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AN ALTERNATIVE FRAMEWORK OF ESTIMATING INVESTMENT AND SAVING FUNCTIONS FOR DEVELOPING COUNTRIES: AN APPLICATION TO TIME-SERIES DATA FOR SUB-SAHARA AFRICAN COUNTRIES

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The study adopts the reduced-form approach that is within the flow-of-funds framework in examining determinants of investment, domestic saving and foreign saving. Time-series annual data for 25 Sub-saharan countries are employed and six possible determinants are considered, with their general primary effects being as follows: (i) foreign reserves availability promotes investment (ii) real interest rate has rather ambiguous effects (iii) change in GDP promotes investment and domestic saving and retards foreign saving (iv) domestic credit availability enhances investment (v) world economic growth reduces foreign saving and (vi) real exchange rate devaluation reduces investment and foreign saving. These primary effects are also with the expected Spillover effects. [O55]

1. INTRODUCTION

The importance of domestic capital formation and its sources of finance, in the form of domestic and foreign savings, is rather obvious within the context of developing countries to the extent that belabouring a re-statement of it here is hardly necessary. Likewise is the need to mention the need for studying the factors that determine them. We only wish to point out that the crucial role of these economic aggregates and, hence, the need for identifying factors that determine them have led to an upsurge of several empirical studies on the factors influencing them in the developing countries. A survey of such studies can be found in Jorgenson (1971), Fry (1980), Leff and Sato (1988), Deaton (1989) and Balassa (1989), among others.

However, rectifiable qualifications exist in respect of these studies. One of these is that data for African (especially, Sub-saharan) countries have often been excluded in conducting the studies. In addition, as we shall establish later in section 2, the structural models that have always been specified have a scope for improvement, especially in so far as the relationships between the capital formation, domestic saving and foreign saving are concerned. As we shall later contend and establish in the paper, what is called for is reduced-form equations based on flow-of-funds modelling and which therefore properly cater for the interrelationships.

Thus, the central objectives of the study reported in this paper are to extend the study on the subject matter to Sub-Sahara African countries and to adopt an alternative framework in doing this. To accomplish the presentation of the discussion in the paper, the remaining part of the paper is organised into four sections. In the next section, i.e. section 2, we shall review the existing model specification. In section 3, our alternative framework shall be presented, together with how the variables employed in the study have been sourced and computed. We shall present and discuss the empirical results in section 4 and give the summary and concluding remarks in section 5.

2. A REVIEW OF THE EXISTING MODEL SPECIFICATION

The commonest specifications of saving and investment functions in the empirical literature are as presented in equations (1a) and (1b) for saving and equations (2a) and (2b) for capital formation.

$$S = S(Y, RINT, F, etc.) \tag{1a}$$

$$S/Y = S/Y(\dot{Y}, PCI, RINT, F/Y, etc) \tag{1b}$$

$$I = I(Y, CREDIT, FORESV, RINT, etc) \tag{2a}$$

$$I/Y = I/Y(\dot{Y}, CREDIT/Y, FORESV/Y, RINT, etc) \tag{2b}$$

where S and I denote real values of domestic saving and capital formation respectively; F denotes real foreign saving; *CREDIT* and *FORESV* stand for domestic real credit availability and foreign reserves availability respectively; Y is the real GDP (or, sometimes, change in real GDP or even permanent income); *RINT* denotes real interest rate, defined as nominal interest rate minus inflation rate; $\dot{Y}$ stands for growth rate of the real GDP; while *PCI* is per capita income. The rationale guiding the choice of the regressors in the above equations shall be discussed later.

There are many areas where the existing studies based on the above model framework can be improved upon, as the study reported in this paper endeavours to do. Perhaps, the most fundamental of the weaknesses inherent in the previous studies that is the objective of the present one to rectify is the one that centres on whether foreign saving should be excluded or included as a regressor in these equations and, if it should be excluded in line with the position taken by Leff and Sato (1988), whether structural as opposed to reduced-form equations is the appropriate one. These issues deserve further comments and the bulk of the remaining part of this section 2 is therefore devoted to them. According to Leff and Sato (1988: 5):

> Another question concerns the treatment of foreign savings in the saving and investment equations. Unlike some researchers in this field, we have not specified F (i.e. foreign savings) as a RHS (i.e. Right-hand-Side or independent) variable either in the savings or in the investment function. We see no theoretical basis for specifying F in a saving function. Inclusion of F in the investment equation is more plausible, for foreign-capital inflow may affect the returns to capital in developing countries. However, as discussed in the appendix, inclusion of F as a RHS variable in investment or savings equations involves misspecification and under-identification. Because of these problems, the costs of specifying F in the investment and saving equations may exceed the potential gains.

In the Appendix to their paper, these authors are able to establish how the accounting identity between domestic and foreign savings on one hand and investment on the other implies that a negative relationship between the two categories of saving should always be observed without a necessarily causal negative relationship between them and as a result of which even a simultaneous equation approach may become inappropriate in correcting for the bias resulting from inclusion of foreign saving in the domestic saving equation. According to them (Leff and Sato: 12): "Further, S and I (and probably F, too) are obviously determined simultaneously. Simultaneous-equations estimation of individual functions for these variables is of little help in this context, for the problem involves specification bias as well as simultaneity."

The authors therefore criticize the previous approaches in the literature whereby any (combination) of the three variables was often treated as being exogenous. A brief review of such studies were given (Leff and Sato: 13) as follows:

> One approach, which has a long tradition in the literature [see, e.g. Chenery and Eckstein (1970)], views F as exogenous, and treats I and /or S as functions of F. By contrast, Sachs (1981), for example, sees I as an independent variable that determines the level of F in individual countries. Other observers construe the situation as one in which I is predetermined, and F is governed by the level of domestic saving.

On the basis of the mathematical exposition in the Appendix of their paper, the authors were able to demonstrate and conclude (on page 15) that:

> As this discussion indicates, regressions of S or I on F can easily result in statistical artifacts or an underidentified equations. Unless identifying restrictions and tests for exogeneity are applied [see Engle, *et al* (1983)], researchers interpreting their regression results in this field will simply retrieve the a priori views with which they started their investigation. Such regressions will be unable to persuade other researchers whose priors concerning LDC macroeconomics differ, or

> economists who recognize that the empirical results are open to alternative interpretations.

It should be noted that the problem of simultaneous determination, by a series of factors, of investment and the two types of saving as well as the problem of determining the direction of causation among them (assuming they are not all determined simultaneously) had earlier been raised in the literature. For example, according to Fry (1980: 324): "With a constant foreign-saving rate and no shortage of profitable investment opportunities at the fixed institutional interest rate, changes in investment will be determined by changes in saving". Also, based on his empirical findings, Giovannini (1983: 602) expressed the view that:

> The coefficients of ... foreign savings are not significant in the instrumental variable estimates (of the domestic saving function). This is consistent with the view that ... trade balance deficit (i.e. foreign savings) is determined by savings and investment, as is the case both in the simplest Keynesian model and in later refinements (Sachs, 1981).... If savings-investment decisions by domestic residents are not constrained by the availability of foreign aid or foreign credit, and investment itself is not constrained, the direction of causality would normally run from domestic savings to foreign savings.

From the review given above, it can be logically inferred that, subject to some peculiarities in some economies, mutual causations pervade the trio of investment, domestic saving and foreign saving. This is in addition to the accounting identity that links the three variables. These conclusions, in turn, suggest that one should ideally not be made an independent variable in the equation specified for the other-irrespective of whether or not a simultaneous equation method of estimation shall be employed. On the other hand, an omission, from the structural equation specified for each of them, of the remaining two as independent variables should create an econometric problem of omitted variables. Thus, despite the attempt of Leff and Sato (1988) to correct for the former problem by including none of the three variables as a regressor in the saving and investment functions, it pays the price of having the resulting estimates suffer from the latter problem. What is called for in order to simultaneously correct for the two problems is to specify and estimate reduced-form equations that recognize joint determination of and accounting identity linking the three variables. This approach is the one followed in the study reported in this paper.

Of recent, due to advances in the literature on the saving function as pioneered by Hall (1978), Blinder and Deaton (1985), etc, savings function based on Euler equation approach has started to be specified for estimation in the empirical literature on the subject. The specification generally takes the form of equation (1c) below:

$$\dot{C} = \dot{C}(\dot{y}, RINT, etc)... \tag{1c}$$

where $\dot{C}$ and $\dot{y}$ stand for growth rates of real private per capita consumption and per capita income respectively and *RINT* is as defined above.

This Euler equation approach has many rather strong assumptions underlying it. In addition, it has no counterpart for investment function and is therefore not very suitable when comparable estimates of both saving and investment functions are to be derived, as in the present study.

3. SPECIFICATION OF THE PRESENT MODEL AND VARIABLES EMPLOYED IN ESTIMATING IT

We shall first present, in sub-section 3.A. the model specification and how the dependent variables have been sourced and computed. Then, in sub-section 3.B. we shall discuss the list of regressors, including how they have been sourced and measured.

A. Model Specification and the Dependent Variables

MODEL SPECIFICATION

As it has been pointed out and justified above, reduced-form equations that recognize both the possible mutual causations among and the accounting identity linking the three variables are to be specified in the present paper. These specifications are as follows:

$$I_t = a_0 + a_1 \Delta Y_t + a_2 RINT_t + a_3 CREDIT_t + a_4 FORESV_t + a_5 REX_t + a_6 GYW_t + u_t \tag{3}$$

$$S_t = b_0 + b_1 \Delta Y_t + b_2 RINT_t + b_3 CREDIT_t + b_4\ FORESV_t + b_5 REX_t + b_6 GYW_t + v_t \tag{4}$$

$$F_t = c_0 + c_1 \Delta Y_t + c_2 RINT_t + c_3 CREDIT_t + c_4 FORESV_t + c_5 REX_t + c_6 GYW_t + e_t \tag{5}$$

where *I*, *S*, and *F* are per capita real capital formation, real domestic saving and real foreign saving respectively; ΔY is the per capita change in the real GDP; *RINT*, the real rate of interest; *CREDIT*, the per capita domestic real credit flow; *FORESV*, the per capita stock of real foreign reserves; *REX*, the real exchange rate (real domestic currency per *SDR*) movement; and *GYW*, the world economic growth. The u_t, v_t and e_t are the error terms (that are supposed to satisfy the usual econometric assumptions); a_0, b_0 and c_0 are the intercept terms; while a_i's, b_i's and c_i's are the parameters of the regressors the estimates of which

are of the major interest in the study. The subscript t denotes the time period.

The reasons for including the six regressors in the above equations and how they are measured are going to be discussed in sub-section 3.2 below. What we want to draw attention to meanwhile is the fact that the above three equations constitute a system and they are premised on the relationship among economy-wide (as opposed to sectoral) flow-of-funds data. According to the United Nations' (1968) System of National Accounts (SNA), the system of flow-of-funds accounts, whether for a sector or for the whole economy, comprises of the Capital Accumulation Account and Capital Finance Account. While the former portrays saving, capital formation and net borrowing for the sector or for the whole economy (as the case may be), the later shows the breakdown of the net borrowing. In the context of the whole economy which is the concern of the present study, it follows that what is now being analysed is the Capital Accumulation Account and the net borrowing now corresponds to what is being referred to as foreign saving. [We are not delving into an analysis of the economy-wide Capital Finance Account, which corresponds to the conventional balance of payments-such as analysis for Nigerian economy had been rigorously carried out in our previous study reported in Odedokun (1984)]. Like any other Capital Accumulation Account of the flow-of-funds data, there exists an identity which requires capital formation to equal saving and net borrowing (of savings undertaken by other sectors, this time foreign sector or the rest of the world). This identity is stated in equation (6) thus:

$$I = S + F \tag{6}$$

Given that none of the three variables in equation (6) can be regarded as being exogenous in line with the reasons previously adduced, it is imperative to specify equation for each of them as in equations (3) to (5) above. These three equations therefore constitute a flow-of-funds model for the whole economy, as opposed to selected sectors. Like the sectoral flow-of-funds modelling [some of which we have done for the foreign; central fiscal/monetary authorities, banking, and state government sectors of Nigerian economy as reported in Odedokun (1984, 1987, 1989, 1990) respectively], some salient features have to be present. Details of these features are contained in these earlier sectoral studies. Only two of them are pertinent to the present study and they are as discussed in the next two paragraphs.

First, to reflect the interrelationships among the system of equations (3) to (5) above, the entire list of the regressors should normally appear in each equation. This is because, if a regressor, say, foreign reserves availability or *FORESV,* has its primary effect on capital formation by increasing investment spending, the repercussions or secondary effects have to take the form of increases in domestic

and/or foreign savings so as to provide a source of finance for the increased investment spending. As another example, if world economic growth or *GYW* has its direct or primary effect by reducing foreign saving, the secondary or indirect effects have to take the form of an increase in the domestic saving to compensate for this and/or a reduction in capital formation. This means that, in as much as a regressor has the postulated primary or direct (and significant) effect in a particular equation, it should feature in the remaining equations even if its secondary or indirect effects are so diffused between the remaining equations as to make the coefficients of the regressor statistically insignificant in these other equations. The discussion in this paragraph is based on the famous exposition by Brainard and Tobin (1968) on financial or flow-of-funds modelling.

The second feature of flow of funds modelling that is relevant to the present study centres on the adding-up restrictions or flow-of-funds constraints and they are related and derive from the feature explained in the preceding paragraph. These adding-up constraints can be compactly described by equation (7) below:

$$a_i = b_i + c_i \; (i = 0, 1, 2,...6) \tag{7}$$

In other words, the coefficient of a regressor (and the intercept term, too) in the investment equation should equal the sum of the coefficients of the same regressor (and, of course, the intercept terms also) in the domestic and foreign saving equations. This follows from the identity stated earlier in equation (6). The economic interpretation of this is that an increase in capital formation caused by a unit change in a regressor must be exactly financed by the net increase in the two sources of finance resulting from this one unit change in the regressor; an increase in domestic saving as a result of one unit change in a regressor must be used in financing an increase capital formation and/or in reducing foreign borrowing to the same extent; and an increase in foreign saving caused by a unit change in a regressor must be exactly absorbed by a reduction in domestic saving effort and/or an increase in capital formation.

MEASUREMENTS AND SOURCES OF THE DEPENDENT VARIABLES

All the data on the dependent variables were sourced from the National Accounts figures provided in the 1987 and 1989 issues of the IMF's International Financial Statistics (IFS) Yearbook. Per capita real capital formation was computed as the sum of gross fixed capital formation (line 93e of the IFS) plus increase in stocks (line 93i of the IFS) divided by both the GDP deflator (line 99bip of the IFS) and total population size (line 99z of the IFS). Per capita real foreign saving, on the other hand, was computed as nominal imports of goods and non-factor services (line 98c of the IFS) minus nominal exports of goods and non-factor services (line 90c of the IFS), with the result being divided by both the GDP deflator and population size. Following the identity stated in equation (6)

above and in line with the common practice, per capita real gross domestic saving was calculated as per capita real gross capital formation minus per capita real foreign saving.

B. The Independent Variables: Measurements, Data Sources and Rationale for Their Inclusion

All the six regressors that appear in the system of equations (3) to (5) were computed from data contained in the 1987 and 1989 issues of the IMF's International Financial Statistics (IFS) Yearbook—the same source of the dependent variables. The justifications for including the regressors and how they were computed are discussed in (a) to (f) below.

PER CAPITA CHANGE IN REAL GDP(ΔY)

This is the first-difference of real GDP (line 99b.p of the IFS) divided by the population size (line 99z of the IFS). This variable is supposed to have a positive direct or primary effect on the per capita real investment because of the famous accelerator effects. Also, it is supposed to have a positive direct effect on domestic saving: "Whether one chooses the relative income, permanent income, stock adjustment or life cycle theories of saving..." (Fry, 1980, p. 317). Finally, it is supposed to also exert a positive direct effect on per capita foreign saving because it should increase import of goods and services more than it should increase (if at all) the export of goods and services. Thus, without considering any indirect effects or secondary repercussions this regressor might have, we expect its coefficients to be positive in the investment, domestic saving and foreign saving equations. That is, in the system of equations (3) to (5), we postulate a_1, b_1, $c_1 > 0$.

REAL RATE OF INTEREST (RINT)

This is the nominal rate of interest (discount rate or line 60 of the IFS) minus the expected rate of inflation. Discount rate was chosen in preference to other types of interest rate because it is the only one with adequate number of sample observations. Concerning the rate of inflation, it was computed as the first-difference of the logarithms of GDP deflator (line 99bip of the IFS). Its expected values were than generated as the fitted values in a regression analysis where its actual values were regressed on their past values, past values of economic growth; contemporaneous values of monetary growth; and past values of nominal exchange rate movements—among others.

We expect the real rate of interest to exert a negative primary effect on per capita investment since the nominal interest rate is a financial cost of financing capital formation while the rate of inflation constitutes a return on capital goods. As rightly pointed out by Leff and Sato (1988: 2): "The expected-inflation term enters because... firms may anticipate that under more inflationary conditions due

to demand shocks they will be able to raise prices ahead of costs, and thus increase real profits".

Concerning per caita saving, we expect (or, at least, do not rule out) direct effects of real interest rate on it but we are not in a position to posit the direction of this effect—whether positive or negative. Neither the theoretical nor empirical literature on the role of interest rate and/or inflation on domestic saving is able to assist in this regard as such literature (even for industrial countries) are full of contradictions and inconclusiveness. An examination of the literature review on this subject by Balassa (1989); Deaton (1989); and Smith (1990) clearly attests to this assertion. At the level of theoretical proposition, various and rather conflicting channels of the effect of real interest rate and/or inflation on domestic saving have been posited, e.g. Lehmussari (1990: 79), Smith (1990: 17); Leff and Sato (1988: 3); Deaton (1989: 88 & 89); and Lahiri (1989: 231).

DOMESTIC CREDIT AVAILABILITY (CREDIT)

This was computed as the first-difference of or change in the nominal value of the stock of credit from money-creating banks to the private sector (line 32d of the IFS). The result was then divided by both the GDP deflator and population size. In essence, it is the per capita real flow of domestic credit.

As various studies, like Blejer and Khan (1984), Fry (1980), Tybout (1983) and Leff and Sato (1980, 1988) have empirically shown, businesses rely on credit flows from the banking sector in financing their investment spending and a positive impact of this regressor on investment spending has been detected by them. Credit availability constitutes a factor influencing investment spending due to credit rationing brought about by pegging the rate of interest below what is required to clear the credit market, a feature that is prevalent in most developing countries as documented in many previous studies, including McKinnon and Mathieson (1981).

It is also possible for domestic credit availability to have a direct reducing effect on domestic saving. As observed by Smith (1990: 39) in respect of advanced countries: "The availability of consumer credit... is often mentioned as a factor contributing to low saving in the United States and high saving in other countries". He cited several empirical studies, including Makin (1986), which attribute lack of consumer credit in Japan as a factor contributing to high saving rates there and several other empirical studies like Friend (1986) and Summers and Carroll (1987) who identified availability of consumer credit as a contributory factor to relatively low saving rates in the United States. It is possible that such a situation may characterize developing countries too.

FOREIGN RESERVES AVAILABILITY (FORESV)

This was calculated as the average (of the beginning-of-year and end-of-year) of purchasing power of foreign reserves divided by the population size. The purchasing power of foreign reserves was, in turn, got through division of the nominal US dollar of foreign reserves (got from the World Tables of the IFS) by the export unit value (also, in US dollar) of industrial countries (also got from the World Tables of the IFS). We experimented with foreign reserves-import ratio as a substitute measure of foreign reserves availability and did not find the results to be more robust or materially different.

The main primary effect of this regressor is supposed to be on capital formation, which is expected to be promoted by availability of foreign reserves. This is because, in developing countries and, especially, Sub-sahara African countries, capital goods are mostly imported from industrial countries. In the typical real-world situation where exchange rates are not often permitted to clear the foreign exchange market, foreign reserves have to be rationed to importers (e.g. through import-licensing arrangement). Therefore, the quantum of available foreign reserves should have a positive effect on the capacity to import capital goods. This is why various measures of foreign reserves availability have been included in investment equations in some previous studies like Bilsborrow (1977) and Fry (1980), where the postulated positive has often been detected.

REAL EXCHANGE RATE MOVEMENT (REX)

This is the product of the nominal exchange rate (domestic currency per SDR or line rb of the IFS) and world price level (GDP deflator got from the World Tables of the IFS) divided by the domestic price level also, GDP deflator. In effect, this variable indicates the depreciation of domestic, currency in real terms.

Thus, by reducing imports and increasing exports of goods and services, we expect the main primary effect of this regressor to be negative on foreign saving since it should improve current account balance of balance of payments. It can also have some negative direct effect on investment spending by increasing the cost of acquiring capital goods from abroad. This tendency has of recent being accorded theoretical and empirical attention in the literature. For example, according to the survey of studies on investment spending carried out by Serven and Solimano (1989), it was observed (on pages 13 & 14) that:

> A devaluation may effect the profitability of investment through its impact on the relative price of capital in the economy. In fact, Branson (1986) shows that if capital goods have an import content then a devaluation raises the supply (or reposition) price of capital in terms of home goods; Ceteris paribus, this effect tends to depress investment in the home goods sector.... Solimano (1989) finds a negative effect of

real devaluation on investment in his empirical simultaneous equation model for Chile....

WORLD ECONOMIC GROWTH (GYW)

This was calculated as the first-difference of the natural logarithm of the index of real GDP of all (IMF-member) countries, that was sourced from the World Tables of the IFS. This variable is a proxy for world demand for the exports of the countries being studied. As a result, by increasing exports without any perceptible effect on imports, we expect this regressor to improve the current account of the balance of payments and thereby exert its primary negative effect on foreign saving.

EXCLUSION OF LAGGED DEPENDENT VARIABLES

While some previous studies do include lagged dependent variables in the investment and saving equations, there is little theoretical justification and even less empirical reason for doing so. For example, according to Leff and Sato (1988: 3): "On the basis of earlier research on investment equations in developing countries [see Leff and Sato (1982: 176)], we do not specify I_{-1} or lagged investment as a right-hand-side (or independent) variable."

Also, as rightly observed by Giovannini (1983, p. 604): "In a well-specified life-cycle savings function, the inclusion of the lagged dependent variable is very questionable." This latter view had earlier been empirically vindicated by Fry (1980, p. 325) who concluded that: "In fact, however, virtually no explanatory power is lost when the lagged dependent variable is dropped from the estimates (of the saving function)." For these theoretical and empirical reasons, we therefore exclude lagged values of the three dependent variables as regressors.

4. EMPIRICAL RESULTS

A. The Estimation Technique

It is expected that per capita change in real GDP(ΔY) in the system of equations (3) to (5) is not truely exogenous because it is supposed to affect and affected by both the per capita real investment and per capita real domestic saving. Thus, a straight-forward application of OLS technique in estimating the equations would produce simultaneous equation bias in the estimates. As a result, we employed the fitted value of ΔY as its instrument in estimating the equations. The fitted value of ΔY, in turn, was generated by regressing it on those variables that should be truely exogenous within the system, including lagged value of ΔY, lagged value of domestic saving, lagged value of inflation rate, and contemporaneous values of real export growth, population growth and financial intemediation growth.

Another issue that borders on estimation technique which should be briefly explained is the correction for autocorrelation. Where the error terms (u_t, v_t and e_t) in the system of equations (3) to (5) exhibited first-order serial correlation (as detected by the values of the Durbin-Watson or DW statistic), we tried to correct for this by transforming the original data with the first-order autocorrelation coefficient which was, in turn, computed by regressing the error term on its lagged value. This technique of correcting for autocorrelation is equivalent to the conventional Generalized Least Squares (GLS). However, in some cases the situation is still inconclusive concerning the existence or otherwise of autocorrelation, i.e. despite the effort to correct this econometric problem in this manner. Fortunately, such cases are few.

B. Presentation of the Estimates

The estimates are reported in Table 1 below for the 25 Sub-sahara African countries for which requisite data were available. For each country, it is the estimates of the capital formation equation (3) that we report first or on top, followed by the estimates of domestic saving equation (4) in the middle while those of the foreign saving equation (5) are reported last or at the bottom.

Against the name of each country, we indicate the period covered and the resulting number of annual observations, denoted by N. Beside the parameter estimates, we also report the t-values in the parentheses. Generally, a coefficient estimate is absolutely greater than zero (i.e. concerning one-tailed statistical test) at 10%, 5% and 1% significance levels if its t-value is absolutely up to 1.5, 1.8 and 2.5 respectively—although slight variations across countries exist in respect of these critical t-values due to the corresponding inter-country differences in the number of annual observations employed. Due to the rather poor quality of data employed, we shall be deeming a regressor to have had a significant effect if the t-value of its coefficient is statistically significant at just 10% level of significance.

Figures on nominal interest rates were not available for two of the 25 countries viz: Liberia and Zaire. For these countries, it is the rate of deflation (i.e. negative of inflation rate) that we employed instead of the real rate of interest.

C. Evaluation of the Empirical Results

As it can be readily seen from the Table 1 above, the R^2 values are generally very high, suggesting correspondingly high explanatery power or goodness-of-fit of the model. Also, the Durbin-Watson (DW) statistic values are not sufficiently different from 2 as to suggest the presence of first-order serial correlation—although, very few of these are inconclusive as to whether the serial correlation exists or not despite the effort made to correct for the presence of serial correlation as pointed out earlier.

So that the interpretations of the results do not become clumsy; unwieldy;

Table 1. The Estimates of Capital Formation, Domestic Saving and Foreign Saving Functions

	Intercept Term	Per Capita Foreign Reserves	Real Rate of Interest*	Per Capita Change in Real GDP	Per Capita Real Domestic Credit Flow	World Economic Growth	Real Exchange Rate Devaluation	R^2	DW
Benin	191.3 (2.5)	0.026 (0.02)	−174.9(−1.3)	0.273 (1.6)	0.059 (2.3)	−367.2 (−0.4)	−0.105(−0.1)	79.2	2.44
(1971-86:N=16)	−269.8(−2.2)	8.050 (3.7)	−230.5(−1.1)	−0.431(−1.6)	0.045 (1.1)	1576.6 (1.2)	3.432 (2.7)	68.6	1.55
	461.1 (3.1)	−8.024(−3.0)	55.7 (0.2)	0.705 (2.2)	0.013 (0.3)	−1943.7 (−1.2)	−3.538(−2.3)	78.9	1.91
Botswana	2037 (1.9)	−4.165(−1.8)	653.4 (0.3)	−0.049(−0.1)	0.431 (0.4)	−1870 (−1.3)	2.094 (2.2)	66.0	1.61
(1969-86:N=18)	−1519 (−1.8)	−0.748(−0.4)	−178.1(−0.1)	0.268 (0.7)	1.554 (1.7)	35 (0.03)	2.456 (3.3)	91.2	1.60
	3555 (4.2)	−3.417(−1.8)	831.5 (0.5)	−0.316(−0.8)	−1.123(−1.2)	−1905 (−1.7)	−0.362(−0.5)	80.9	1.67
Burkina Faso	106.6 (4.4)	−0.049(−0.1)	67.52 (1.4)	−0.094(−0.6)	0.068 (1.9)	−735.9(−2.6)	−0.695(−0.1)	58.9	1.88
(1969-85:N=17)	−75.4(−4.4)	4.459 (6.8)	−31.37(−0.9)	0.344 (3.0)	0.048 (1.9)	618.9 (3.0)	−8.964(−2.4)	87.1	2.38
	182.0 (6.7)	−4.508(−4.4)	98.88 (1.8)	−0.439(−2.4)	0.020 (0.5)	−1354.7(−4.2)	8.269 (1.4)	82.6	1.88
Burundi	44.07 (0.4)	0.378 (0.1)	39.69 (0.1)	0.146 (0.8)	1.214 (2.5)	−2442 (−1.6)	0.154 (3.3)	68.5	1.28
(1970-88:N=19)	−172.9 (−2.3)	5.947 (1.6)	90.75 (0.4)	0.140 (1.0)	−0.008(−0.02)	782 (0.7)	0.117 (3.4)	55.2	1.30
	217.0 (3.1)	−5.569(−1.6)	−51.06(−0.2)	−0.006(−0.1)	1.222 (3.7)	−3226 (−3.0)	0.037 (1.1)	72.8	2.30
Cameroon	−25.53(−1.4)	−0.233(−1.0)	−86.11(−2.3)	0.728 (2.5)	0.740 (1.5)	53.03 (0.5)	0.014 (3.0)	77.8	1.75
(1968-85:N=16)	−38.73(−2.3)	−0.231(−1.1)	−84.60(−2.5)	0.715 (2.8)	0.154 (0.3)	−41.84(−0.4)	0.020 (4.8)	84.8	2.22
	13.20 (0.9)	−0.003(−0.01)	−1.51(−1.1)	0.012 (0.1)	0.586 (1.4)	94.87 (1.0)	−0.006(−1.6)	37.6	2.62
Congo	249.8 (0.4)	13.95 (2.6)	1517 (2.2)	0.544 (1.5)	0.247 (2.5)	−7120 (−1.7)	0.058 (0.4)	76.0	1.88
(1966-86:N=21)	−1009.3 (−0.7)	4.32 (0.3)	1732 (1.1)	2.296 (2.8)	0.334 (1.5)	−4822 (−0.5)	0.348 (0.9)	53.2	1.49
	1259.1 (1.1)	9.62 (1.1)	−216 (−0.2)	−1.752(−2.9)	−0.088(−0.5)	−2298 (−0.3)	−0.289(−1.1)	39.2	1.57

Table 1. (Continued)

	Intercept Term	Per Capita Foreign Reserves	Real Rate of Interest*	Per Capita Change in Real GDP	Per Capita Real Domestic Credit Flow	World Economic Growth	Real Exchange Rate Devaluation	R^2	DW
Cote d'Ivaire	94.10 (6.6)	0.192 (1.5)	26.66 (1.0)	0.099 (0.8)	0.383 (1.1)	−198.1(−1.5)	−0.013(−4.9)	93.0	1.94
(1972-86:N=15)	45.67 (3.4)	0.317 (2.6)	−84.34(−3.3)	0.533 (4.3)	−0.036(−0.1)	−37.5(−0.3)	0.001 (0.3)	89.0	2.81
	48.43 (2.5)	−0.124(−0.7)	111.01 (3.1)	−0.433(−2.5)	0.419 (0.9)	−160.5(−0.9)	−0.014(−3.9)	84.9	2.78
Ethopia	11.88 (5.4)	0.456 (1.6)	55.23 (4.0)	−0.074(−1.0)	−0.283(−1.3)	60.17 (1.5)	−0.001(−0.5)	58.2	1.25
(1962-88:N=27)	7.43 (2.2)	1.072 (2.4)	−20.92(−1.0)	0.192 (1.7)	−1.255(−3.9)	61.35 (1.0)	−0.003(−0.2)	73.1	1.69
	4.46 (1.8)	−0.607(−1.8)	76.15 (4.9)	−0.271(−3.1)	0.972 (4.0)	−1.18(−0.03)	−0.003(−0.2)	80.3	1.68
Ghana	426.7 (3.1)	4.115 (2.6)	1006 (3.3)	0.035 (0.5)	0.579 (2.2)	−1676 (−0.7)	0.004 (0.4)	75.7	1.52
(1962-87:N=26)	105.4 (1.6)	4.936 (2.5)	227 (0.7)	−0.138(−2.7)	−0.120(−0.5)	1397 (0.8)	0.010 (1.1)	49.8	1.49
	125.5 (1.2)	1.110 (0.9)	380 (1.6)	0.174 (3.4)	0.514 (2.5)	−3648 (−2.0)	−0.006(−0.9)	62.8	1.90
Kenya	38.20 (2.2)	0.441 (1.9)	−58.22(−1.0)	0.042 (1.3)	0.516 (0.9)	−280.1 (−1.1)	0.863 (1.6)	64.3	1.87
(1964-88:N=25)	17.21 (1.8)	0.413 (2.9)	−92.21(−2.5)	−0.010(−0.5)	0.459 (1.3)	230.3 (1.5)	1.317 (3.9)	63.9	1.94
	20.99 (1.8)	0.028 (0.4)	33.99 (1.2)	0.052 (2.4)	0.057 (0.3)	−510.4 (−2.5)	−0.454(−1.1)	55.4	2.19
Liberia	−60.69(−0.6)	4.831 (2.5)	−379.7*(−1.8)	0.039 (0.1)	1.430 (2.2)	525.5 (0.6)	0.059 (0.9)	68.2	1.52
(1965-86:N=22)	−168.5 (−1.8)	12.037 (6.7)	−36.4*(−0.2)	0.148 (0.3)	−0.228(−0.4)	−686.7(−0.9)	0.187 (2.9)	85.5	1.85
	107.9 (1.0)	−7.206(−3.4)	−416.0*(−1.8)	−0.109(−0.2)	1.658 (2.3)	1212.2 (1.3)	−0.127(−1.7)	71.1	1.44
Madagascar	182.3 (4.2)	−1.874(−1.6)	157.8 (1.0)	0.168 (0.9)	0.527 (2.0)	287.0 (0.5)	−0.020(−2.5)	53.1	1.22
(1961-85:N=25)	154.0 (4.4)	−3.169(−3.4)	105.3 (0.9)	0.092 (0.6)	−0.569(−2.7)	391.7 (0.9)	−0.011(−1.6)	46.7	1.25
	28.4 (1.0)	1.295 (1.7)	52.6 (0.5)	0.076 (0.7)	1.095 (6.4)	−104.8(−0.3)	−0.009(−1.8)	77.9	1.81
Malawi	227.0 (1.0)	0.567 (0.1)	−598.2 (−0.8)	0.691 (1.4)	1.532 (2.1)	−391.4(−0.1)	−0.028(−0.4)	44.1	1.13
(1965-88:N=24)	252.5 (1.7)	−6.946(−1.4)	−360.9 (−0.9)	0.442 (1.3)	0.818 (1.6)	−650.2(−0.4)	−0.034(−0.7)	48.0	0.99
	−25.5 (−0.2)	7.514 (1.9)	−37.4 (−0.1)	0.248 (0.9)	0.714 (1.8)	258.8 (0.2)	0.006 (0.2)	46.1	1.48

Table 1. (Continued)

	Intercept Term	Per Capita Foreign Reserves	Real Rate of Interest*	Per Capita Change in Real GDP	Per Capita Real Domestic Credit Flow	World Economic Growth	Real Exchange Rate Devaluation	R^2	DW
Mauritius	−872.5 (−0.8)	4.585 (1.5)	−1001 (−0.7)	−0.699(−1.1)	1.686 (4.1)	5754 (0.5)	1.285 (2.4)	69.2	1.09
(1964-87:N=24)	−1142.2 (−1.1)	7.332 (2.5)	−2209 (−1.6)	−0.247(−0.4)	0.591 (1.5)	1745 (0.2)	1.660 (3.1)	64.0	1.22
	269.7 (0.3)	−2.747(−1.3)	1208 (1.2)	−0.452(−0.9)	1.095 (3.7)	4009 (0.5)	−0.375(−0.9)	59.7	1.66
Niger	130.0 (0.5)	5.397 (2.0)	−10.21(−0.04)	0.190 (0.6)	1.389 (2.1)	−1130 (−1.0)	−0.013(−0.2)	54.1	1.08
(1965-88:N=24)	5.2 (0.02)	2.378 (0.9)	34.77 (0.1)	0.085 (0.3)	1.114 (1.8)	−83 (−0.1)	0.010 (0.1)	28.9	1.16
	124.8 (1.3)	3.019 (2.9)	−44.98(−0.4)	0.106 (0.9)	0.276 (1.1)	−1047 (−2.3)	−0.023(−0.7)	69.0	1.32
Nigeria	6.767 (0.3)	0.822 (3.0)	−201.6 (−2.6)	0.080 (0.7)	0.766 (2.5)	1074 (2.6)	−0.102(−1.3)	75.1	1.35
(1963-87:N=25)	37.02 (1.2)	1.044 (2.9)	−230.2 (−2.2)	0.230 (1.5)	−0.094(−0.2)	293 (0.5)	−0.007(−0.1)	69.5	1.34
	−30.26(−1.5)	−0.223(−1.0)	28.6 (0.4)	−0.194(−1.5)	0.860 (3.4)	781 (2.3)	−0.095(−1.4)	62.8	1.63
Rwanda	102.6 (2.5)	−3.169(−3.6)	45.43 (1.2)	0.490 (0.6)	3.476 (1.4)	105.0 (0.2)	−0.011(−0.3)	70.6	1.09
(1967-87:N=21)	86.6 (2.0)	−3.550(−3.9)	45.00 (1.1)	0.631 (0.7)	2.948 (1.2)	311.0 (0.7)	−0.010(−0.3)	74.2	1.27
	16.01 (2.3)	0.381 (2.6)	0.44 (0.1)	−0.041(−1.0)	0.528 (1.3)	−206.0 (−2.8)	−0.001(−0.2)	73.5	2.86
Senegal	235.3 (4.4)	−1.396(−1.4)	32.21 (0.1)	0.158 (1.3)	0.082 (0.3)	−321.4 (−0.5)	−0.021(−1.3)	44.1	1.22
(1967-86:N=20)	157.4 (1.6)	−0.139(−0.1)	−703.7 (−1.5)	0.431 (2.0)	−1.091(−2.3)	−11.2 (−0.01)	−0.027(−1.7)	49.7	1.05
	77.9 (1.4)	−1.257(−1.2)	735.9 (2.8)	−0.274(−2.2)	1.173 (4.3)	−310.2 (−0.5)	0.016 (1.8)	77.4	1.27
Sierra Leone	662.7 (6.3)	−1.324(−0.6)	215.3 (1.8)	0.214 (1.6)	0.022 (0.1)	−4681 (−3.2)	−0.022(−0.4)	58.3	1.56
(1964-87:N=24)	−77.0 (−0.5)	10.86 (3.7)	−334.6 (−2.0)	0.151 (0.8)	−0.147(−0.4)	−655 (−0.3)	0.111 (1.5)	64.3	1.03
	739.7 (6.0)	−12.18(−5.0)	549.9 (3.9)	0.064 (0.4)	0.169 (0.5)	−4027 (−2.4)	−0.133(−2.1)	83.6	1.70

Table 1. (Continued)

	Intercept Term	Per Capita Foreign Reserves	Real Rate of Interest*	Per Capita Change in Real GDP	Per Capita Real Domestic Credit Flow	World Economic Growth	Real Exchange Rate Devaluation	R^2	DW
South Africa	77.80 (9.3)	−0.057(−1.5)	−19.26(−0.6)	0.425 (1.3)	0.167 (0.9)	−269.7 (−2.7)	−0.015(−4.7)	71.5	1.32
(1965-88:N=24)	75.29 (8.2)	−0.095(−2.2)	−88.92(−2.7)	0.041 (0.1)	0.055 (0.3)	−108.8 (−1.0)	−0.008(−2.4)	66.4	1.26
	2.511 (0.3)	0.038 (0.8)	69.66 (2.0)	0.384 (1.1)	0.112 (0.5)	−160.6 (−1.4)	−0.007(−1.9)	57.1	1.11
Tanxania	2.190 (0.1)	1.022 (1.3)	80.30 (1.0)	0.427 (1.7)	0.849 (2.4)	−278.1(−1.1)	0.039 (1.4)	39.9	1.07
(1966-86:N=21)	15.37 (0.6)	0.404 (0.5)	58.85 (0.8)	0.390 (1.6)	0.045 (0.1)	33.5 (0.1)	0.010 (0.4)	40.9	1.51
	−13.18(−0.8)	0.618 (1.2)	21.45 (0.4)	0.037 (0.2)	0.803 (3.3)	−311.6 (−1.8)	0.029 (1.5)	71.7	1.94
Togo	226.6 (3.0)	−9.434(−5.6)	415.7 (1.9)	0.457 (1.0)	−0.260(−0.4)	304.9 (0.3)	0.152 (5.1)	76.9	1.73
(1968-86:N=19)	101.9 (6.2)	−2.703(−7.4)	−425.2 (−9.0)	0.712 (7.4)	−0.510(−3.9)	203.6 (0.8)	0.049 (7.6)	95.2	2.02
	127.7 (1.7)	−6.731(−3.9)	840.9 (3.8)	−0.256(−0.6)	0.250 (0.4)	101.3 (0.1)	0.103 (3.4)	72.2	1.60
Zaire	154.7 (3.4)	3.930 (2.1)	47.13* (0.7)	0.008 (0.02)	0.913 (2.4)	−632.1 (−0.9)	−0.066(−1.6)	41.6	2.09
(1964-87:N=24)	159.1 (2.3)	2.620 (0.9)	−52.26*(−0.5)	−0.186(−0.3)	−0.831(−1.4)	−79.4 (−0.1)	0.061 (1.0)	19.0	1.98
	−4.3 (−0.1)	1.310 (0.5)	99.39* (0.9)	0.194 (0.3)	1.744 (3.0)	−552.6 (−0.5)	−0.127(−2.0)	39.7	2.16
Zambia	87.44 (5.5)	0.057 (0.3)	68.78 (0.8)	0.033 (0.2)	−0.483(−0.9)	−1205 (−1.7)	−0.024(−1.6)	39.2	1.81
(1965-88:N=24)	38.94 (2.0)	0.448 (2.1)	−288.3 (−2.9)	0.503 (2.5)	0.516 (0.8)	1078 (1.2)	−0.040(−2.2)	60.8	1.41
	111.0 (3.1)	−0.367(−3.0)	358.7 (3.2)	−0.344(−1.6)	−1.129(−1.5)	−2165 (−2.5)	0.021 (1.5)	74.1	1.80
Zimbabwe	122.3 (2.7)	2.114 (1.9)	819.8 (2.6)	1.033 (2.8)	0.179 (0.3)	−1171 (−2.2)	−0.109(−0.04)	55.0	2.01
(1970-86:N=17)	116.5 (2.6)	2.327 (2.1)	1031 (3.3)	1.281 (3.6)	−0.253(−0.4)	−632 (−1.2)	−0.113(−0.04)	58.5	1.74
	5.9 (0.3)	−0.212(−0.5)	−211 (−1.6)	−0.247(−1.7)	0.432 (1.7)	−539 (−2.5)	0.004 (0.01)	74.0	1.78

Notes: [1] The coefficients of the real rate of interest asterisked are the coefficients of deflation rate, i. e., negative of inflation rate.
[2] Estimates of capital formation equation are presented first, followed by those of domestic saving equation while those of foreign saving equations are presented last.

unduely voluminous; and/or boring to read, we shall highlight only the salient aspects—and very briefly too. But to assist the readers who need more elaborate information about the estimates presented in the Table, we wish to provide the guidelines, at this juncture, for self-interpretation of the estimates—using the estimates for Nigeria as an illustration. Accordingly, foreign reserves availability increases capital formation and this is being financed solely by domestic saving and not by foreign saving i.e. the primary effect is on capital formation and secondary or indirect effect is on domestic saving. Also, real interest rate retards capital formation which, in turn, leads to a reduction in domestic saving—there is also the possibility of the direct or primary negative effect of real interest rate on domestic saving or, possibly, the indirect or spillover negative effect from capital formation might have outweighed the positive direct effect of this regressor on domestic saving. Thirdly, change in GDP has insignificant positive direct or accelerator effect on capital formation and significant positive direct effect on domestic saving—this has indirect negative effect on foreign saving. Fourth, domestic credit availability has a direct significant positive effect on capital formation, this being financed by foreign saving. Fifth, against expectation, world economic growth increases foreign saving, this being used in financing capital formation. Sixth, in line with expectation, real devaluation of domestic currency reduces foreign saving and capital formation with the resulting spillover effect on domestic saving being virtually nil.

Having provided the guidelines for the interpretation of the estimates, we now provide the highlights (for all the countries) below in respect of each explanatory variable.

FOREIGN RESERVES AVAILABILITY

The primary effect of this should be positive one on capital formation while the secondary or spillover effect should be correspondingly positive on domestic saving, foreign saving or both for there to be funds with which increased capital formation has to be financed. In 6 or 24% of the countries (viz: Congo, Zaire, Ghana, Kenya, Niger and Tanzania), this condition is perfectly met in the sense that foreign reserve availability exerts positive effects on capital formation and each of the two categories of saving. In another set of 9 or 36% of the countries (viz: Benin, Burundi, Zambia, Cote d'Ivoire, Ethopia, Mauritius, Nigeria, Zimbabwe and Liberia), the condition is largely but not perfectly fulfilled in the sense that the variable has positive effect on capital formation and the domestic saving with which to finance the capital formation. However, it has negative effect on foreign saving in such countries—although this negative effect is not statistically significant except for Liberia. In yet another country, which is Malawi, the condition is still partly met in the sense that the variable has positive effects on capital formation and foreign saving, but a negative though insignificant effect on domes-

tic saving. This suggests that the increased capital formation is being financed by foreign saving alone.

Thus, it is in 64% of the countries where the expected effects of foreign reserves availability are detected fully or partly. In the remaining 36% of the countries, the expectation is not fulfilled as the primary effect of this variable is negative on capital formation and the significant negative effect is detected for three countries, viz: South Africa, Madagascar and Rwanda. Notwithstanding the observation stated in the preceding sentence, the balance or preponderance of evidence is still that foreign reserves availability generally promotes capital formation.

REAL INTEREST RATE

The effects of this variable in some country equations can be argued to be plausible while the plausibility of its effects in the remaining country equations can hardly be defended. The following are those that can be interpreted to be plausible: First, in 4% of the 25 countries (i.e. only a country, which is Niger), the coefficients of the variable are negative in capital formation and foreign saving equations and positive in domestic saving equation—although none of the coefficients is statistically significant. This observation can be interpreted to mean that real interest rate has negative primary effect on capital formation with the spillover effect being negative one on foreign saving also and that it has positive primary effect on domestic saving with the spillover effect still being manifested in reduced foreign saving. Second, in 3 or 12% of the countries (viz: Cameroon, Liberia and Malawi), the coefficients of real interest rate are negative in all the three equations. Since a negative primary effect of real interest rate on saving is about as theoretically plausible as a positive one, this observation can be interpreted to mean that the real interest rate has negative primary effect on both capital formation and domestic saving in such a way that the net or overall spillover effect on foreign saving is negative. Third, in 5 or 20% of the countries (viz: Kenya, Mauritius, Nigeria, South Africa and Benin), the coefficients are negative in capital formation and domestic saving equations and positive in foreign saving equation. As in the second situation just discussed, this can be interpreted to mean that real interest rate has negative primary effects on each of capital formation and domestic saving in such a way that the net spillover effect on foreign saving is positive. Unlike in the second case just analysed where the negative spillover effect on foreign saving from capital formation dominates the positive one from the domestic saving, the reverse is now the case and that is why the overall spillover effect on foreign saving is now positive. Fourth, in 3 or 12% of the countries (viz: Congo, Zimbabwe and Burundi), the coefficients of real interest rate are positive in capital formation and domestic saving equations and negative in foreign saving equation. An interpretation that can be given to this

finding is that real interest rate has little or no primary effect (which is supposed to be negative) on capital formation whereas it has positive primary effect on domestic saving. The resulting increase in domestic saving is then being represented or used in financing increased capital formation and in subsituting for or reducing foreign saving so that the spillover effects of the increased domestic saving (induced by the interest rate) are positive and negative in capital formation and foreign saving equations respectively.

The total of countries whose equations are analysed in the preceding paragraph is 12, representing 48% of the 25 countries. In the remaining 13 countries or 52% of the total, the coefficients of real interest rate are hardly amenable to plausible interpretations. In 4 of such countries (viz: Ghana, Madagascar, Rwanda and Tanzania), its coefficients are positive in all the three equations and this cannot be meaningfully interpreted unless we admit that real interest rate can have positive primary effect on foreign saving or capital formation or both—the existence of its positive primary effect on domestic saving alone does not justify the observed positive "spillover" effect on foreign saving. In the remaining 9 countries, the coefficients are positive in capital formation and foreign saving equations and negative in domestic saving equation. Again, this observation is not amenable to plausible interpretations since positive primary effect of real interest rate on capital formation and/or foreign saving is not supported by economic theory and since the observed positive effect of the inter rate on capital formation cannot be interpreted as a spillover effect of the interest rate-induced reduction in domestic saving.

Thus, economic explanations can be provided for the observed effects of real interest rate in only 48% of the countries. In the remaining 52% of the countries, plausible explanations are hardly available for the observed effects of this variable. That the findings are not robust is still supported by the fact that the expected negative effect of real interest rate on capital formation is observed in only 9 (or 36% of the total) countries. Also, positive effect on domestic saving is observed in 8 countries and negative effect in the remaining 17 countries. Therefore, the overall impression is that real interest rate does not reduce capital formation and neither does it promote domestic saving in the Sub-saharan countries. In fact, the balance of evidence suggests the opposites.

CHANGE IN THE REAL GDP

We expect this variable to have positive primary effects on both capital formation and domestic saving. This expectation is fulfilled in the equations for 17 (or 68% of the) countries. Out of these, the expected positive spillover effect from capital formation on foreign saving dominates the expected negative spillover effect of domestic saving on foreign saving in 7 countries (viz: Sierra Leone, Cameroon, Tanzania, Madagascar, Malawi, Niger and South Africa) and this

explains while the overall spillover effect on foreign saving is positive. But in the other 10 countries (viz: Togo, Cote d'Ivoire, Nigeria, Senegal, Zambia, Congo, Zimbabwe, Burundi, Liberia and Rwanda), the reverse is the case so that the net spillover effect on foreign saving is negative.

In addition to the clear-cut plausible results of 17 countries analysed in the preceding paragraph, partly plausible results characterize 7 more countries. In 4 of these (viz: Kenya, Ghana, Benin and Zaire), the expected positive primary effect of the variables on capital formation is observed—with what appears to be the corresponding positive spillover effect on foreign saving. However, the primary effect on domestic saving is unexpectedly negative—although the effect is not statistically significant except for one country which is Benin. In the remaining 3 countries with this partly plausible observation (viz: Burkina Faso, Ethopia and Botswana), the expected positive primary effect on domestic saving coupled with what appears to be the attendant negative spillover effect on foreign saving are detected. However, as against expectation, the primary effect on capital formation is negative—although the negative effect is never statistically significant.

Thus, it is in 24 out of 25 countries that either completely or partly plausible results are observed. (In the remaining 1 country, which is Mauritius, the coefficients of the variable are negative in all the 3 equations and statistically significant in none). Thus, there is enough evidence to conclude that change in GDP has positive effects on both capital formation and domestic saving as one would expect.

DOMESTIC CREDIT AVAILABILITY

We expect this variable to exert positive primary effect on capital formation. Also, because it is a reflection of expansionary domestic credit or monetary policy, it should have a positive primary effect on foreign saving by increasing the current account deficit or reducing the current account surplus of the balance of payments. A negative primary effect on domestic saving is also expected but a positive effect can be observed because of the opposing spillover effects from increased capital formation which might outweigh the combination of both the negative primary effect and negative spillover effect resulting from increased foreign saving.

The expected results identified in the preceding paragraph are observed in 80% of the 25 countries, i.e. in 20 countries. In 10 of the countries (viz: Benin, Cameroon, Burkina Faso, Niger, Tanzania, Malawi, Mauritius, Kenya, Rwanda and South Africa), the overall effect—direct and spillover—of credit availability on domestic saving is positive and it is negative in the remaining 10 countries (which are Zimbabwe, Sierra Leore, Burundi, Ghana, Liberia, Nigeria, Zaire, Senegal, Madagascar and Cote d'Ivoire). Also, in 2 other countries (viz: Botswana and Congo), the primary effect of credit availability on capital formation is

positive as expected, with what appears to be the indirect or spillover effect being positive on domestic saving. However, the effect is found to be unexpectedly negative on foreign saving and this makes the overall evidence to be only partly plausible. Again, in another set of 2 countries (viz: Togo and Ethopia), the primary effect of this variable on foreign saving is positive as expected, with what appears to be the resulting indirect effect appearing to be negative on domestic saving. However, the effect (though statistically insignificant) is found to be unexpectedly negative on capital formation and this makes the overall evidence to be regarded as only partly plausible.

Thus, out of 25 countries, very plausible and expected results—of positive effects of credit availability on capital formation and foreign saving—are detected in 20 countries. Partly plausible results are detected in 4 countries and an implausible finding characterizes the remaining country, which is Zambia—where the unexpected negative effects of the variable on capital formation and foreign saving are observed. Thus, the evidence observed provides a reliable basis to conclude that domestic credit availability promotes capital formation and increases foreign saving. There is mixed finding concerning the overall (direct and spillover) effect of it on domestic saving.

WORLD ECONOMIC GROWTH

The only primary or direct effect of this variable is supposed to be a negative one on foreign saving. We expect it to exert the negative impact because it is a proxy for world demand for exports as earlier discussed in section 2. Ideally, we expect the indirect effect to be an increase in domestic saving and a decrease in capital formation and this condition is perfectly met in 8 out of the 25 countries (which are Botswana, Kenya, Tanzania, Burundi, Ghana, Zambia, Burkina Faso and Benin). In another set of 8 countries (which are Congo, Cote d'Ivoire, South Africa, Niger, Sierra Leone, Zimbabwe, Senegal and Zaire), the condition would have been fully met except that the unexpected "spillover" negative effect on domestic saving is observed—although the negative effect is never statistically significant. In a third set of 3 countries (viz: Ethopia, Rwanda and Madagascar), the condition would have been completely met except for the existence of unexpected positive "indirect" effect on capital formation—although the positive effect is statistically significant for only one country, which is Ethopia.

Thus, out of 25 countries, the expected negative primary effect on foreign saving is observed in 19 countries or 76% of the total. The secondary or spillover effects are perfectly in line with expectation is 8 countries and only largely (but not perfectly) in line with expectation in 11 countries. In the remaining 6 (out of 25) countries, the unexpected positive effect of world economic growth on foreign saving is observed. All the same, the preponderance of evidence suggests the conclusion that increasing world demand for exports of these countries as a result

of world economic growth generally reduces their foreign saving and this, in turn, has spillover effects in the form of reduced capital formation and/or increased domestic saving.

REAL EXCHANGE RATE DEVALUATION

As pointed out earlier in section 2, we expect the primary or direct effects of this variable to be reduction of each of foreign saving and capital formation. This means that the secondary or indirect effect on domestic saving can then be positive or negative since the direct reduction of capital formation means that the need for domestic saving may be reduced while the direct reduction of foreign saving implies that an offsetting increase in domestic saving may be needed.

The expected effects spelt out in the preceding paragraph are fully met in 10 (or 40% of the 25) countries. The overall secondary effects on domestic saving are negative in 5 countries (viz: Zaire, Cote d'Ivoire, Benin, Sierra Leone and Nigeria) and positive in 5 countries (viz: Madagascar, South Africa, Ethopia, Nigeria and Rwanda). In another set of 7 countries (which are Botswana, Kenya, Mauritius, Liberia, Cameroon, Congo and Ghana), the expectation is only partly met in the sense that while the expected negative primary effect on foreign saving (together with what appears to be the attendant positive spillover effect on domestic saving) are observed, the unexpected positive effect on capital formation is also detected. In a third set of 5 countries (which are Burkina Faso, Senegal, Zambia, Malawi and Zimbabwe), the expectation is also only similarly partly met. This time, it is because while the expected negative primary effect on capital formation (together with what appears to be the attendant negative spillover effect on domestic saving) are detected in these 5 countries, it is the unexpected positive effect on foreign saving that is observed here.

Thus, altogether, the expected negative effects of real exchange rate devaluation on capital formation and foreign saving are observed for 15 and 17 countries respectively. Out of these, the negative effects on both capital formation and foreign saving simultaneoualy characterize 10 countries while they are found to be mutually exclusive in 12 countries. In the remaining 3 countries (viz: Tanzania, Burundi and Togo), the unexpected positive effects of real exchange rate devaluation on both capital formation and foreign saving are found to simultaneously exist. While these findings, as summarized in this paragraph, may not be very robust, there is still an overall impression that real devaluation of the exchange rate generally reduces capital formation and foreign saving in these countries.

5. SUMMARY AND CONCLUDING REMARKS

A. The Summary

Given the general neglect of African countries in the existing empirical studies on determinants of saving and investment spending coupled with the faulty framework often adopted in such studies, the study reported in this paper endeavoured to fill these gaps—among others. This was accomplished by undertaking a time-series study of the determinants of capital formation, domestic saving and foreign saving in 25 Sub-sahara African countries over the periods that generally fall between early 1960's and late 1980's. Annual data were employed and, as opposed to virtually all the existing studies on the subject that employed structural equation approach, we employed reduced-form equation method.

Having provided the background information in the first section of the paper, we reviewed the existing framework of analysis in section 2 with a view to identify their major shortcomings. This paved the way for the specification of the model adopted in this study, the description of which is the subject matter of section 3 of the paper. We specified reduced-form equation system that comprises of the capital formation, domestic saving and foreign saving equations and the specification is rooted in the standard flow-of-funds framework which requires, among others, that an identical list of explanatory variables should feature in each equation of the system. Six such independent variables were included and they are foreign reserves availability, real rate of interest, change in real GDP, domestic credit availability, world economy growth and real exchange rate devaluation.

We estimated the effects of these six factors and the empirical results were presented and discussed in section 4 of the paper. The highlights of the findings are as follows:

(a) The preponderance of evidence is that foreign reserves availability increases domestic capital formation, often financed by increased domestic saving and occasionally financed by foreign saving. However, this finding is not applicable to some countries.

(b) Generally, real interest rate does not reduce capital formation and neither does it promote domestic saving in the Sub-saharan countries. In fact, the balance of evidence suggests the reverse. On the whole, the effects of real interest rate are the least robust and most inconclusive of all the six explanatory variables considered in the study.

(c) The effects of change the real GDP are, in most cases, positive in the capital formation equation, confirming the famous accelerator theory of investment spending. Also, the preponderance of evidence is that it has positive effects on domestic saving and somewhat offsetting negative impacts on foreign saving.

(d) Domestic credit availability promotes capital formation, which is being predominantly financed by foreign as opposed to domestic saving in most Sub-saharan countries.
(e) World economic growth, which is a proxy for world demand for the export of the African countries, generally reduces the flow of foreign saving to the Sub-saharan countries by improving their balance in the current account (of the balance of payments) and this, in turn, has spillover effects in the form of reduced capital formation and/or increased domestic saving.
(f) Real exchange rate devaluation was found to have generally reduced foreign saving and capital formation in the Sub-saharan countries—although, this finding does not apply to some of these countries.

B. Concluding Remarks

As pointed out earlier, non-availability and/or poor quality of data might have been responsible for the virtual previous non-existence of this type of study for African countries. While we endeavoured to tackle the problem of non-availability of data, the problem of poor quality of data still remains. While this is not peculiar to African countries alone, the problem is most severe there when compared with other LDCs.

An important implication of this problem is that the inability to detect a significant effect of a factor on capital formation, domestic saving and/or foreign saving might not be because such an effect does not actually exist but might simply be due to poor data quality. This, in turn, suggests that some of the findings reported in this paper should be interpreted with caution. All the same, we hope that this study would be a springboard for more refined study on the subject and for Africa in future—especially as and when more qualitative data become available.

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