereby understating the degree of competition faced by domestic producers. REER indices calculated using weights to capture third party competition have been found to have significant impacts on the measures.³⁴ However, in countries where primary commodity exports make up a large share of total trade, third party competition may not be a serious issue given the lack of substitutability across countries of most primary commodities. Nevertheless, the IMF's Total Competitiveness Weights (TCW) attempt to capture competition from third countries and is a feature of the IMF's REER index for Tanzania shown in the next section.

The second issue concerns the choice between fixed or flexible weights over time. Fixing the trade weights in a particular year is frequently done because it is easy to do. However, as trading patterns change over time the real exchange rate index may provide a misleading picture of the net effect of movements in particular bilateral exchange rates, and thereby competitiveness. In this context, it may be worthwhile to have the trade weights change over time. The weights can be changed continuously or at somewhat frequent discrete intervals depending on how the country's trading partners have changed over time. Tanzania's trading partners have indeed changed quite significantly over time (Table 1) suggesting that a flexible weighting scheme is in order. We discuss the implications of different weighting schemes on Tanzania's REER in the next section.

³³ An import competitiveness indicator measures a country's competitive position in its home market, while an indicator of export competitiveness measures a country's competitive position in its export markets.

³⁴ Please see Ghose, Devajyoti and Kharas, Homi. (1993). 'International competitiveness, the demand for exports and real effective exchange rates in developing countries'. *Journal of Development Economics* 41, pp. 377-398.

Table A1: Trading Share for Major Trading Partners (%)

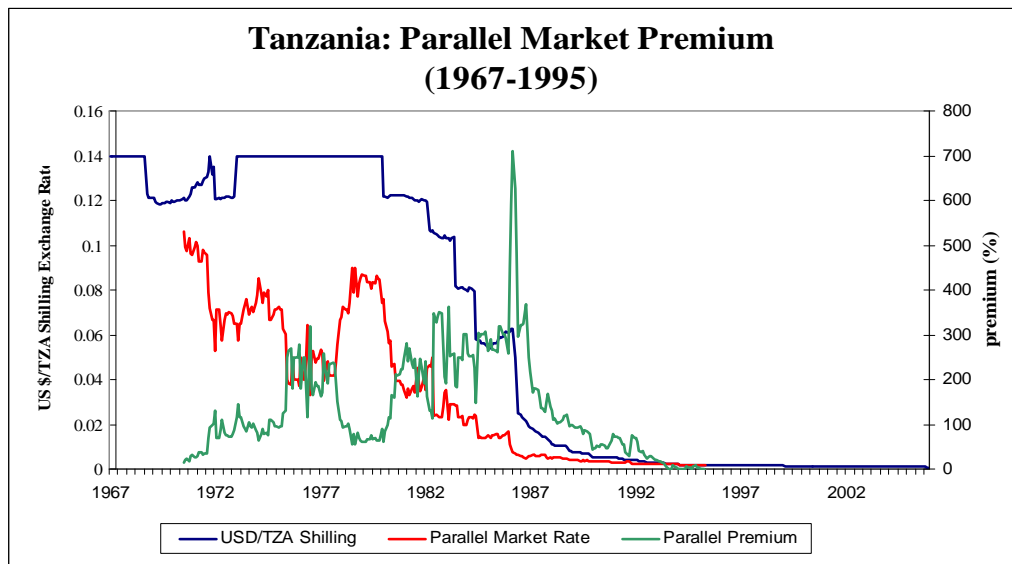
Trading Partners	1975	1985	1995	2000	2005
United Kingdom	12.7	14.4	8.0	11.3	4.2
United States	10.2	3.2	3.8	3.3	2.9
China	7.7	1.3	3.6	3.1	10.1
Germany	7.5	12.7	5.0	5.3	3.9
Saudi Arabia	7.2	2.8	3.7	2.6	2.2
Kenya	6.4	1.6	10.5	5.8	6.4
Japan	4.4	8.4	7.1	7.9	3.6
Italy	3.3	8.6	2.9	2.0	2.2
India	3.0	1.5	5.4	8.3	7.4
Netherlands	2.9	4.3	2.9	3.4	3.5
Singapore	2.7	2.0	2.5	0.6	0.4
Sweden	2.2	2.8	1.3	0.8	1.8
Belgium	2.1	3.0	2.1	1.5	1.5
Denmark	2.0	2.1	1.1	1.1	0.2
South Africa	0.0	0.0	7.8	8.5	10.3
United Arab Emirates	0.0	2.1	3.2	2.8	5.5
Other trading partners	25.6	29.0	29.0	31.7	33.7

Source: IMF Direction of Trade Statistics

iii) Other issues in the LIC context

In the LIC context, careful attention must be paid to the nominal exchange rate used in the calculation of the REER. Many LICs either have had or still have parallel markets for foreign exchange, where an exchange rate determined by the market (either legally or illegally) coexists with a pegged or managed exchange rate. Using the officially managed nominal exchange rate only in the calculation of an REER could be a misleading indicator of economy-wide price incentives in the LIC as the official rate is most times overvalued. Tanzania has had a parallel exchange rate for much of its post-independence history, with the parallel exchange premium peaking at over 700 percent in 1986. The parallel premium gradually declined to less than 10 percent in 1993 and the exchange rates were unified in 1994 (see Chart 1). In the next section we present an REER using a weighted average of the parallel and official nominal exchange rates.³⁵

³⁵ Jorgensen and Paldam (1986) justify the use of an average of the two rates on the basis that misalignments in the parallel and official rates tend to be in opposite directions (the parallel rate being undervalued while the official rate is overvalued) and policy shocks such as large devaluations often move the rates in opposite directions.



Related to the issue of the parallel market rate is the existence of unrecorded trade through unofficial markets. Such unrecorded trade is likely to be greater the higher are tariffs and nontariff barriers to official trade and the greater is the parallel market premium (Hinkle and Nsengiyumva 1999). It may also be the case that due to weak recording of trade data that unrecorded trade may be significant in the absence of a large parallel market premium. In either case, adjustments to the weighting schemes that are based on official direction of trade statistics may be necessary when constructing the REER in LICs. Adjustments can typically be made on the basis of specific country knowledge of unrecorded trade patterns. The next section shows how Tanzania's REER is affected by making adjustments to the weighting scheme to account for simulated levels of unrecorded trade.

Tariffs and administered price schemes that act as taxes or subsidies on imports or exports may cause domestic prices to diverge from border prices. When such tax or administered price effects are significant, they will affect the relationship between internal and external REERs and will not reflect the true internal price incentives to producing and consuming tradables. An increase in protection, other things being equal, will depreciate the internal REER by raising the domestic price of tradables and hence may partially offset an appreciation of the external REER. However, it is the internal RER inclusive of taxes that reflects relative domestic prices and affects domestic resource allocation.

II. A comparison of alternative REERs for Tanzania

i) Alternative weighting schemes

Table A2 shows the fixed weighting scheme used in the IMF's measure of Tanzania's REER and the weights used in our flexible weighting scheme. The IMF weights are fixed at the average of the 1989-1991 period and based on the 23 largest trading partners. Our weights are based on Tanzania's 50 largest trading partners and change according to a

five-year moving average. Our weights indicate significant differences relative to the IMF weights in the later years of the sample, where developing countries like Kenya and India take on greater weights in the weighting scheme. Also, the difference in country coverage appears to be significant and is increasing over time as indicated by growing weight on the *other* category in Table A2.

Table A2: Comparing Weights

Trading partner	IMF weights	Our Weights in Different Time Periods				
		1969~2005	1975	1985	1995	2005
United Kingdom	16.1	15.4	17.1	14.4	10.0	7.2
Germany	11.9	9.4	8.1	14.4	7.5	4.2
Japan	11.2	8.0	6.3	9.2	7.9	6.5
Italy	10.1	5.0	4.2	6.4	4.4	2.4
United States	8.1	5.1	7.8	4.1	3.2	3.7
Netherlands	5.5	4.6	3.5	5.9	3.6	3.7
France	4.5	2.4	2.1	2.0	1.9	4.5
Sweden	3.8	2.1	2.2	2.6	1.8	1.1
Belgium	3.7	2.6	2.2	3.5	3.3	1.8
India	2.8	5.3	4.3	2.7	5.9	7.8
China	2.7	2.3	0.0	1.4	3.6	6.5
Denmark	2.4	1.8	1.1	1.7	1.4	0.5
Canada	2.4	1.3	1.7	1.2	0.7	1.4
Kenya	1.9	4.8	9.5	1.1	6.7	5.8
Switzerland	1.8	1.1	0.8	2.0	0.6	0.6
Pakistan	1.8	1.1	0.4	0.3	1.7	0.9
Brazil	1.7	0.3	0.0	0.4	0.3	0.2
Finland	1.5	0.9	0.2	1.8	0.7	0.5
Spain	1.4	0.6	0.5	0.4	0.6	1.4
Australia	1.3	1.3	2.0	0.6	0.4	2.6
Norway	1.2	0.7	0.4	0.7	0.7	0.2
Singapore	1.2	1.9	1.5	1.7	2.5	0.6
Korea, Rep.	1.2	0.4	0.0	0.0	0.8	0.9
Other	0.0	21.9	24.0	21.5	30.1	34.8

Source: IMF Direction of Trade Statistics

Note: The twenty-three IMF trading partners are shown, while the remaining twenty-seven trading partners captured in the flexible weighting scheme are grouped in the other category.

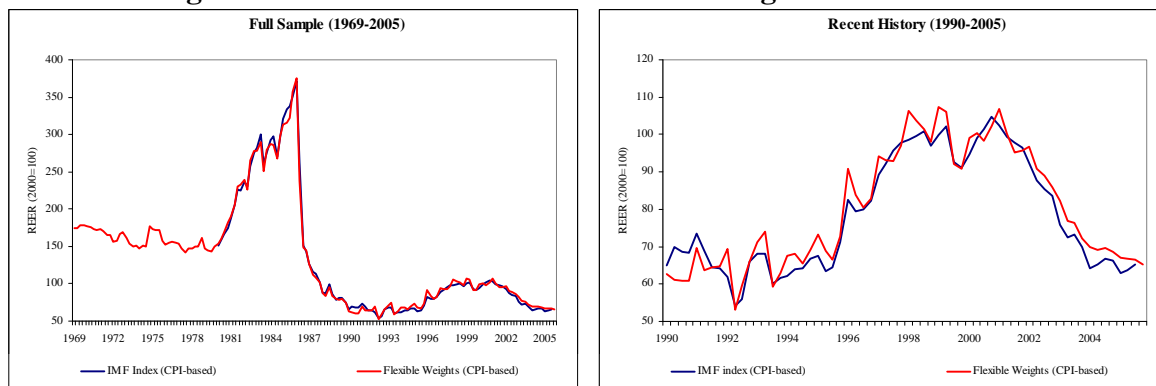
Despite the differences in the two weighting schemes, using a flexible weighting scheme appears to have very little impact on measures of Tanzania's REER. Figure 1 shows the IMF's REER and an index using the flexible weighting scheme described above.³⁶ Both measures virtually coincide, although the flexible weights measure does indicate greater volatility, especially from the 1990s. A closer look at the indices over the last fifteen years shows that the trends are the same: a 40 percent appreciation over the 1990s (45 percent with flexible weights) followed by a 30 percent depreciation since the beginning of 2000 (27.4 percent). The correlation coefficient for the two indices is 0.97

³⁶ An increase in the index corresponds to an appreciation of the REER. This presentation is consistent throughout the paper.

over the period 1990-2004. The apparent insignificance of different weighting schemes on measures of Tanzania's REER is not unexpected, as the relatively small changes in weights are dominated by changes in relative prices and or the nominal exchange rate (see Edwards 1989).

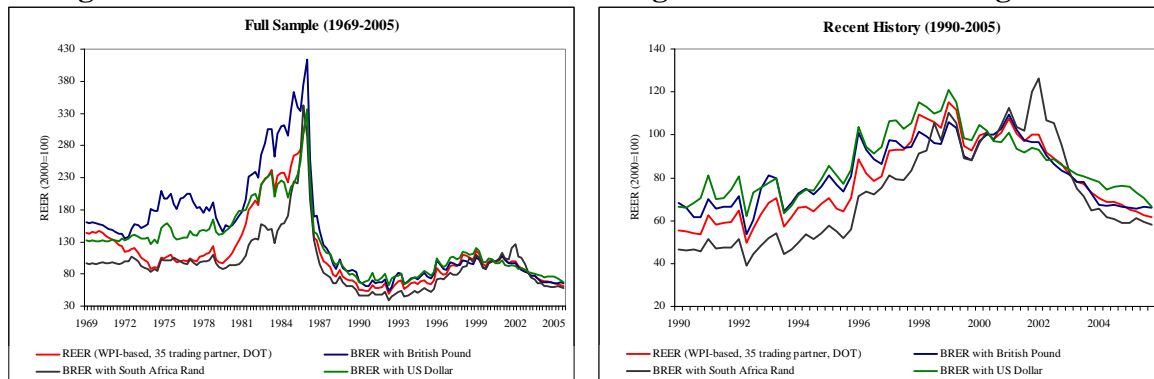
Adjusting the official trade weights to account for Tanzania's unrecorded trade also has little impact on the REER measure. We tested the sensitivity of the REER index to unrecorded trade by increasing the trade value of Tanzania's neighboring countries by five times throughout the entire sample period. While there is a marginal level shift in the index during the 1980s the trend is virtually identical. For the rest of the period, the indices virtually coincide. This is explained in part by the strong comovement in the bilateral nominal exchange rates between Tanzania and its neighbors and the shilling and other developed country exchange rates during the entire sample period.

Figure A1. Tanzania: Real Effective Exchange Rate Measures



The apparent insignificance of using different weighting schemes does not suggest that no weighting scheme is preferable. Tanzania is reliant on the export of primary products whose prices are determined in world markets and in major currencies. Arguably, bilateral real exchange rates with the pricing currencies are as strong an indicator of external competitiveness as a multilateral real exchange rate. Figure 3 shows that the TZA shilling/US dollar and the TZA shilling/UK pound real exchange rates have a correlation coefficient of 0.90 over the 1990-2004 period. The multilateral RER and the bilateral indices are slightly less correlated (REER-US dollar 0.85, REER-UK pound 0.88, REER- SA Rand 0.88), indicating that a multilateral real exchange rate is a more robust (albeit marginally), measure of competitiveness in Tanzania.

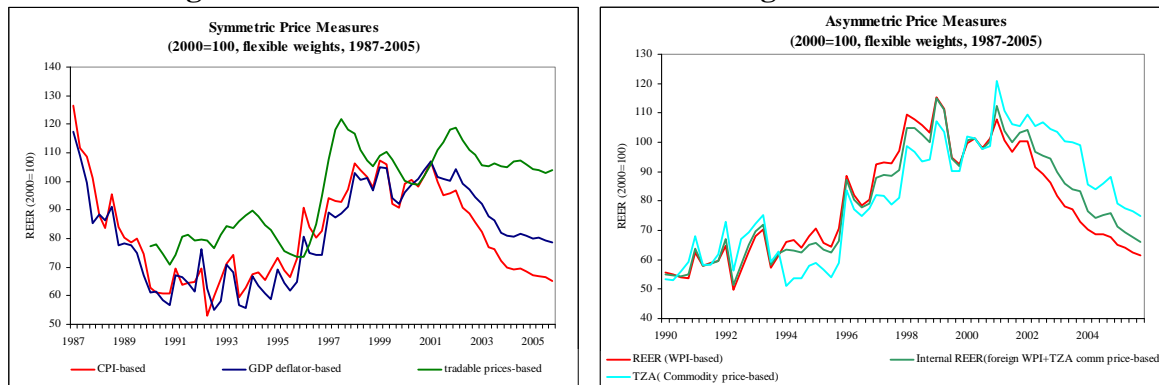
Figure A2. Tanzania: Real Effective Exchange Rate and Real Exchange Rates



ii) Alternative price measures

Figure 4 presents a number of indices measuring Tanzania’s REER using a variety of price indices. The first panel in Figure 4 shows ‘symmetric’ measures, i.e. using the same price indicator in the trading partner as in Tanzania. Conceptually, these indices derive from PPP theory and proxy the external real exchange rate. The second panel presents the ‘asymmetric’ measures of the REER, which use price indices that proxy the prices of tradables and nontradables in Tanzania. The ‘asymmetric’ measures attempt to capture movements in the *internal* REER. One general observation is that all the REER measures show a strong tendency to move together implying that these measures of the *internal* and the *external* REER are closely related and seem to indicate an improvement in Tanzania’s competitiveness in recent years. Although, the ‘symmetric’ measure using the relative price of tradables (export and import prices) does not show as pronounced a depreciation in recent years. However, there are technical and conceptual reasons not to put too much stock in the relative price of tradables measure of Tanzania’s REER. As a primary product exporter and importer, Tanzania’s tradables price basket is quite different than the prices of the components contained in developed country tradable price baskets that are being measured (e.g. U.K, U.S. and Germany). It is not clear, for example, what the relative price of tea to autos tells us about Tanzania’s external competitiveness in the tea sector.

Figure A3. Tanzania: Real Effective Exchange Rate Measures



Another observation of note regarding the ‘symmetric’ measures is the recent divergence between the CPI-based index and the GDP deflator-based index. The GDP deflator-based index indicates a somewhat less dramatic depreciation from 2001. When Tanzania’s external terms of trade (TOT) change significantly, movements in CPI (which includes the price of imports, but excludes the price of exports) and its GDP deflator (which includes the price of exports, but excludes the price of imports) may diverge. In recent years, the price of Tanzania’s exports have increased faster than import prices (a TOT improvement) and thus the GDP deflator has risen faster than CPI, thereby indicating a dampening of the improvement in competitiveness relative to the CPI-based REER measure.

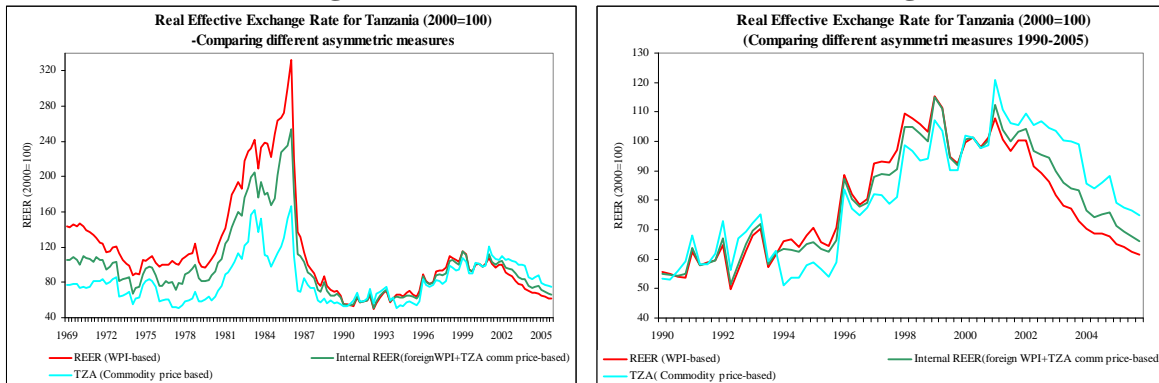
The ‘asymmetric’ measures, the measures of the REER that we find conceptually most relevant in the case of Tanzania, are collinear at 0.70. However, the measure using Tanzania’s export and import price indices does show more pronounced appreciations and depreciations. This can be explained by the more dramatic swings in Tanzania’s tradables prices than the changes in foreign country WPIs. Concerns about the quality and availability of Tanzania’s export and import price data lead us to construct an additional measure of the REER. Employing a modified methodology used by Cashin et al (2004), we construct a separate price index for Tanzania’s exports as a weighted average of its nine key commodity prices.³⁷ We combine this measure with foreign WPIs to proxy nontraditional export and import prices to report another measure of the REER. It also shows a strong correlation with the other indices (Figure 4).

As discussed above and observed with the ‘symmetric’ REER measures, if export and import prices do not move together then aggregating them into one tradables price measure can give misleading signals of the price incentive to produce and consume tradables and by extension external competitiveness. It may be more informative to

³⁷ The nine commodities are: coffee, cotton, tea, tobacco, sisal, copper, spice, nut and fish. Overall, these nine commodities accounted for more than 50 to 75 per cent of total Tanzania non-gold exports over the sample period. Though gold accounted for about 50 per cent of Tanzania exports in 2004, the gold industry is an enclave and largely detached from the rest of economy, so gold prices are not included in the measure.

separate the price of tradables into its export price component and its import price component to produce two measures of the *internal* REER. Again, this distinction does not alter general conclusions and magnitudes of the changes in the other measures of the REER. Although, the commodity price based export price index shows a sharp appreciation during 2004 not seen in the WPI-based measure, which reflects strong fish price increases in 2004.

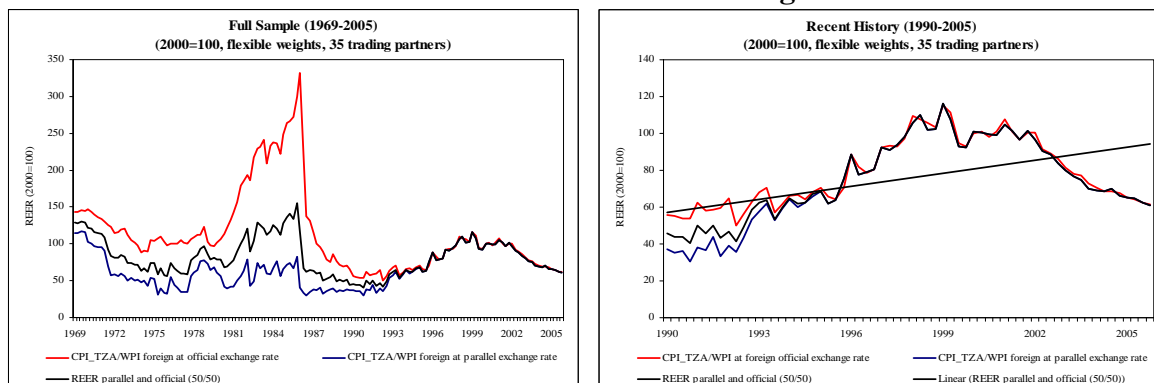
Figure A4. Tanzania: Real Effective Exchange Rate Measures



iii) Incorporating the parallel exchange rate market

Accounting for the parallel nominal exchange rate in the calculation of Tanzania's real exchange rate is a particular concern given the large parallel market premiums that have existed in the past (see Section I). While the parallel market premium has disappeared since 1994, understanding current REER level in a historical context necessitates inclusion of the parallel exchange rate. A complicating factor, however, is that when combining the parallel and official rates in one measure of the nominal exchange rate it is necessary to have some information on the share of transactions in the parallel market. We take a weighted average of the official and parallel rates by assuming that the share of transactions in the parallel market is 80 percent when parallel premium is highest and the share of parallel market trade decline proportionally with (square root of) parallel premium. While somewhat arbitrary, this definition is based on discussions with Bank of Tanzania officials. Incorporating the parallel market rate in this way indicates that while there has been a depreciation of the REER in the last 5 years its current level is still appreciated relative to 1990 levels (Figure 5). The heavier the weight that is placed on unrecorded trade the more pronounced the appreciation would become and the stronger the upward trend observed.

**Figure 6. Tanzania: Real Effective Exchange Rate Measures
Official and Parallel Nominal Exchange Rates**



Annex 2.

A3. Unit Root Test

Variable	ADF Test	ADF Test	Phillips-Perron	Phillips-Perron
	Level	First Difference	Level	First Difference
Log(WPI-based REER)	-1.965(1)	-3.355(0)**	-1.583	-3.393**
Log(REER incorporating parallel rate)	-1.597(1)	-6.323(0)**	-1.886	-6.302**
Log(openness)	-2.262(0)	-5.633(0)***	-2.303	-5.645***
Log (real commodity price)	-1.233(0)	-6.602(0)***	-1.088	--6.767***
Log(Public Investment)	-2.550(0)	-5.916(0)***	-1.929	-5.921 ***
Log(Relative Per Cap GDP)	-1.240(0)	-5.853(0)***	1.209	-5.795***
Log(aid/GDP)	-2.409(0)	-6.232(0)***	-2.379	-6.300***

Note: In paranthese are numbers of lags

* significant at 10%

** significant at 5%

*** significant at 1%

Annex 3.

Table A4. Central Government Operation 1995-2005

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	Years of REER Appreciation					Years of REER Depreciation					
Levels (Billions of Tza shilling)											
Net Financing	79.20	12.50	18.75	158.80	325.10	344.95	320.45	522.05	836.79	1203.08	1562.00
Net Aid	21.75	46.90	117.95	175.35	288.40	346.70	386.75	613.20	935.90	1226.67	1433.47
Net Domestic Financing	31.55	-36.05	-88.85	-60.45	-60.25	-76.30	-83.75	-90.25	-99.01	-23.58	111.88
Other	25.90	1.65	-10.35	43.90	97.00	74.60	17.45	-0.95	-0.15	0.00	16.65
Balance (before grants)	-79.20	-12.50	-18.75	-158.80	-325.10	-344.95	-320.45	-522.05	-836.79	-1203.08	-1562.00
Revenue	389.79	510.20	595.58	654.30	731.00	851.05	986.25	1130.20	1338.40	1599.30	1949.28
Expenditure (excl. interest)	440.80	505.51	610.22	809.20	1035.25	1165.75	1293.70	1645.25	2154.68	2762.36	3511.276
Development Expenditure	103.70	115.85	153.85	222.65	321.60	340.80	288.80	396.10	571.70	867.04	1079.97
Percent of GDP											
Net Financing	2.62	0.33	0.40	2.85	5.05	4.75	3.87	5.53	7.83	9.76	11.42
Net Aid	0.72	1.24	2.51	3.15	4.48	4.77	4.67	6.49	8.76	9.96	10.48
Net Domestic Financing	1.04	-0.96	-1.89	-1.08	-0.94	-1.05	-1.01	-0.96	-0.93	-0.19	0.82
Other	0.86	0.04	-0.22	0.79	1.51	1.03	0.21	-0.01	0.00	0.00	0.12
Balance (before grants)	-2.62	-0.33	-0.40	-2.85	-5.05	-4.75	-3.87	-5.53	-7.83	-9.76	-11.42
Revenue	12.90	13.54	12.66	11.74	11.36	11.71	11.92	11.97	12.52	12.98	14.26
Expenditure (excl. interest)	14.59	13.42	12.97	14.52	16.09	16.04	15.64	17.42	20.16	22.42	25.68
Development Expenditure	3.43	3.07	3.27	4.00	5.00	4.69	3.49	4.19	5.35	7.04	7.90
Changes (Billions of Tza shilling)											
Δ Net Financing		-66.70	6.25	140.05	166.30	19.85	-24.50	201.60	314.74	366.29	358.92
Δ Net Aid		25.15	71.05	57.40	113.05	58.30	40.05	226.45	322.70	290.76	206.80
Δ Net Domestic Financing		-67.60	-52.80	28.40	0.20	-16.05	-7.45	-6.50	-8.76	75.43	135.46
Δ Other		-24.25	-12.00	54.25	53.10	-22.40	-57.15	-18.40	0.80	0.15	16.65
Δ Balance (before grants)		66.70	-6.25	-140.05	-166.30	-19.85	24.50	-201.60	-314.74	-366.29	-358.92
Δ Revenue		120.41	85.38	58.72	76.70	120.05	135.20	143.95	208.20	260.89	349.98
Δ Expenditure (excl. interest)		64.72	104.71	198.99	226.05	130.50	127.95	351.55	509.43	607.68	748.92
Δ Development Expenditure		12.15	38.00	68.80	98.95	19.20	-52.00	107.30	175.60	295.35	212.93
Changes (% of GDP)											
		1995-1999				2000-2005					
Δ Financing		-2.29	0.07	2.45	2.20	-0.31	-0.87	1.65	2.30	1.93	1.66
Δ Net Aid		0.52	1.26	0.64	1.34	0.29	-0.10	1.82	2.27	1.20	0.53
Δ Net Domestic Financing		-2.00	-0.93	0.80	0.15	-0.11	0.04	0.06	0.03	0.74	1.01
Δ Other		-0.81	-0.26	1.01	0.72	-0.48	-0.82	-0.22	0.01	0.00	0.12
Δ Balance (before grants)		2.29	-0.07	-2.45	-2.20	0.31	0.87	-1.65	-2.30	-1.93	-1.66
Δ Revenue		0.64	-0.88	-0.92	-0.38	0.35	0.21	0.05	0.56	0.46	1.28
Δ Expenditure (excl. interest)		-1.18	-0.44	1.55	1.57	-0.05	-0.41	1.78	2.74	2.26	3.26
Δ Development Expenditure		-0.36	0.20	0.73	1.00	-0.31	-1.20	0.70	1.16	1.69	0.86

Source: IMF Staff Reports