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The Impact of Real Exchange Rate Misalignment and Instability on Macroeconomic Performance in Sub-Saharan Africa

by

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Abstract

This study investigates the relationship between indicators of macroeconomic performance and real exchange rate (RER) misalignment and instability in Sub-Saharan Africa (SSA). Three measures of RER misalignment are used. There is ample evidence that countries which have pursued more predictable macroeconomic policies and lower levels of RER misalignment have experienced better economic performance. Also, it appears that higher levels of misalignments in the RER are accompanied by higher levels of macroeconomic instability. Empirical support is found for Edwards' model of the equilibrium RER and black market premia tend to show a greater degree of misalignment than alternative measures.

The Impact of Real Exchange Rate Misalignment and Instability on Macroeconomic Performance in Sub-Saharan Africa

Introduction

Sub-Saharan Africa (SSA) is one of the poorest regions of the world, and in the last two decades it has been getting poorer. Most countries of the region have experienced slow or negative growth in real income per capita during that period. Many factors may have contributed to slow growth including some that are beyond the control of residents of the region. Drought, adverse terms of trade, and limited access to foreign credit and aid are among the external factors that are frequently cited as contributing to slow growth.

However, faster growth of developing countries in other regions (especially Asia) that have faced the same external conditions as Africa has led observers to focus on the contribution of domestic policy to economic problems in the region. A World Bank study (1989a) notes that "Africa's crisis cannot be satisfactorily explained as the result of an adverse [international] economic climate, low commodity prices [on world markets], or dwindling foreign assistance, p. 2." If domestic policy failure has contributed to slow growth, internal policy reforms have the potential to stimulate African economic growth without altering external economic conditions.

This paper will focus on one important factor believed to have contributed to the economic distress in virtually all

countries in SSA -- inappropriate domestic macroeconomic and trade policies. It is now widely accepted that chronic misalignment in the real exchange rate (RER) has been a major source of slow growth in Africa and Latin America, and prudent exchange rate and macroeconomic policies have fostered growth in Asia [World Bank (1984) and Gulhati et al. (1985)]. The RER, the relative price of tradables to nontradables, can be an important variable in determining economic performance, since it reflects the overall state of macroeconomic and trade policies and of economic fundamentals.

Although there is much interest in the impact of RER misalignment on economic performance, there is limited empirical evidence on its importance in SSA. Other RER studies [Agarwala (1983), Edwards (1988a and 1990), Cottani et al. (1990), and Frenkel and Khan (1990)] have used broad geographical samples of developing countries that have included some African countries, but this paper will use data exclusively from SSA. Balassa (1990) and Cleaver (1985) did focus on Africa, but their analyses of RER misalignment were limited to the simple Purchasing Power Parity (PPP) measure. The results of using exclusively African data are informative in light of some problems reported about the use of certain African data in other contexts [Officer (1990) and Yeats (1990)].

Three different measures of the RER have been used in the empirical literature: measure using the Purchasing Power Parity (PPP) theory [Balassa (1990), Agarwala (1983), and Cottani et al.

(1990)]; model-based measure using official nominal exchange rates [Edwards (1990) and Cottani et al. (1990)]; and model-based measure using black market nominal exchange rates [Edwards (1989 and 1990)]. Edwards found some advantage for black market rates over official exchange rates. Cottani et al. (1990) found empirical support for the model-based measure but no support for the PPP measure. Although, the study by Balassa (1990) did not address the RER misalignment per se, his measure of the RER did imply misalignment using the PPP theory and he did offer empirical support for the adverse effects on exports of that de facto measure misalignment. This paper uses both the PPP measure and the model-based measure (using the official nominal rates). In addition, the RER misalignment is proxied with the black market premia. The relationships among these three measures of misalignments are investigated. Also, the impacts between these measures of misalignments and various indicators of performance are analyzed.

In addition to RER misalignment, the effect of variability of the RER on economic growth and trade has been investigated. Edwards (1990) found a negative effect of RER variability on real income growth and investment during the period of floating exchange rates (but not during the Bretton Woods period), but no effect of variability on exports. This paper presents new evidence on the same relationships and for additional macro variables in the exclusive context of SSA.

The purposes of this paper are threefold. The first is to

identify the factors determining the RER in SSA. Second, the effects of RER misalignment and instability on real income growth, total exports and imports, and saving and investment are analyzed.[1] In that regard, three alternative measures of misalignment in RER are used. A third issue considered is whether macroeconomic instability as measured by variability in the RER has an adverse impact on income growth and trade.

Macroeconomic Performance in Sub-Saharan Africa

During the period 1970-87 most countries in SSA have experienced steady deterioration in their aggregate economic performance (see Table 1). Real income per capita declined in most SSA countries. This poor growth performance contrasted with the experience of other developing regions during the same period, and the faster growth in Africa during the previous decade. The decline in income growth was also reflected in the decline in investment and savings relative to gross domestic product. Of the many factors that may have contributed to the growth problem one that has been identified by many observers (including the World Bank and the IMF) is misalignment of the real exchange rate.

[1]Although, the real exchange rate misalignment is not the only form of distortion which can affect macroeconomic performance, Agarwala (1983) has shown that it is by far the one single most important form of distortion affecting economic growth in a diverse group of 31 LDCs. His empirical analysis, considered several forms of distortions.

The Real Exchange Rate Misalignment and Instability: Theoretical Concepts and Measurements

This section defines the RER concept and discusses the empirical measurements of both the RER misalignment and instability. The index of RER misalignment (RERMIS) is measured as:

$$(1) \quad RERMIS_{it} = \{(ERER_{it}/RER_{it})-1\}*100$$

where ERER is the equilibrium RER, t is a time index, and i is a country index. The RER is defined as P_T/P_N, where P_T and P_N are the domestic prices of tradables and nontradables respectively. This concept of the RER has a firm theoretical foundation [see Edwards (1989)], but it lacks a clear empirical counterpart. Thus, three proxies will be used. An operational definition for RER is given by:

$$(2) \quad RER = (E.P_T^*)/P_N,$$

where E is the official nominal exchange rate measured as the amount of domestic currency per unit of U.S. dollar, and P_T^* is the foreign currency price of tradables. Many researchers [Balassa (1990), Edwards (1990, 1989, 1988b), and Cottani, et al. (1990)] have used the U.S. wholesale price index (WPIUS) as proxy for P_T^* and the domestic CPI as the proxy for P_N. Hence,

(3) $RER_{it} = (E_{it}.WPIUS_t)/CPI_{it}$

Note that an increase in this number denotes a real depreciation of the domestic currency. Discussion of three alternative measures of equilibrium RER and misalignment follows.

The first measure of RER misalignment, uses the predictions of the PPP theory. According to the latter, deviations of the actual RER from some base year where it is believed that the RER was in equilibrium are used to calculate the RERMIS. Following Cottani et al. (1990), this paper uses the average of the three highest values of RER over the period 1970-87 as a proxy for the ERER. Hence, the PPP measure of misalignment is:

(4) $RERMIS_{it} = \{([(\Sigma_j \max RER_{ij})/3]/RER_{it})-1\}*100,$

where $[(\Sigma_j \max RER_{ij})/3]$ (j=1,2,3) is the average of the three highest values of RER for the i-th country. (See Table 2 for the reference years for this measure of misalignment.) As shown in Table 3 all countries in the SSA sample had overvalued exchange rates. (This is confirmed by Figure 1 also.) A major weakness of the PPP measure of RER distortion is the inadequate consideration given to changes in the sustainable ERER caused by changes in economic fundamentals such as terms of trade, capital inflows and technology, and trade and macroeconomic policies

Hence, a second measure of RER misalignment is used which is based on a formal model of RER determination developed by Edwards

(1989) and applied by Edwards (1990, 1989, 1988a and 1988b), and Cottani et al. (1990). An advantage of the model-based measure of misalignment is that it allows the ERER to change continuously to reflect changes in economic fundamentals and domestic macroeconomic and trade policies. The PPP and model measures of RER misalignment are conceptually distinct from each other, and they could potentially move in opposite directions on a yearly basis [Edwards (1989 p. 6)].

The idea underlying the measurement of RER misalignment using a model is simple. Figure 1 gives a conceptual explanation underlying this measure. The vertical axis measures the inverse of the RER [i.e., $1/RER = P_N/(E.P_T^*)$]. The horizontal axis gives the quantities demanded and supplied of nontradable goods (DN and SN). The intersection of the demand and supply for nontradables (DN_1 and SN) gives the inverse of ERER ($1/ERER_1$) -- point A -- in period 1. Note that point A is not observable. However, it is believed that ERER is determined by real variables to be discussed below. Also, due to a policy of fixed nominal exchange rate, the actual RER is observed at the horizontal line KK. Hence, in period 1, the degree of RER misalignment is given by the vertical distance AB. The distance AB is not observable but it is believed to be determined by inappropriate macroeconomic, trade and exchange rate policies. Suppose now that there is a deterioration in the terms of trade faced by the country. The loss in income induced by the decline in terms of trade will cause the demand for nontradables to shift to the left -- to DN_2.

Assuming that the supply of nontradables does not shift, the new inverse ERER in period 2 is point C -- $1/ERER_2$. There has been a depreciation in the ERER. However, if the actual RER does not change in period 2, there is an increase in the RER misalignment, given by the vertical distance CD. Note that if the nominal exchange rate (E) is devalued in period 2, the degree of misalignment will be reduced. In practice, however, the degree of nominal devaluation is often smaller than the amount necessary to restore the equilibrium. So, even if the authorities devalued the currency after such a shock, there would still be some degree of misalignment of the RER.

Although the misalignment in the RER is not observable, it can be empirically retrieved by using the following relationship between the actual RER and the ERER:

$$(5) \quad \log(RER_{it}) \equiv \log(ERER_{it}) - [\log(ERER_{it}) - \log(RER_{it})],$$

where the term in the squared brackets on the RHS of the above identity is the wedge between the actual RER and the ERER -- the RER misalignment. Once, the nature of the relationship between each of the two terms on the right hand side RHS of (5) and its respective determinants is known, regression analysis can be used to determine the precise relationship between $\log(RER_{it})$ and $\{\log(ERER_{it}) - [\log(ERER_{it})-\log(RER_{it})]\}$. Then, the estimated parameters of the equation for RER in conjunction with some criteria to identify years in which unsustainable policies were

in effect can be used to construct the model-based misalignment in the RER.

Following Edwards (1988a), the ERER is affected by real variables only, categorized as external and internal "fundamentals". The external fundamentals are measured by (i) the international terms of trade, and (ii) international transfers including capital and aid inflows. The domestic fundamentals include those that can be affected by policy and those that are independent of policy decisions. The policies which can directly affect ERER include import tariffs, import quotas, and export taxes. Also, technological progress is among the most important domestic non-policy fundamentals.[2] While these fundamentals affect the ERER, deviations of the actual RER from its equilibrium are induced by inappropriate macroeconomic policies which encourage large fiscal deficits relative to GDP and rapid growth in money stock relative to money demand to finance such deficits. Such policies are inconsistent with a policy of fixed exchange rates and cause an appreciation in the actual RER and hence raise the degree of misalignment.

To facilitate comparison, the RER equation in this study

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[2]The expected partial effects (with expected signs in parentheses) of each of the fundamentals on ERER under plausible theoretical conditions and assumptions follow. [See Khan and Montiel (1987), and Edwards (1989) for the theoretical models and comparative static analysis.] A minus sign implies a real appreciation of the RER. Improvement in terms of trade (-); inflow of foreign aid (-); capital inflow (-); increase in world interest rate (+); restriction on imports either by an increase in import tariffs or a rise in quantitative restrictions (-); higher export taxes (+); higher export subsidies (-); liberalization of capital accounts (-); government finance of budget deficit through foreign borrowing (-); increase in government consumption on nontradables (-); and productivity improvements in tradables sector (-).

follows the exact empirical form used by Cottani et al. (1990) and is given by:

$$(6)\quad \log(RER_{it}) = b_{0i} + b_1\log(TOT_{it}) + b_2\log(CLOSE_{it}) + b_3CAPFLOW_{it} + b_4EXCRE_{it} + b_5t + u_{it}$$

where: RER = the actual real exchange rate, measured as above;

TOT = the terms of trade measured as the ratio of the index of dollar value of export prices to the index of dollar value of import prices;

CLOSE = [Y/(X + M)] is the ratio of GDP over the sum of imports (M) and exports (X);

CAPFLOW = the capital inflow measured as the difference between net change in reserves and trade balance scaled by GDP;

EXCRE = the excess domestic credit, measured as the difference between growth in domestic credit and the sum of the real GDP growth, foreign inflation and devaluation of the domestic currency;

t = time index,

i = country index,

u = is the disturbance term; and

and the b_{oi}'s and b_1-b_5 are the parameters to be estimated.

It has been observed that the terms of trade have accounted for wide fluctuations in the ERER in SSA. For instance, during the oil boom period, oil exporting countries such as Nigeria and Gabon experienced appreciation of their ERER.[3] Oil importing countries, however, experienced increasing misalignment in their

[3]Congo and Cameroon were the exceptions.

RER since they did not take immediate steps to correct the resulting disequilibria in the fixed nominal exchange rates.

The variable CLOSE is used as a proxy for policies affecting trade in general. It can be expected that in periods where trade restrictions are tightened by import tariffs and quotas, and exchange controls, the economy will become less open to international trade. The impact of trade restrictions is to reduce openness and exert downward pressure on the price of tradables versus nontradables (i.e. ERER appreciation).

Furthermore, net capital inflows (including international transfers and foreign aid) tend to cause the ERER to appreciate by increasing the demand for both tradables and nontradables. To the extent that prices of importables are determined in the world market, a surge in domestic demand for such goods will not put upward pressure on domestic prices, given that the nominal exchange rate is not altered. However, an increase in demand for nontradables will put upward pressure on the P_N causing the ERER to appreciate.

Finally, the ERER can be influenced by technological progress. According to Balassa (1964), countries experiencing rapid technological progress in the tradables sector will experience an appreciation of their ERER -- the Ricardo-Balassa effect. This is due to the fact that technological progress will cause P_T to fall relative to P_N due to rightward shifts in the supply for tradables. The effect of technological progress is captured in a very simple way by use of a time trend.

The construction of the variable EXCRE (excess domestic credit) starts with the simple quantity theory of money where $Mv = Py$, and M are the nominal (broad) money balances, v is the velocity of circulation, P is the domestic price level, and y is domestic output (measured by real GDP). Two simplifying assumptions are made in regard to the demand for real balances: (a) unitary elasticity with respect to real income, and (ii) insensitivity to interest rate changes. Hence, assuming a constant velocity of circulation (v), the following condition must hold: $\Delta\log M = \Delta\log P + \Delta\log y$, where $\Delta\log x = \Delta x/x$ is the percentage change in x. Assuming, also, that the law of one price holds in the long run, so that $P = E.P^*$, where P^* is the foreign price level, then $\Delta\log M = \Delta\log E + \Delta\log P^* + \Delta\log y$. Furthermore, money supply in an open economy follows the identity $\Delta M = \Delta D + \Delta R$, where D is the total domestic credit and R measures the foreign reserves of the consolidated banking system. The money supply identity can be rewritten as $\Delta M/M = \Delta D/M + \Delta R/M$. In steady state $\Delta R/M$ cannot be negative. Hence, excess domestic credit becomes $[\Delta D/M - (\Delta\log E + \Delta\log P^* + \Delta\log y)]$.[4] The effect of excess domestic credit, which captures the influence of overexpansionary macro policies, is to induce appreciation in the ERER and raise the level of misalignment.

The above equation for RER was estimated by OLS with pooled time-series/cross-section data with country-specific dummies to

[4]The country-specific foreign inflation is measured by the percentage change in its dollar-denominated import prices.

allow for a fixed-effect. With at most 17 effective observations for each country, this pooled regression is desirable to obtain efficient parameter estimates. Edwards (1989 and 1988b) uses a similar pooled time-series/cross-section regression method to overcome the problem of relatively short time-series for each of the country in his sample. The estimated equation (with t-statistics in parentheses below estimated parameters) is:[5]

$$\begin{aligned}(7)\quad \log(RER_{it}) = {} & -0.236*\log(TOT_{it}) \quad -0.729*\log(CLOSE_{it}) \\ & \quad (6.14) \qquad\qquad (20.31) \\ & -0.398*CAPFLOW_{it} \quad -0.091*EXCRE_{it} \quad -0.006*t \\ & \quad (4.03) \qquad\qquad (2.85) \qquad\quad (3.10)\end{aligned}$$

$$\text{ADJ-}R^2 = .796 \quad MSE = .038 \quad N=530 \quad F\text{-value} = 55.46$$

All the estimated coefficients have the expected theoretical signs. From the estimated equation, several sources of variation in the RER can be identified. The RER becomes appreciated with (i) an improvement in the terms of trade, (ii) a capital inflow, (iii) an decrease in openness, (iv) a surge in excess domestic credit, and (v) technology improvements. The estimated coefficients are close to the ranges reported in the current empirical literature for LDCs [see Cottani et al. (1990) and Edwards (1988a and 1990)].

The parameters of the estimated equation for the RER

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[5]All data used in this study were obtained from (i) World Bank, World Tables, (ii) International Monetary Fund, International Financial Statistics, and (iii) World Currency Yearbook. The period of estimation for most countries is 1970-87. However, for certain countries, a complete time-series was not available for all the variables. Great care was taken to ensure a continuous time-series for the time period used for each country.

together with the sources of misalignment can be used to construct a model-based measure of RER misalignment. The three sources of policy-induced misalignments are: (i) excess domestic credit, (ii) excessive net capital inflows, and (iii) excessive inward-oriented trade strategies. Using a procedure similar to that employed by Cottani et al. (1990), the following index for the model-based misalignment was constructed:

$$(8)\quad RERMIS_{it} = -\{\exp(-.091*EXCRE_{it}\,|_{EXCREit>0} -.398*CAPFLOW_{it}\,|_{t=s}$$

$$-.729*\log(CLOSE_{it}/[(\Sigma_j \text{ min } CLOSE_{ij})/3]) -1\}*100$$

where $[(\Sigma_j \text{ min } CLOSE_{ij})/3]$ (j=1,2,3) is the average of the three lowest values for [Y/(X+M)] for each country, and s represents the year in which excessive borrowing from the rest of the world may have occurred.

The first source of misalignment assumes that expansionary monetary and fiscal policies which expand domestic credit beyond its sustainable level will cause the RER to become overvalued and raise the degree of misalignment.

The second source of model-based misalignment needs clarification. Cottani et al. (1990) start with the concept of a sustainable value for the net capital inflow given by:

$$(9)\quad CAPFLOW_{it} = (g^{e}_{it} - r^{*}_{it}).F_{it}$$

where F is the "desired" stock of foreign debt as a percentage of GDP, g^e is the expected growth rate in GDP and r^* is the world real interest rate. It is argued that if in a particular year the capital inflow exceeds this sustainable level, then the ERER appreciates. To determine the years in which countries might have overborrowed from the rest of the world, the following procedure was employed. First, the expected growth rate was proxied by lagged GDP growth and country-specific expected foreign inflation was proxied by the lagged rate of growth in the country's dollar-denominated import prices. Second, the real cost of credit was proxied by the average nominal interest rate on public and publicly guaranteed loans (reported in the World Bank, World Debt Tables). The latter constitutes a very high proportion of the foreign loans of most countries in SSA. The real world interest rate faced by each country was calculated by subtracting that country's nominal cost of capital from its expected foreign inflation. Then using the equation (9) the following procedure was used to determine the years in which countries overborrowed. When $g^e_{it} > r^*_{it}$, then both positive or negative values of $CAPFLOW_{it}$ were considered sustainable. However, when $g^e_{it} < r^*_{it}$, positive values for $CAPFLOW_{it}$ were considered unsustainable. For a list of years when countries seem to have overborrowed, refer to Table 2. This empirical procedure (correctly) identifies most of the years of overborrowing as being in the early to mid 1980s.

The third measure of misalignment uses the premium of the

nominal black market exchange rate (B) over the official rate (E) as a proxy for RER misalignment and is given by:

$$(10) \qquad RERMIS_{it} = \{(B_{it}/E_{it}) - 1\}*100.$$

This proxy is expected to measure the (i) misalignment in the RER, (ii) distortion in the foreign exchange market, and (iii) degree of exchange control and import rationing in the economy. The fixed exchange rate systems in SSA typically keep the official rates of exchange below the market equilibrium and create an excess demand for foreign exchange. As a result, it is common practice in many countries in SSA for governments to use various forms of exchange controls to ration scarce foreign exchange to traders and travellers.[6] It can be expected that the tighter the control on foreign exchange the higher will be the black market premia measured by (10). Black market premia may also incorporate distortions outside the trade sector if countries that use exchange controls also use non-price measures in other sectors.

In addition to the measures of RER misalignment, the effect of RER <u>variability</u> is considered. The coefficient of variation of the RER for the period 1972-87 for each country is used to represent variability. It can be expected that inconsistent macroeconomic and trade policies and frequent policy changes

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[6]Pinto (1988) has pointed out the possibility of a revenue motive for governments operating multiple exchange rate systems.

raise the variability of RER, send conflicting signals to economic agents, and lower the credibility of economic policies. This in turn raises the uncertainty of economic returns on imported inputs (such as fertilizer and farm equipment) and long-term investments. The profitability of producing tradable goods also becomes uncertain.

Table 3 gives the period (1972-87) averages of the alternative indices of RER misalignments and variability. As can be observed, there is a wide variation in the model-based measure of misalignment -- ranging from 5.8 for Botswana (the best performer in the region) to 101 and 102 for Uganda and Ghana respectively (among the worst performers in the region). Also, there is a tendency for the black market rate premia to show larger degrees of misalignment than the other two measures for non-CFA countries and smaller degrees of misalignment for CFA countries. For most countries, the model-based measure of misalignment is lower than both the PPP measure and the black market rate measure. This may be due to the fact that the model-based measure takes into consideration that the ERER moves with its fundamentals and does not remain unchanged over time as implied by the PPP measures.

Tables 4 and 5 give the correlation coefficients between the various measures of misalignment using both the cross-section data (Table 4) and the pooled time-series/cross-section data (Table 5). Although the three measures are conceptually different, there is a high degree of correlation among them. It

is also interesting to note a fairly high degree of correlation between RER misalignments and instabilities. It seems that policies which induce larger misalignments in the RER are also responsible for higher instabilities in that variable.

The results of the analysis of these different measures of misalignments and instabilities on macroeconomic performance are discussed in the next section

Empirical Results

The regression results of the effects of various measures of RER misalignment and instability are presented in Tables 6 and 7. Table 6 reports the results for the cross-section evidence. [The results of that table are most closely comparable with those of Cottani et al. (1990)]. Table 7 gives the results from the pooled time-series/cross-section data. Five indicators of macroeconomic performance are considered -- growth rate in real GDP per capita, total exports and imports to GDP ratios, and saving and investment to GDP ratios. Regressions (1) for each indicator report the impact of instability. Regressions (2) report the results for the model-based measure of misalignment (denoted as MODEL). Regressions (4) and (5) report similar results of analysis as regressions (2), but with the two other measures of misalignment: (i) misalignment as measured according the PPP theory (denoted as PPP), and (ii) misalignment using the black market rate as a proxy (denoted as BLACK). Finally, the

model-based measure of misalignment was used together with the instability measure to evaluate the joint effects of both misalignment and instability on economic performance [regressions (3)].

Some general relationships between misalignment and the macroeconomic variables should be noted. First, the negative impact of misalignment on macroeconomic performance is confirmed by all measures of misalignment (see Table 7). Second, in most cases the expected results are statistically stronger with the pooled time-series/cross-section data than with cross-section data alone. For example, the coefficients of the black market premia proxy for the RER misalignment are negative and significant for three out of five macro variables in Table 6, but in Table 7 they are negative and significant in all five cases. This same general pattern holds for the other two measures of misalignment and the measure of RER instability. Third, the estimated magnitudes of the model-based measures are higher for all indicators of performance than the magnitudes reported for the other two measures. Also, for most indicators of performance the coefficients of the PPP measure of misalignment are greater than the coefficients of the black market measure of misalignment. This result is consistent with the hypothesis that the black market premia overstate the degree of misalignment and understate the magnitude of the impacts on economic performance. Fourth, the model-based measure of misalignment seems to perform well (and statistically better than the other measures of

misalignments in some cases) considering the simplicity of the model and assumptions used in its construction.

Fifth, the result reported by Cottani et al. (1990) of the "... apparent lack of correlation between growth performance and RER deviations from PPP ..., pp. 65" is not confirmed by this study. In fact, the results of Table 7 (time-series/cross-section analysis) indicate that the PPP measure of misalignment strongly supports the expected negative association between misalignment and most measures of performance. This difference may be attributable to the fact that the econometric analysis of this paper exploits not only the cross-country differences in performance and misalignment but also the variation over time of these variables.

The rest of the discussion of the results will focus on the joint influence of misalignment and RER instability on income growth imports and investment. The empirical results support the theoretical implications of the impact of relative price distortions. Growth is adversely affected by both instability and misalignment. However, although these two measures of distortion adversely affect growth separately, it does not seem that they affect it jointly. The statistical significance of misalignment and non-significance of instability in regression (3) seem to indicate that instability and misalignment are not two separate empirical variables regarding their influence on economic growth. These results differ from those reported by Cottani et al. (1990) who found that these two measures affect

growth per capita in a significant and negative way both separately and jointly for a more diverse group of countries. Furthermore, the negative correlation between RER misalignment on growth is confirmed by the other two measures of misalignment. However, the magnitudes of the other two measures are lower than the one found by using the model-based measure of misalignment.

The adverse influence of misalignment on exports and imports is confirmed by all measures of misalignment. Also, the joint impact of misalignment and instability on total imports tends to suggest that these variables are measuring two empirically distinct effects on imports. That total imports are affected in a negative way by misalignment and instability is not very encouraging for growth in SSA. Many countries in SSA depend heavily on imported inputs such as raw materials, capital goods, farm equipment and fertilizer for use in domestic industries and agriculture. For instance, Sharpley (1985) notes that "... food production in Tanzania remains heavily dependent on imported inputs ..., p 77." Policies that distort the use of imported inputs influence the production of tradable goods, non-tradable goods and economic growth.

Furthermore, domestic investment is adversely affected both by misalignment and instability (Table 7). Either when relative prices are misaligned or when macroeconomic policies create an unstable economic atmosphere, investors are less willing to commit current funds to projects with uncertain future returns. Finally, saving is adversely affected by misalignment although

not by instability. Misalignment may be associated with policies that reduce the rewards to savers. Agarwala (1983) also found lower (than average) saving rate for developing countries with high levels of distortions in their RER.

Conclusions

The empirical results confirm the earlier conclusions of Edwards (1988a and 1990), Cottani et al. (1990), Agarwala (1983), Frenkel and Khan (1990) that real exchange rate misalignment has adversely affected real income growth and other macroeconomic variables in low income countries. The results also confirm the usefulness of Edwards' model of the equilibrium real exchange rate. A policy implication is that African governments have an opportunity to stimulate economic growth by reforming monetary, exchange rate, and trade policies.

One specific contribution of the paper is an explicit comparison of three alternative measures of the RER. All three measures are empirically significant and cannot be rejected on a priori grounds. A second contribution is an application of RER analysis using exclusively African data. The robustness of the analysis is informative in view of the severity of growth problems in the region and the problems with African data that have been reported in other contexts.

A third contribution is an explicit comparison of results using pooled time-series/cross-section data with results from cross-sectional data alone. The analysis using pooled data shows

a stronger negative relationship between RER misalignment and macroeconomic performance indicators. A final contribution relates to variability of the real exchange rate. For this sample of African countries variability of RER has a negative effect on exports as well as income growth. However, the empirical analysis indicates that possible joint relationships between RER variability and misalignment are important in affecting macroeconomic performance.

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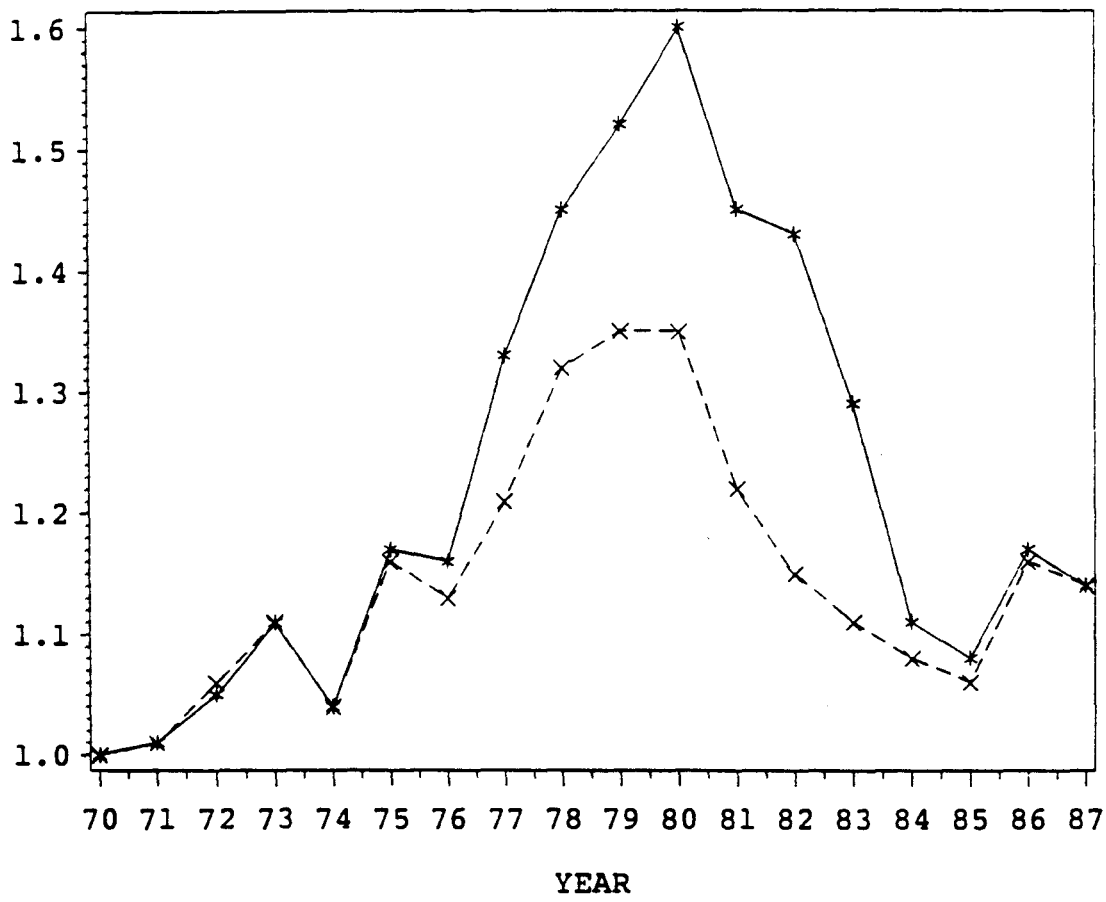
Table 1. Macroeconomic Performance Indicators for Selected Countries in SSA: (1972-87).

Country	Real GDP Per Capita Growth (%) **/	Investment Output Ratio (%) ***/	Saving Output Ratio (%) ***/	Total Exports Output Ratio (%) ***/	Total Imports Output Ratio (%) ***/
High Growth Countries					
Botswana	7.51	39.2	22.9	58.9	73.6
Cameroon */	5.36	20.5	19.9	20.3	18.7
Congo */	4.60	33.9	24.6	37.9	28.5
Mauritius	3.21	24.4	21.0	38.0	47.6
Lesotho	2.20	28.4	-74.3	10.8	125
Medium Growth Countries					
Burkina Faso */	1.84	24.1	-2.2	12.0	33.8
Mali */	1.84	17.4	-1.1	11.7	26.3
Rwanda	1.55	14.2	5.8	11.7	19.1
Burundi	1.03	12.5	3.9	9.9	16.0
Low Growth Countries					
Somalia	0.87	31.1	-0.4	7.6	21.3
Benin */	0.51	18.4	-0.3	16.3	34.1
Malawi	0.34	23.2	14.2	22.2	30.1
Kenya	0.25	23.8	20.1	18.9	27.7
Gambia	0.19	18.1	4.6	25.7	53.1
Negative Growth Countries					
Senegal */	-.35	16.4	5.9	21.2	34.5
Sudan	-.41	15.5	7.0	9.1	16.7
Ethiopia	-.57	10.7	5.7	9.0	15.2
Sierra Leonne	-.68	13.2	7.1	17.8	25.5
Mauritania	-.77	28.9	6.5	37.2	51.2
Cote d'Ivoire */	-.82	21.4	24.3	33.0	26.9
Zimbabwe	-.83	22.5	20.6	24.4	21.1
Togo */	-.92	26.9	14.9	30.9	43.4
Central Afric. Rep. */	-1.12	12.8	-0.3	17.3	24.4
Niger */	-1.13	16.3	7.3	15.3	18.3
Tanzania	-1.51	20.6	10.4	11.5	22.6
Nigeria	-2.09	17.8	19.5	18.4	15.3
Ghana	-2.56	8.0	7.1	11.5	11.1
Gabon */	-2.65	42.0	52.6	48.8	23.9
Madagascar	-2.74	15.2	8.5	14.3	18.1
Zambia	-2.85	22.5	22.2	36.6	27.8
Liberia	-2.91	20.8	24.7	49.4	40.1
Zaire	-3.11	14.2	13.9	20.1	13.4
Uganda	-3.87	8.6	7.1	9.3	7.4
GROUP AVG.	-.03	20.9	10.0	23.4	32.0

*/ CFA countries.
**/ The growth rates are calculated by regressing the natural logarithm of real GDP per capita on a time trend and an intercept for each country.
***/ Simple period averages.

Figure 1. **Behavior of the Inverse of the Real Exchange Rate ($P_N/E.P_T^*$) in Selected Countries in SSA (1970=1).**



See Table 1 for a list of countries included in this study.

Figure 2. **A Diagrammatic Illustration of the ERER, and the RER Misalignment.**

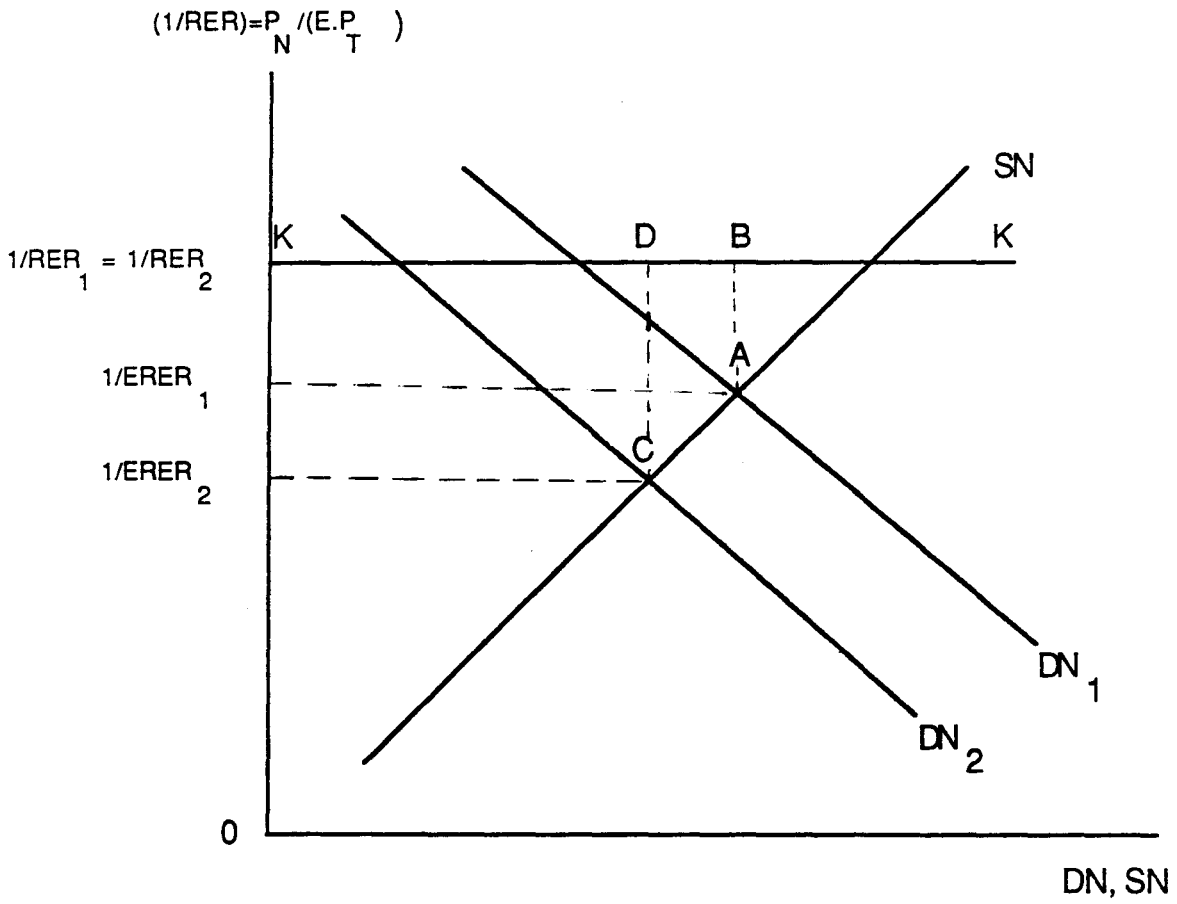


Table 2. Reference Years for PPP Measure of Misalignment and Years in which Countries Might Have Overborrowed from the International Community.

Country	Reference Years for PPP Measure of RER Misalignment	Years in which Countries Might Have Overborrowed
Benin	83-85	84, 85, 87
Botswana	84-86	83
Burkina Faso	83-85	76, 83-85
Burundi	70, 72, 77	73, 83-85
Cameroon	70, 84-85	76
Central Afric. Rep.	70, 71, 84	82, 84
Congo	83-85	77, 85-87
Cote d'Ivoire	70, 84-85	82-83
Ethiopia	72, 74-75	83-86
Gabon	70-71, 84	85-87
Gambia	70, 84, 86	76, 82-83
Ghana	70, 72-73	76-77, 82-87
Kenya	83-85	76, 83-87
Lesotho	84-86	76, 82-87
Liberia	70-72	77, 82-85, 87
Madagascar	84-86	73, 76-77, 82-87
Malawi	85-87	77, 82-83
Mali	83-85	83-84, 86
Mauritania	70, 84-85	76-78, 82-86
Mauritius	83-85	76, 81-85
Niger	70, 84-85	72-73, 77, 82-85
Nigeria	70, 74, 87	76, 82-83, 86
Rwanda	70-72	83, 85
Senegal	70, 83-84	77-79, 82, 84-86
Sierra Leonne	74, 76-77	72, 77, 83-85
Somalia	71-72, 74	77, 83-84
Sudan	70-71, 83	80-86
Tanzania	70-71, 87	77, 82-84
Togo	76, 85-86	77, 82-86
Uganda	70, 83-84	79, 83-87
Zaire	84-85, 87	76-77, 83-86
Zambia	85-87	76-78, 83-86
Zimbabwe	84-86	83-85

Table 3. Summary Statistics of RER Instability and Alternative Measures of RER Misalignment (1972-87).

COUNTRY	Deflator Used	Coefficient of Variation of RER (%)	Model Measure of RER Misalignment (%)	PPP Measure of RER Misalignment (%)	Black Market Proxy for RER Misalignment (%)
Benin */	DEF	17.5	29.0	31.7	.62
Botswana	DEF	22.1	5.8	43.1	23.3
Burkina Faso */	CPI	17.6	15.0	32.2	.62
Burundi	CPI	11.8	17.7	17.4	25.2
Cameroon */	CPI	16.1	13.8	27.7	.62
Central Afric. Rep. */	DEF	15.1	19.0	27.2	.62
Congo */	CPI	16.3	19.2	29.8	.62
Cote d'Ivoire */	CPI	19.2	9.0	31.2	.62
Ethiopia	CPI	16.1	14.4	29.5	71.8
Gabon */	CPI	17.9	13.1	31.1	.62
Gambia	CPI	12.7	23.4	20.4	2.5
Ghana	CPI	67.2	101.6	261.9	405.7
Kenya	CPI	9.7	14.0	13.6	16.9
Lesotho	DEF	19.8	16.2	38.9	na
Liberia	CPI	5.1	19.0	9.9	na
Madagascar	CPI	16.5	19.5	31.7	32.8
Malawi	DEF	13.5	19.6	23.6	53.5
Mali */	DEF	25.4	32.5	50.6	.62
Mauritania	DEF	10.7	20.7	20.1	92.9
Mauritius	CPI	12.0	15.0	21.0	na
Niger */	CPI	17.3	33.6	31.1	.62
Nigeria	CPI	42.8	30.5	98.4	93.7
Rwanda	CPI	19.0	24.4	47.3	39.6
Senegal */	CPI	18.1	21.0	30.2	.62
Sierra Leonne	CPI	26.6	40.0	41.9	64.0
Somalia	CPI	28.5	36.7	50.2	60.2
Sudan	CPI	13.6	25.2	25.5	73.0
Tanzania	CPI	22.3	43.1	34.4	183.7
Togo */	CPI	18.8	32.6	36.0	.62
Uganda	DEF	43.5	101.0	115.9	388.4
Zaire	CPI	45.9	66.0	110.8	101.3
Zambia	CPI	43.9	22.8	103.0	82.7
Zimbabwe	CPI	14.7	10.9	26.4	102.6
GROUP AVG.			28.7	46.1	65.3

*/ CFA countries.
DEF = GDP Deflator.
CPI = Consumer Price Index.
The nominal exchange rates used are the bilateral rates with respect to the dollar.

Refer to the text for a detailed explanation of the procedures used to calculate these indices.

Table 4. Pearson Correlation Coefficients Between Different Measures of Misalignments: The Cross-Section Evidence.

	MODEL	PPP	BLACK	CV
MODEL	1.000 N=33	---	---	---
PPP	0.809 (**) N=33	1.000 N=33	---	---
BLACK	0.861 (**) N=30	0.787 (**) N=30	1.000	---
CV	0.788 (**) N=33	0.951 (**) N=33	0.731 (**) N=30	1.000 N=33

(**) Significant at the .01 level.

Table 5. Pearson Correlation Coefficients Between Different Measures of Misalignments: The Time-Series/Cross-Section Evidence.

	MODEL	PPP	BLACK
MODEL	1.000 N=501	---	---
PPP	0.839 (**) N=501	..000 N=528	---
BLACK	0.781 (**) N=437	0.805 (**) N=443	1.000 N=443

(**) Significant at the .01 level.

Table 6. Results of Impact of RER Misalignment and Instability on Macroeconomic Performance in SSA (1972-87): The Cross-Section Evidence.

Dependent Variable	Regression No.	Intercept	RER Instability	RER Misalignment MODEL	PPP	BLACK	ADJ. R-SQ	F-Value	N
Per capita growth rate	(1)	1.51 #	-.070 *	---	---	---	0.101	4.6 *	33
		(1.83)	(2.15)						
	(2)	1.50 *	---	-.054 **	---	---	0.198	8.9 **	33
		(2.33)		(2.99)					
	(3)	1.44 #	.007	-.057 #	---	---	0.172	4.3 *	33
		(1.81)	(0.13)	(1.91)					
	(4)	0.85	---	---	-.019 *	---	0.091	4.2 *	33
		(1.43)			(2.05)				
	(5)	0.63	---	---	---	-.011 *	0.182	7.4 *	30
		(1.27)				(2.73)			
Total exports to GDP ratio	(1)	27.2 **	-.223	---	---	---	0.017	1.5	33
		(5.99)	(1.24)						
	(2)	28.7 **	---	-.229 *	---	---	0.117	5.2 *	33
		(8.09)		(2.29)					
	(3)	26.79 **	.222	-.33 #	---	---	0.107	2.9 #	33
		(6.18)	(0.80)	(2.03)					
	(4)	24.96 **	---	---	-.056	---	0.008	1.3	33
		(7.59)			(0.27)				
	(5)	23.6 **	---	---	---	-.036	0.050	2.5	30
		(8.87)				(1.59)			
Total imports to GDP ratio	(1)	40.9 **	-.47	---	---	---	0.048	2.6	33
		(5.58)	(1.62)						
	(2)	40.6 **	---	-0.356 *	---	---	0.102	4.7 *	33
		(6.92)		(2.16)					
	(3)	40.4 **	.02	-.37	---	---	0.073	2.3	33
		(5.59)	(0.05)	(1.35)					
	(4)	36.4 **	---	---	-.122	---	0.039	2.3	33
		(6.86)			(1.52)				
	(5)	30.2 **	---	---	---	-.056 *	0.135	5.5 *	30
		(10.78)				(2.35)			
Investment to GDP ratio	(1)	24.9 **	-.19 #	---	---	---	0.067	3.3 #	33
		(9.29)	(1.81)						
	(2)	25.8 **	---	-.18 **	---	---	0.222	10.3 **	33
		(12.80)		(3.21)					
	(3)	24.6 **	-.137	-.24 *	---	---	0.218	5.5 **	33
		(10.02)	(0.87)	(2.65)					
	(4)	23.5 **	---	---	-.060 *	---	0.095	4.4 *	33
		(12.4)			(2.09)				
	(5)	22.5 **	---	---	---	-.034 *	0.136	5.6 *	30
		(13.35)				(2.36)			
Saving to GDP ratio	(1)	10.26	-.021	---	---	---	-.032	0.01	33
		(1.57)	(0.08)						
	(2)	11.76 *	---	-.070	---	---	-.025	0.21	33
		(2.19)		(0.46)					
	(3)	10.07	0.19	-.16	---	---	-.052	0.21	33
		(1.53)	(0.45)	(0.64)					
	(4)	10.1 *	---	---	-.007	---	-.032	0.01	33
		(2.16)			(0.10)				
	(5)	12.5 **	---	---	---	-.012	-.024	0.32	30
		(5.05)				(0.57)			

See footnotes at the end of Table 7.

Table 7. Results of Impact of RER Misalignment and Instability on Macroeconomic Performance in SSA (1972-87): The Time-Series/Cross-Section Evidence.

Dependent Variable	Regression No.	Intercept	RER Instability	RER Misalignment MODEL	RER Misalignment PPP	RER Misalignment BLACK	ADJ. R-SQ	F-Value	N
Per capita growth rate	(1)	1.53 ** (2.62)	-.067 ** (2.72)	---	---	---	0.012	7.4 **	528
	(2)	0.95 ** (2.71)	---	-.034 ** (4.79)	---	---	0.042	22.9 **	501
	(3)	1.42 * (2.45)	-.027 (1.02)	-.031 ** (3.90)	---	---	0.042	12.0 **	501
	(4)	0.75 * (2.31)	---	---	-.013 ** (3.76)	---	0.024	14.2 **	528
	(5)	0.43 (1.32)	---	---	---	-.008 ** (4.19)	0.036	17.6 **	443
Total exports to GDP ratio	(1)	27.4 ** (21.48)	-.237 ** (4.53)	---	---	---	0.036	20.5 **	528
	(2)	25.7 ** (34.73)	---	-.126 ** (8.40)	---	---	0.122	70.6 **	501
	(3)	26.5 ** (21.67)	-.046 (0.83)	-.120 ** (7.25)	---	---	0.122	35.6 **	501
	(4)	24.0 ** (33.6)	---	---	-.038 ** (4.80)	---	0.040	23.0 **	528
	(5)	22.3 ** (32.23)	---	---	---	-.020 ** (5.08)	0.053	25.8 **	443
Total imports to GDP ratio	(1)	41.5 ** (21.10)	-.515 ** (6.35)	---	---	---	0.069	40.3 **	528
	(2)	33.4 ** (30.97)	---	-0.152 ** (6.93)	---	---	0.086	48.0 **	501
	(3)	39.6 ** (22.70)	-.355 ** (4.51)	-.106 ** (4.47)	---	---	0.120	35.1 **	501
	(4)	33.2 ** (29.51)	---	---	-.054 ** (4.74)	---	0.037	21.3 **	528
	(5)	28.1 ** (39.89)	---	---	---	-.029 ** (7.07)	0.100	50.0 **	443
Investment to GDP ratio	(1)	24.9 ** (28.5)	-.203 ** (5.63)	---	---	---	0.055	31.7 **	526
	(2)	22.3 ** (43.03)	---	-.072 ** (6.81)	---	---	0.084	46.3 **	499
	(3)	24.6 ** (28.9)	-.128 ** (3.35)	-.055 ** (4.78)	---	---	0.102	29.2 **	499
	(4)	21.54 ** (43.2)	---	---	-.020 ** (3.93)	---	0.025	14.5 **	526
	(5)	21.5 ** (44.30)	---	---	---	-.018 ** (6.39)	0.083	40.8 **	442
Saving to GDP ratio	(1)	10.0 ** (5.64)	-.011 (0.15)	---	---	---	-.002	0.10	528
	(2)	12.0 ** (12.56)	---	-.049 * (2.54)	---	---	0.011	6.5 *	499
	(3)	10.6 ** (6.71)	0.080 (1.12)	-.060 ** (2.78)	---	---	0.011	3.9 *	499
	(4)	10.1 ** (10.19)	---	---	-.008 (0.74)	---	-.0009	0.54	526
	(5)	12.2 ** (18.08)	---	---	---	-.008 * (2.07)	0.007	4.29 *	442

See footnotes on next page.

Footnotes for Tables 6 and 7.

**/	=	Significant at the 1% level.
*/	=	Significant at the 5% level.
#/	=	Significant at the 10% level.
Model	=	Model-based measure of RER misalignment.
PPP	=	RER misalignment measured using PPP theory.
Black	=	Proxy for RER misalignment using black market nominal exchange rates.
ADJ. R-SQ	=	Adjusted coefficient of determination.
N	=	Number of observations used in each regression. The numbers differ for the different regressions because of data limitations for certain countries. Great care was taken to ensure a continuous time-series for the time periods used for each country. An explanation of the number of effective observations used for each regression can be obtained from the authors.

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