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Structures of Fiscal Budget and National Accounts as Real Exchange Rate Fundamentals: Econometric Evidence from Africa

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Abstract

The study examines the effects of the composition of government expenditure and national accounts on real exchange rate behavior in Africa. Annual data over periods that fall within 1970 and 1990, pooled across 38 countries, form the basis of the empirical analysis. Our findings suggest that the shares of (both public and private) investment spending in GDP and in domestic absorption depreciate real exchange rate, just as the share of government total expenditure in GDP and in absorption. The corresponding shares of (public and private) consumption expenditures appreciate real exchange rates, just as the overall absorption-GDP ratio; terms of trade and per capita income level. (JEL: F31)

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I. Introduction

Typically, cuts in government spending and, in fact, aggregate spending in general have been regarded by policy makers – including international agencies like the IMF and the World Bank – as a recipe for depreciating the real exchange rate when the domestic currency is considered to be over-valued. But a given cut in government expenditure or any other component of aggregate demand may have different effects on the real exchange rate, depending on the category of expenditure affected. There is thus the need to know which expenditure categories affect real exchange rate in a particular way.

It is not until recently that studies started to address this issue. For instance, Montiel [1986] and Khan and Lizondo [1987] theoretically demonstrate how the structure of government spending is associated with the real exchange rate. Also, the share of total investment expenditure in the GDP is shown to be a determinant of real exchange rate in Edwards' [1989] model – although the direction of the effect is theoretically indeterminate. Some empirical attempts on this issue have also been reported, *e.g.* Edwards [1989] tested for the effects of the shares of both government and investment expenditures in the GDP with annual data over 1965-85 pooled across 12 developing countries; Ramangkura and Nidhiprabha [1991] investigate the role of composition of government spending; and Matin [1992] examines the effects of the share of government expenditure in the GDP and that of total capital expenditure in overall government spending with annual data for bangladesh.

The present study is an attempt to comprehensively look at this issue. This is accomplished by employing annual data over 1970-90 for 38 African countries. Specifically, the study investigates the role of the shares of; capital in total government spending; capital in total private spending; government in total domestic capital formation; government in total domestic consumption spending; total government spending in both the GDP and domestic absorption; and domestic absorption in the GDP.

The remaining part of the paper is set out as follows: In section II, the theoretical framework is presented while the methodology and empirical results are in sections III and IV respectively. Section V is on summary and

conclusion after which there is an appendix on the data employed and countries covered by the study.

II. The Framework

The framework of analysis that we shall adapt to form the basis of the empiricism in the study is the one proposed by Rodigruez [1989]. According to this theoretical analysis of the *fundamentals* or determinants of *equilibrium* real exchange rates, a small open or dependent economy is assumed. This economy produces three goods viz: non-tradable goods N; exportable goods X; and importable or import-competing goods M whose absolute prices are P_N; P_X; and P_M respectively.

The supply or production of N, Q_N, is assumed to depend on the three prices and the nominal GDP, Y thus :

$$Q_N = Q_N(P_N, P_X, P_M, Y) \tag{1}$$

Since the above equation should be homogenous of degree zero in all prices and Y, it can be re-written, after choosing P_N to be the numeraire, as:

$$Q_N = q_N[(P_X/P_N, P_M/P_N]^*(Y/P_N) \tag{2}$$

where: $q_N[\cdot]$ represents the share of Q_N in the real GDP measured in P_N (as Y/P_N). In other words, the share of non-tradables in the total output or real GDP depends on the relative prices of both the exportables X and importables M.

We need to re-write the above equation in terms of the real exchange rate Π, defined as ratio ($\Pi = P_N/P_T$) of the price of non-tradable to that of the tradables, bearing in mind that tradable price is a weighted average prices of exportables and importables [or $P_T = \alpha P_X + (1 - \alpha)P_M$, where α is the weight of exportables in the total tradables]. To do this, we can express the price of tradables P_T in terms of P_X and P_M ratio, noting from the above relationship that the function $P_T = P_T(P_X, P_M)$ is homogenous of degree zero in P_X and P_M so that it can also be written as:

$$P_T = P_M{}^*f(P_X/P_M) = P_M{}^*f(P_{XM}) \tag{3}$$

where $P_{XM} = P_X/P_M$ or the (bilateral) terms of trade.

Dividing each expression on the right-hand side of equation (2) by P_T and multiplying it by $P_M{*}f(P_{XM})$ would give:

$$Q_N = q_N[\Pi/f(P_{XM}), \Pi{*}P_{XM}/f(P_{XM})]{*}(Y/P_N) \quad (4)$$

where: Π, it should be recollected, is the real exchange rate or the non-tradable/tradable price ratio whose upward movement represents real appreciation of domestic currency – because the P_T is in the denominator.

The above equation can be re-written as:

$$Q_N = q_N(\Pi, P_{XM}){*}(Y/P_N) \quad (5)$$

A negative effect of Π and an ambiguous (but more likely to be positive) effect of P_{XM} on real output of non-tradables Q_N are often postulated in the literature.[1]

Now, coming to the demand side of the market for non-tradables denoted by D_N, the derivation of its functional specification follows a similar process to what has just been described in the case of the supply side. The exception is just that, instead of the share of the non-tradables in total output or real GDP (viz: q_N), we now talk in terms of the share (denoted by d_N) of demand for non-tradables in total domestic absorption (A) – which is the sum of aggregate consumption and investment expenditure in the economy. Thus, the corresponding equation for non-tradables demand can be written as:

$$D_N = d_N(\Pi, P_{XM}){*}(A/P_N) \quad (6)$$

Market equilibrium requires equality between the demand and supply or, $Q_N = D_N$ in equations (5) and (6). Therefore:

$$q_N(\Pi, P_{XM}){*}(Y/P_N) = d_N(\Pi, P_{XM}){*}(A/P_N) \quad (7)$$

But the national income accounting identity requires national output Y to equal the sum of the absorption A and the current account surplus (S) in the balance of payments. That is:

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1. A negative effect of real exchange rate is expected because production or supply of non-tradables should positively depend on its price.

$$Y \equiv A + S \text{ or } A \equiv Y - S \tag{8}$$

Dividing the two sides of this identity by Y gives:

$$A/Y = 1 - S/Y = 1 - s \tag{9}$$

where: s is the ratio of current account surplus to the GDP.

Dividing the two sides of equation (7) by Y/P_N, and rearranging after substituting (9), yields the following market equilibrium condition in terms of the real exchange rate, terms of trade and domestic absorption – GDP ratio:

$$q_N(\Pi, P_{XM}) = d_N(\Pi, P_{XM}) * (1 - s) \tag{10}$$

This equilibrium condition can be written in terms of the real exchange rate Π as follows:

$$\Pi = \Pi(P_{XM}, a) \tag{11}$$

where: $a = 1 - s$ or the domestic absorption – GDP ratio.

In this real exchange rate function or reduced-form equation, the domestic absorption rate a is generally regarded in the literature to have a positive effect on or appreciate the real exchange rate Π. On the other hand, the direction of the total effect (which comprises substitution and income effects) of the terms of trade is ambiguous, although more likely to be positive.

So far, we have been presenting the exposition in a similar manner to how the idea was originally presented by Rodigruez [1989]. The extension that we make to adapt it to the purpose of the present study is what we are now going to describe.

First, in equation (2), we wish to include a measure of productivity as a (negative) determinant of the relative supply or production of non-tradables (q_N). This is in line with Balassa's [1964] contention that a country experiencing economic development also experiences productivity expansion simultaneously and the tendency is for the productivity expansion to be concentrated in the tradable sector and thus increase the production of tradables faster than that of non-tradable. This Balassa-effect, which has since been popularized in the literature, is sometimes proxied by the growth of real GDP and also, sometimes, by the level of *per capita* real income. In this

study, we choose the latter.[2] After including this variable, denoted by y, in equation (2),[3] the final supply equation (5) would become:

$$Q_N = q_N(\Pi, P_{XM}, y)^*(Y/P_N) \tag{5a}$$

Second, we wish to include the level of *per capita* income (*i.e.*, y) as a determinant of the share of demand for non-tradables in the domestic absorption (d_N). This is because it would be by rare coincidence for the income elasticities of demand for non-tradables and tradables to be the same which, in turn, suggests that *per capita* income would not normally be neutral as an argument in the d_N equation (6).

More importantly for the purpose of the present study, however, is the fact that we split the domestic absorption (A) into various components (A_1, ... , A_m such that $\Sigma A_i = A$). For example, A can be split into 4 *viz*: public investment; private investment; public consumption; and private consumption expenditure categories or into just 2 *viz*: public and private expenditure categories. Substituting the relationship $\Sigma A_i = A$ into equation (6) and also including the level of *per capita* income y lead to equation (6a) below:

$$D_N = d_N(\Pi, P_{XM}, y)^*(\Sigma A_i/P_N) \tag{6a}$$

National income identity requires, as before, that:

$$Y \equiv \Sigma A_i + S \quad \text{or} \quad \Sigma A_i = Y - S \tag{9a}$$

Equating the q_N in (5a) and d_N in (6a) in fulfillment of equilibrium gives the following result, after re-arrangement:

$$q_N(\Pi, P_{XM}, y) = d_N(\Pi, P_{XM}, y)^*(\Sigma a_i) \tag{10a}$$

where: $a_i = A_i/Y$ or $\Sigma a_i = \Sigma A_i/Y$.

We can also manipulate the right-hand expression in equation (10a) to express the d_N in terms of the share of each category of expenditure A_i in the total absorption instead of just their shares in real GDP – which a_i

2. We also tried the real GDP growth empirically but found its effects to be statistically insignificant.

3. The same result would be got by including the *nominal*, as opposed to *real*, *per capita* income in equation (1) as it would, in a way, become *real* through deflation with the non-tradable price P_N by the time it gets to the equation (2) stage.

stands for. This would be accomplished by multiplying and dividing the Σa_i by the total absorption-GDP ratio a $(=\Sigma a_i)$ to arrive at:

$$\Sigma a_i \equiv a^* \Sigma c_i = (\Sigma a_i)^* \Sigma c_i \qquad (12)$$

where: $c_i = A_i/A$ or the share of expenditure type i, A_i, in the total domestic absorption A.

Substituting (12) into (10a) and solving to derive the real exchange rate reduced-form equation produces:

$$\Pi = \Pi(P_{XM}, y, a_i, c_i) \quad (i = 1, \ldots m) \qquad (11a)$$

Thus, equation (11a) expresses the real exchange rate as a function of the terms of trade; *per capita* income level; the share of each category of domestic expenditure in the GDP; and its share in domestic absorption also.

As mentioned earlier in connection with equation (11), the role of the terms of trade is somewhat ambiguous although it is more likely to appreciate the real exchange rate. Also, although the role of *per capita* income via the ***production*** side is supposed to appreciate the real exchange rate through *Balassa-effect*, its effect through the ***demand or consumption*** side is not clear in as much as we are not in a position to know which of the tradables and non-tradables are more income elastic in demand. If non-tradables are more income elastic in demand, the resulting positive effect on the real exchange rate would reinforce the positive effect emanating from the ***production*** side. Otherwise, the negative effect from the ***demand*** side due to more income-elastic demand for tradables than for non-tradables might possibly outweigh the positive effect from the ***production*** side. Thus, the direction of the total effect of *per capita* income on the real exchange rate is similarly as ambiguous as that of the total effect of the terms of trade.

Concerning the effects of the shares of various expenditure items in the total absorption and in the GDP, it should be noted that the tendency is for the overall absorption-GDP ratio to be positively related to the real exchange rate because it is equivalent to the current account deficit-GDP ratio. Thus, splitting it to various components (denoted by a_i's in the above equations) may not remove this tendency. All the same, we expect some of the categories to have negative effect on real exchange rate – particularly, those that are (sufficiently, and not just moderately) predominantly trad-

ables in nature – like the share of investment spending in GDP, bearing in mind that capital goods are importables in the countries covered by the study. When it comes to the shares of these expenditure items in the total domestic absorption (*i.e.*, what are denoted by c_i's in the above equations), the effect of the share of each item in domestic absorption no longer needs to be beclouded by the positive tendency of domestic absorption rate on real exchange rate. We shall therefore be in a position to better identify the role of each expenditure *vis-a-vis* the total, as opposed to *vis-a-vis* the *GDP*, on the real exchange rate. This is purely an empirical issue as it may not be straight-forward to know on *a priori* ground which of them are more tradable-intensive than others. What we can only speculate before getting to empirical results is that the share of each category of capital goods in total domestic absorption is likely to depreciate the real exchange rate by being more tradable-intensive than consumer expenditures in general.

At this juncture, we wish to point out that the present study has to do with an analysis of the real exchange rate equilibrium so that our consideration of the real exchange rate determinants to test for would be limited to the real exchange rate fundamentals. To facilitate a proper understanding of this statement, it is in order to allude to the concept of exchange rate misalignment and make a distinction between the prevailing (or actual) and equilibrium real exchange rates. This then constitutes the subject matter of the remaining discussion in this paragraph: Macroeconomic policies that take the form of changes in aggregate monetary and fiscal policies do affect the prevailing or actual real exchange rate. An expansionary monetary policy in the form of monetary expansion and/or domestic credit creation would tend to appreciate the real exchange rate beyond what would have being its equilibrium rate and thereby leading to an "over-valued" real exchange rate. An expansionary fiscal policy in the form of fiscal deficit too would have a similar effect while contractionary or tight monetary and fiscal policies would have the opposite effect. Of course, nominal exchange rate depreciation and appreciation can possibly be resorted to by the authorities in order to remove the misalignments in the form of "over-valuation" and "under-valuation" of real exchange rate, as caused by the expansionary and contractionary aggregate demand policies respectively. But, as rightly pointed out by Kiguel [1992], the effectiveness of this policy in removing the misalign-

ment positively depends on the inflexibility of domestic prices and wages and, in any case, such a policy could only be a temporary measure. Otherwise, sooner or later, rising domestic prices and wages (that would accompany nominal exchange rate depreciation) would neutralize the effect of depreciating the nominal exchange rate, with similar but reverse process taking place too in the case of appreciating process nominal exchange rate to correct a real exchange rate "under-valuation". The deviation of prevailing real exchange rate from its equilibrium value caused by such aforementioned aggregate demand policies is what is being commonly referred to as exchange rate misalignments. On the other hand, those factors (like the ones being considered in the present study, *e.g.* composition of aggregate demand, terms of trade and *per capita* income) that cause permanent changes in the real exchange rate and, hence, that determine its equilibrium permanent value are commonly called the real exchange rate fundamentals while the adjustment of nominal exchange rate to remove the misalignments is being called exchange rate realignment. As it is not an objective of the present study to analyze the exchange rate misalignments, we are not going to evaluate the effects of changes in aggregate monetary and fiscal policies. Neither is the effect of realignment or nominal exchange rate adjustment policy going to be empirically evaluated too – for the same reason. (An empirical evaluation of the exchange rate misalignment and realignment for the same set of countries can be found in Odedokun [1997].)

III. The Methodology

A. Model Specification and Estimation

Based on the discussion in the preceding section, the regression equations specified for estimation in this study is as described below:

$$S_{it} = S(P_{XMit}, y_{it}, a_{it}, c_{it}) \quad (i = 1, \ldots, n; t = 1, \ldots, T) \tag{13}$$

where: S, P_{XM}, y, a, c are all in logarithms;

n = number of countries;
T = number of periods (years) for each country,
S = empirical equivalent of the theoretical real exchange rate now defined as the foreign currency price, in real term, of domestic

currency so that its upward movement represents appreciation of domestic currency in real terms;

P_{XM} = terms of trade or export-import price ratio;

y = *per capita* real income;

a = vector of the m categories of domestic expenditure-GDP ratio; and

c = vector of $m-1$ categories of domestic expenditure-absorption ratio.[4]

It should be noted that the dependent variable is now defined or computed differently from the theoretical concept that we were using in section II. One reason for this – which is also the practice in almost all other empirical works on this subject – is the problem of identifying the prices of non-tradables and tradables in reality. This is why the price of non-tradable is usually approximated by the domestic (in most cases, consumer) price level and tradable price by the product of foreign (in most cases, wholesale) price and the domestic currency price of foreign currency. This is why this approach is followed in the present study.[5]

The various categories of domestic expenditure (expressed as ratios of GDP and/or domestic absorption in the manner discussed in section II) include: (i) public investment, private investment; public consumption; private consumption; (ii) total investment, total consumption; and (iii) total public expenditure and total private expenditure. However, not many of them feature simultaneously in a particular equation in the estimation process, the aim being to minimize any problem arising from intercorrelation among them. For this same reason, sometimes, a particular expenditure category is expressed as a ratio of another instead of the total absorption.

It can be inferred from the simultaneous presence of the time and country subscripts in the above equation that the equation is estimated with

4. The m^{th} category of expenditure-absorption ratio is excluded to avoid what might approach complete singularity in view of the fact that $\Sigma c_i = 1$ (i = 1, ... m). While our employment of the logarithm values of c_i's as the regressors would avoid complete singularity that is being "feared", it does not remove serious – though incomplete – multicollinearity problem.

5. Specifically, it is the *effective* real exchange rate that is employed as the dependent variable in the sense that the nominal exchange rate and price levels of foreign countries used in the computation are *trade-weighted, i.e.* they reflect the importance of those countries as trading partners.

panel data, *i.e.*, time-series data pooled across countries. To estimate the equation, we employ two variants of panel data estimation techniques. One is the fixed-effect technique that caters for any differences in the autonomous real exchange rate across countries by permitting intercept terms to vary among countries. The other is the random-effect technique, which decomposes the residuals into the individual-country; time; and purely random effects in the estimation process – with this decomposition being built into the Generalized Least Squares (GLS) estimation method.[6] Due to the possible endogeneity of the shares of expenditure categories in the GDP (*i.e.*, the elements of the $\underline{a}$ vector in the above equation) in the sense of being determined themselves by the real exchange rate, we employ 1-period lagged values as their instruments . However, as no material difference is found to exist when compared with when contemporaneous values are used, it is only in some of the equations that the lagged values are retained – current values feature in others so as to increase the total number of annual observations for each country. Finally, to correct for serial correlation of the residuals, we employ the *AR*1 version of the GLS technique of autocorrelation correction, with country-specific serial correlation coefficients being used to transform the data.

It would be observed that the above equation (13) that is to be estimated is a long-run equilibrium type. In other words, the equations estimated in the study relate the long-run real exchange rate movement to its fundamental determinants. This relationship presumes that either the variables in the equation are stationary or that the relationship is cointegrated. While we are not able to conduct a formal test of stationarity in view of the very limited number of time-series observations per country, our knowledge of the economies being studied and inspection of the data employed in the analysis both suggest that the variables are stationary for most of the countries. For instance, the terms of trade figures do not appear to be time-variant for the countries and neither do the *per capita* income data too. Also, although the GDP, domestic absorption and their various components tend to be time-variant or non-stationary, this is not the case when expressed as ratios of

6. The two methods happen to produce very similar results in the present study. Further explanations on these two methods can be found in Hausman and Taylor [1981].

each other as it is done in the study. Thus, in line with all existing studies that have come to our notice on this subject (and given the apparent tendency of the data to exhibit stationarity), we too specify and estimate only the long-run equilibrium relationship as described by the above equation (13).

As pointed out earlier (in the last paragraph but one), some of the equations are estimated through the fixed-effect method of panel data estimation. By this, any instability engendered by inter-country heterogeneity in autonomous real exchange rate movements is catered for. But, as the results are practically the same when compared with those obtained through the aforementioned alternative (*i.e.* random-effect) technique, one can infer that such inter-country heterogeneity is not so substantial as to materially affect the stability of the estimates. Also, in order to evaluate the stability of the results between the CFA and non-CFA groups of African countries (the former comprising 14 former French colonies whose currencies are pegged to the French Franc and the latter, other African countries generally operating exchange rate policies of more adjustable peg), we partitioned the data set into two accordingly. But, as there are no material differences in the results based on these CFA and non-CFA data sets, we do not report them in the paper. Finally, on this same issue of stability, some of the reported equation estimates are based on data for as few as below 30 countries over very few years while others are based on a greater number of countries and years (sometimes, up to the entire 38 countries and almost over the entire 1970-90 period as mentioned in the Appendix – depending on data availability in respect of one or more regressors featuring in that particular equation). But in all these equations, the estimates of the parameters of regressors that are common to all or most of them (including *per capita* income and terms of trade) and the R^2 values that indicate the explanatory power of the equations are all materially the same across equations. This similarity of results obtained from unequal data sets (from both inter-country and temporal perspectives) further attests to the inter-country and temporal stability of the estimates.

B. The Data and Scope

Details concerning the sources of data, how the data are further transformed, list of countries included, etc are spelt out in the appendix. What we

do here is to run through these issues very briefly.

The empirical analysis is based on annual data for 38 African countries. The maximum period covered for each country is 1970-90 – although, for most of the countries, only the data for 1980's are employed in estimating the equations. The choice of the countries and the period covered for each included country is solely determined by data availability.

All the data are from the IMF and World Bank sources or sources closely associated with these two institutions as explained in the appendix.

IV. Empirical Results

Presented in Tables 1 and 2 below are the empirical results. The estimates of Table 2 reflect the effects of lagged values of the shares of relevant expenditure categories in the GDP which, as mentioned in section III, have practically the same effect on the real exchange rate as the contemporaneous counterparts contained in Table 1 and a portion of Table 2. All estimates of Table 1 are derived through random-effect estimation technique while those of Table 2 are based on the *fixed-effect* technique. Further explanatory notes are presented below these Tables.

As it can be seen from the two Tables, the equations have fairly high explanatory power, judging by the adjusted R^2 values. Also, the values of Durbin-Watson (D.W.) statistic are so close to zero that an absence of serial correlation of residuals is suggested in each equation.

The coefficients of terms of trade are positive and statistically significant in all equations, in accord with the general view. Also, *per capita* income enters all the equations with positive and statistically significant coefficients. In line with our discussion in section II, this may be because the demand for non-tradable is income elastic so that the positive effect from the demand side of the market for non-tradables reinforces the productivity or *Balassa-effect*. It may also be that demand for non-tradables is income inelastic but the resulting negative effect on real exchange rate is, however, dominated by the productivity effect.

Concerning the effects of total and composition of domestic expenditure, the overall domestic absorption ratio (E/Y) enters all equations with the expected positive and statistically significant coefficients. However, a fur-

Table 1
Empirical Results

Constant	.536 (8.8)	.626 (16.1)	.240 (2.1)	.504 (4.8)	.379 (4.7)	.443 (4.6)	.578 (17.2)	.486 (13.6)	.468 (12.1)
P_{XM}	.132 (3.8)	.205 (7.7)	.384 (5.5)	.296 (4.1)	.221 (4.3)	.283 (4.3)	.212 (8.1)	.223 (8.6)	.213 (7.5)
y	.249 (11.7)	.158 (11.1)	.231 (6.5)	.166 (4.7)	.247 (8.2)	.214 (6.3)	.144 (10.3)	.154 (11.1)	.175 (11.4)
I_g/Y	—	—	−.090 (−2.3)	—	—	—	—	—	—
I_v/Y	—	—	−.191 (−4.6)	—	—	—	—	—	—
C_g/Y	—	.098 (3.4)	.099 (1.3)	—	—	—	—	—	—
C_v/Y	—	.256 (4.4)	.363 (2.6)	—	—	—	—	—	—
E_{cg}/Y	−.333 (−9.3)	—	—	−.158 (−2.4)	—	—	—	—	—
I/Y	—	−.131 (−6.5)	—	—	—	−.065 (−1.6)	—	—	—
C/Y	—	—	—	—	—	—	.516 (7.7)	—	—
I_g/C_g	—	—	—	−.129 (−3.3)	—	—	—	—	—
I_v/C_v	—	—	—	—	.209 (−6.1)	—	—	—	—
I_g/I_v	—	—	—	—	—	−.016 (−0.3)	— —	— —	— —
C_g/C_v	—	—	—	—	—	—	0.003 (0.1)	— —	— —
E/Y	—	—	—	—	—	—	—	.493 (6.0)	—
$(E/Y)_{t-1}$	—	—	—	—	—	—	—	—	.328 (3.8)
I/C	—	—	—	—	—	—	—	−.181 (−10.5)	−.170 (−9.4)
Adjusted R^2	.630	.637	.514	.494	.576	.527	.642	.638	.612
D.W.	1.74	1.75	2.00	1.85	1.85	1.82	1.67	1.74	1.79
N	562	756	251	230	278	251	756	756	723

NOTES:

(i) The dependent variable is the (logarithm of) ***real effective exchange rate*** whose upward movement represents appreciation of the real value of domestic currency.

(ii) The figures in parentheses below the parameter estimates are the t-values. A parameter estimate is statistically different from zero at 10%; 5%; and 1% levels of significance (using 2-tailed test) if its t-value is absolutely up to 1.6; 2.0 and 2.6 respectively.

(iii) The panel data estimates are derived by the ***random-effect*** method.

(iv) D.W. is the Durbin-Watson statistic and N is the number of observation. The meanings of notations used for the regressors are as follows: P_{XM} is the terms of trade or export-import price ratio and y = ***per capita*** income. Also I; C; E; and Y stand for investment spending; consumption spending; expenditure or absorption; and GDP respectively while the g; and v subscripts stand for government and private sectors. Thus I_g/Y = government investment/*GDP* ratio; I_v/Y = private investment/*GDP* ratio; C_g/Y = government consumption/*GDP* ratio; C_v/Y = private consumption/*GDP* ratio; E_{cg}/Y = (central) government total expenditure/*GDP* ratio; I/Y = total investment/*GDP* ratio; C/Y = total consumption/*GDP* ratio; I_g/C_g = government investment/government consumption ratio; I_v/C_v = private investment/private consumption ratio; I_g/I_v = government investment/private investment ratio; C_g/C_v = government consumption/private consumption ratio; E/Y = domestic absorption/*GDP* ratio; and I/Y = investment (total)/*GDP* ratio. All the regressors are in logarithms so that their coefficients are elasticities.

Table 2
Further Empirical Results

P_{XM}	.377 (5.1)	.396 (5.5)	.243 (3.7)	.252 (3.8)	.254 (3.8)	.437 (5.4)	.206 (6.1)	.207 (6.0)	.148 (4.6)
y	.242 (5.5)	.249 (5.7)	.288 (6.9)	.289 (6.9)	.290 (6.9)	.386 (7.8)	.286 (12.9)	.294 (13.2)	.264 (12.3)
I_g/E	−.188 (−4.1)	−.182 (−4.2)	—	—	—	—	—	—	—
I_v/E	−.182 (−3.9)	−.289 (−5.4)	—	—	—	—	—	—	—
C_g/E	.159 (3.0)	—	—	—	—	—	—	—	—
C_v/E	—	.281 (3.0)	—	—	—	—	—	—	—
E_g/E	—	—	−.043 (−0.8)	—	—	—	—	—	—
E_v/E	—	—	—	.054 (1.2)	—	—	—	—	—
E_g/Y	—	—	—	—	−.161 (−2.0)	—	—	—	—
E_v/Y	—	—	—	—	.093 (0.6)	—	—	—	—
$(I_v/Y)_{t-1}$	—	—	—	—	—	−.128 (−3.0)	—	—	—
$(I/Y)_{t-1}$	—	—	—	—	—	−.195 (−3.7)	—	—	—
$(C_g/Y)_{t-1}$	—	—	—	—	—	—	.140 (3.8)	—	—
$(C_v/Y)_{t-1}$	—	—	—	—	—	—	.118 (1.6)	—	—
$(I/Y)_{t-1}$	—	—	—	—	—	—	−.178 (−6.8)	−.168 (−6.4)	—
$(C/Y)_{t-1}$	—	—	—	—	—	—	—	.263 (2.9)	—
$(E/Y)_{t-1}$	—	—	—	—	—	—	—	—	.211 (2.0)
Adjusted R^2	.465	.466	.497	.492	.493	.491	.574	.570	.591
D.W.	1.89	1.97	1.75	1.79	1.79	1.98	1.74	1.74	1.66
N	251	251	251	251	251	223	652	652	652

NOTES:

(i) The dependent variable is the (logarithm of) ***real effective exchange rate*** whose upward movement represents appreciation of the real value of domestic currency

(ii) The figures in parentheses below the parameter estimates are the t-values. A parameter estimate is statistically different from zero at 10%; 5%; and 1% levels of significance (using 2-tailed test) if its t-value is absolutely up to 1.6; 2.0 and 2.6 respectively

(iii) The panel data estimates are derived by the ***fixed-effect*** method

(iv) D.W. is the Durbin-Watson statistic and N is the number of observation. The meanings of notations used for the regressors are as follows P_{XM} is the terms of trade or export-import price ratio and y = ***per capita*** income. Also, I; C; E; and Y stand for investment spending; consumption spending; expenditure or absorptions and *GDP* respectively while the g; and v subscripts stand for government and private sectors. Thus, I_g/E; I_v/E; C_g/E; and C_v/E are the ratios of government investment; private investment; government consumption and private consumption to total domestic expenditure respectively in the same manner that I_g/Y; I_v/Y; C_g/Y; C_v/Y; I/Y; C/Y; and E/Y are the ratios of government investment; private investment; government consumption; private consumption; total investment; total consumption; and domestic absorption to the *GDP* respectively. Similarly, the E_g/E and E_v/E respectively stand for the shares of government total expenditure and private total expenditure in domestic absorption while E_g/Y and E_v/Y are their respective shares in the *GDP* – this time, E_g/Y is not just the share of central government (E_{cg}) that features in Table 1 – it is now the share of general or all tiers of government. All the regressors are in logarithms so that the coefficients represent the elasticities.

ther analysis – by breaking it into components – shows that this positive effect is attributable to only the consumption component (C/Y) and not the investment component (I/Y). Both categories of consumption component – government (C_g/Y) and private (C_v/Y) sector categories – exhibit positive effects while the two corresponding categories of investment component – public (I_g/Y) and private (I_v/Y) ones – are found to have negative effects. In other words, the negative effect of investment spending in relation to GDP is invariant with whether it is public-sector or private-sector type in the same manner that the tendency for the share of consumption spending in GDP to appreciate the exchange rate is not affected by how much of it is attributable to the public sector.

This finding is further supported by the observed effects of shares of these 4 expenditure categories in domestic absorption viz: The shares of public (I_g/E) and private (I_v/E) investment categories in domestic absorption both have negative effects while the shares of public (C_g/E) and private (C_v/E) consumption in the absorption are found with positive effects. That the effects of investment and consumption are invariant with the relative contributions of the public and private sectors can also be inferred by the statistically insignificant effects of the government-private investment ratio (I_g/I_v) and the government-private consumption ratio (C_g/C_v) in the equations. What affects the real exchange rate is the relative size of capital expenditure in the public sector budget (I_g/C_g) and also in the private sector budget (I_v/C_v) both of which have negative effects.[7] An explanation for this finding is that capital goods are generally importables (and, hence, tradables) in these countries so that an exogenous decision to increase the share of capital expenditure in the GDP or in domestic absorption would increase the relative demand for tradables and thus depress the non-tradable/tradable price ratio or the real exchange rate. For the same reason, the reverse would be the effect of consumption expenditure. That the share of

7. That the share of capital expenditure in the government budget depreciates real exchange rate tallies with the finding reported by Matin [1992] for Bangladesh. Negative effect of the size of total government expenditure in GDP is also reported there, as in the present one too. However, the analysis does not extend to a consideration of any other component of domestic absorption.

government in either investment or consumption expenditure has no effect on real exchange rate should be because government spending on investment is not more "intensive" in or biased towards tradables than that of private investment spending in the same manner that government consumption spending needs not be more biased towards non-tradables than private consumption.

In respect of the relative size of overall government versus private expenditure, it can be seen that combined public expenditure in relation to GDP (E_{cg}/Y and E_g/Y) have negative coefficients or elasticities that are also statistically significant. That is, the share of total government expenditure in GDP tends to depreciates real exchange rates.

A similar conclusion would be reached by considering the shares of total government spending in domestic absorption (E_g/E) and combined private spending in domestic absorption (E_V/E), which are found with negative and positive effects respectively. Given the neutrality of the share of government in each of total investment and total consumption, this observation of non-neutrality of the share of government total expenditure (in GDP or in domestic absorption) has to be due to the greater preponderance of capital expenditure in government budget than in private budget. In other words, the share of investment in government-expenditure generally exceeds the share of investment in private expenditure so that an increase in the share of government in the total domestic spending would have the effect of increasing the overall share of investment in GDP or domestic absorption.

V. Summary and Concluding Remarks

The composition of government budget and national accounts can affect real exchange rate movements. A knowledge of how this is brought about – which has attracted little attention in the literature – is of great importance for policy decisions. This is a major reason for conducting the study reported in this paper. The study is based on annual data (over varying periods that fall within 1970-90) pooled across 38 African countries.

After the usual preamble in section I of the paper, we present (in section II) a theoretical framework for evaluating the effects of *fundamentals*, espe-

cially the composition of expenditure aggregates that is the pre-occupation of the study, on real exchange rate behavior. This is followed in section III by a description of the methodology adopted in the study, including model specification and estimation technique. The real exchange rate regression equation specified includes terms of trade and *per capita* income as its arguments. More importantly, it includes various categories of government expenditure and national accounts, based on the theoretical framework. The empirical estimates of the model are presented and evaluated in section IV and the highlights of the findings are as follows:

(a) Per capita income and terms of trade appreciate real exchange rates.

(b) While the ratio of total domestic absorption to GDP appreciates real exchange rate, the shares of investment in GDP and in domestic absorption depreciate it. In effect, only the consumption component of domestic absorption appreciates exchange rates.

(c) The effects of investment and consumption expenditure categories on real exchange rate are invariant with the relative shares of the public sector in the total investment and total consumption. A high share of capital expenditure in the government budget depreciates real exchange rate just as a high share of capital expenditure in the private sector's budget. Conversely, the shares of consumption spending in the budgets of government and private spenders have equal tendency to appreciate real exchange rate. However, because the share of capital in total government expenditure is generally higher than its share in the private sector's budget, an increase in the share of total government expenditure in GDP increases the total investment-GDP ratio and, hence, depreciates real exchange rates.

With the above finding that the shares of public and private investment spending in GDP and in total domestic absorption depreciate real exchange rate, there should be caution in implementing adjustment policies in these countries. One of the goals of such policies is to depreciate real exchange rate or reduce "over-valuation" of domestic currency whereas, they also often have the effect of reducing the shares of government and, especially, investment spending by private and public sectors in GDP. The "incidental" cuts in these investment ratios, going by the results of this study, would tend to negate the goal of real exchange rate depreciation.

Appendix
The Data and List of Countries Covered

The 38 African countries included in the study are: Algeria, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo, Cote d'Ivoire, Egypt, Ethiopia, Gabon, Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, Zaire, Zambia, and Zimbabwe.

The main data sources are the World Bank's, *World Tables* and International Monetary Fund's *International Financial Statistics* (IFS) *Yearbook*. The specific sources of data and how they are measured are as follows:

(i) The effective real exchange rate is the product of domestic-foreign price ratio (p/p^f) and nominal exchange rate defined in terms of foreign currency per unit of domestic currency so that appreciation of domestic currency in real terms is represented by upward movement. The domestic price p is the consumer price level and both the foreign price p^f and nominal exchange rate are trade-weighted values, with the weights being the shares of total trade from the trading partners. The data, in already calculated index form (with 1980 being the base year), are from an unpublished World Bank source, as augmented for few countries by an unpublished IMF source.

(iii) Nominal GDP, real GDP, government consumption, private consumption, total investment, exports, imports, *per capita* real income (in US dollars), terms of trade (with 1987 being the base year) are from the *World Tables*, 1991.

(v) Central government expenditure-GDP ratio is from (World Pages or Tables of) various issues of IFS Yearbook.

(vii) Government investment-GDP and private investment-GDP ratios are from Pfeffermann and Madarassy [1989] in respect of few countries (*viz*: Cote d'Ivoire, Ethiopia, Kenya, Malawi, Mauritius, Nigeria, Tanzania, and Zimbabwe). For other countries, the figures are from the UNDP-World Bank's *African Development Indicators*. (Data on these variables are not available for 10 countries *viz*: Central African Republic, Congo, Ghana, Liberia, Madagascar, Mali, Niger, Rwanda, Somalia and Zambia so that they are not included in deriving estimates of equations where private and public

investments feature as regressors).

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