TAXATION AND AGGREGATE SAVINGS: AN ECONOMETRIC ANALYSIS
FOR THREE SUB-SAHARAN AFRICAN COUNTRIES

Ajay Chhibber

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Resource Mobilization Division  
Country Policy Department  
The World Bank

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ABSTRACT

This study examines the impact of taxation on aggregate savings in three Sub-Saharan countries: Malawi, Sudan and Senegal during the period 1965-81. It corrects several econometric problems with past work on the subject. The results indicate that the public propensity to consume revenue in the three countries is close to unity and is at least as high if not greater than the propensity to consume of the private sector. Increased taxation is therefore not likely to be an effective instrument to raise the savings rate of the economy in the three countries analysed in this paper. One possible explanation for this result is the distinction in financing of the current budget (largely from domestic resources) and the development budget (financed externally) in these three countries. In other African countries where this distinction is prevalent, a similar conclusion on the savings impact of taxation is likely. Development agencies should therefore carefully examine recommending tax increases to finance public investment expenditures.
1. INTRODUCTION

In the development literature, tax policy has been considered an important instrument for raising the savings rate of the economy. In countries in which the savings rate is low and the financial sector is not adequately developed, it is often argued that increased taxation can be used to increase public savings without a corresponding equal decline in private savings thereby raising aggregate savings in the economy.\(^1\)

However, some studies\(^2\) have questioned the feasibility of raising aggregate savings through increased taxation with the argument that public consumption out of increased revenue is greater than the fall in private consumption due to a loss in disposable income from higher taxation. This study examines the record, in this respect, of three countries in Sub-Saharan Africa where the financial sector is relatively underdeveloped: Malawi, Senegal and Sudan for the period 1965-81. As a backdrop, the same analysis is carried out for India; a large country with a fiscally conservative government, and a relatively better developed financial sector.

In several instances, external agencies have recommended tax and other non-tax revenue increases in the face of rising budgetary deficits without adequate examination of the level and composition of

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\(^1\) Several empirical studies Bhatia (1967), Krishnamurty (1968), Morss (1968), Singh (1972) show that taxation and savings are positively related.

government expenditure. In many African economies where traditionally the current account budget has been financed through domestic revenue and the development budget through external assistance and borrowing, the correlation between revenues and current expenditure is very close (see Figures 1, 2, 3). In this framework, a tax increase is unlikely to result in substantial public savings increases and may even lead to a decline in aggregate (combined public and private) savings.

Although the focus of the paper is on consumption and savings as they are currently defined, it should be noted that the paper in no way endorses the Rostowian notion that savings is the "sine qua non" of development. Government expenditure on health, education and other social services which are presently classified as current expenditure are in no way less valuable than capital expenditure on plant and equipment. In many economies in Sub-Saharan Africa recurrent expenditure for maintenance and rehabilitation to improve capital utilization rather than additional capital for new projects is likely to result in much higher returns in the short-to medium-run future. And in India despite a two-fold increase in the domestic savings rate from 10 percent of GDP to about 20 percent of GDP between the 1950s and the 1970s, the long run growth rate of the economy was not significantly affected and remained in the range of 3.5-4.5 percent per annum. This paper, therefore, does not address the desirability of raising the savings rate. It examines the feasibility of using taxation to raise the savings rate.
Determining the impact of taxation on consumption (savings) is not a straightforward exercise for several reasons of which three are addressed in this paper. First, both the level of taxation and the level of consumption (savings) can be affected by the level of foreign inflows. Consumption (savings) is, therefore, a function of a pure tax effect and a foreign inflow induced effect. Second, past work on the impact of taxation on consumption and savings has ignored the fact that different countries may have different consumption (savings) functions due to social and cultural factors, or due to differences in the structure of the economy particularly with respect to credit and pricing policies. Despite well-known econometric tests for selecting appropriate consumption functions, such tests have not been used in the past even on time-series data. This paper applies nested hypothesis tests for selecting consumption functions separately for each country.

Finally, a well-known but often ignored problem in consumption function analysis is that consumption, income and tax revenue can be simultaneously determined. The estimates of the propensities to consume may therefore be subject to simultaneous equation bias. This paper rectifies the problem by estimating the structural form consumption functions using two stage least squares (2SLS).

1/ It must be noted, however, that some empirical evidence has been presented in the literature showing that income is exogenous with respect to consumption. See Ortmeyer (1980) for evidence from Korea and Japan, and Sargent (1978) for evidence from the U.S.
In addition to the introduction, the paper is divided into five sections. Section 2 outlines the framework used in the paper. Section 3 presents estimates of the private consumption functions. Section 4 outlines alternative models to examine public consumption behavior and presents estimates of the public consumption and revenue functions. In Section 5, the issue of interaction between public and private consumption is discussed. Total consumption functions are estimated in order to circumvent the interaction problem. Section 6 summarizes the findings of the paper and presents possible extensions and limitations of the analysis.
2. FRAMEWORK OF ANALYSIS

The relationship between consumption (savings) and taxation is very complex. Given the variety of tax instruments with different rates of taxation, and the multiplicity of sources of income the impact of changes in taxation on consumption (savings) are difficult to predict. In addition, changes in taxation are likely to affect other macro-variables e.g. income, which in turn affects consumption. An increase in taxation designed to raise the savings rate may eventually lower aggregate savings because of its detrimental effect, for example, on income growth. 1/ The framework used in this paper is aggregative and therefore does not address this complexity. It assumes an existing structure of taxation and source of income in the country. It then attempts to determine the impact of a broad-based tax change on consumption with income held constant.

This framework is used to identify the key parameters that need to be estimated in the empirical work to determine the impact of taxation on savings at an aggregate level. In this section, for illustrative purposes, a Keynesian function is used for private consumption (Equation 2.1). The public consumption function used (Equation 2.2) is of the most general form with income, net revenues and net external inflows as independent variables. Public savings is

1/ For evidence on negative correlation between income and tax rates see Marsden (1983).
defined as net revenue minus net public consumption (Equation 2.3) and private savings as income minus net public revenue and private consumption (Equation 2.4). Aggregate savings is the sum of public and private savings.

\[ PC = c_0 + c_1(Y - T) + c_2D + c_3r(1 - td) \]  

\[ BC = b_0 + b_1T + b_2D + b_3Y \]  

\[ S_g = T - BC = -b_0 + (1 - b_1)T - b_2D - b_3Y \]  

\[ S_p = Y - T - PC = -c_0 + (1 - c_1)(Y - T) - c_2D - c_3r(1 - td) \]  

\[ S = -c_0 - b_0 + (1 - c_1 - b_3)Y - (c_2 + b_2)D - c_3r(1 - td) + (c_1 - b_1)T \]

where \( PC \) private consumption, \( (BC) \) public consumption, \( (Y) \) GNP, \( (D) \) net foreign inflows, \( (r) \) real interest rate, \( (td) \) tax to GNP ratio, \( (T) \) net revenue \(^1\), \( (S_g) \) public savings, \( (S_p) \) private savings; \( (S) \) aggregate national savings.

In this simple framework, the direct effect of changes in tax effort on aggregate savings depends on three parameters; \( c_1 \), the propensity to consume of the private sector, \( b_1 \), the public propensity to consume out of increased revenue, and \( c_3 \), the interest elasticity of consumption (savings). In addition, changes in tax rates are also...

\(^1\) Defined as Total Revenue less subsidies and transfers. Chelliah (1971) defines this measure as the best indicator of the share of the public sector in disposable income.
likely to affect consumption through other channels not incorporated in this framework. However, for the moment this analysis concentrates on these three effects which are measurable and likely to be dominant.

Note that in this framework the effect of taxation on savings is estimated with income held constant. The full effect of taxation on savings depends on the elasticity of income taxation and the overall propensity to consume income. The relevant parameters are derived by estimating private and public consumption functions (Equations 2.1, 2.2) for each country using time-series data. The functional forms used are selected by appropriate tests described in subsequent sections.
3. THE PRIVATE CONSUMPTION FUNCTION

The Choice of the Consumption Function

In this Section, the appropriate form of the private consumption function to be used in the structural model for each of the four countries in our sample is selected. Four theories of the consumption function are tested. The first theory is the permanent income hypothesis. According to this hypothesis consumption is a function of permanent disposable income only, and the consumption function is of the following form.

\[ C_t = b Y^p_{dt} + u_t \]  \hspace{1cm} 3.1

The second hypothesis to be tested comes from the rational expectations literature. In its purest form, rational expectations implies that if consumers' decisions are based upon permanent disposable income and if markets are efficient, consumption will follow a random walk.

\[ C_t = b C_{t-1} + u_t \]  \hspace{1cm} 3.2

The simple Keynesian model makes consumption a function of measured disposable income. It implies a consumption function of the form.

\[ C_t = a + b Y^M_{dt} + u_t \]  \hspace{1cm} 3.3
where $Y_{dt}^M = Y_{dt}^P + Y_{dt}^T$, and $Y_{dt}^T$ is transitory disposable income.

Finally, a partial adjustment model is also tested, where:

\[ C_t^* = a + b Y_{dt}^M + u_{lt} \]  
\[ k (C_t^* - C_{t-1}) = C_t - C_{t-1} \]

(3.4)
(3.5)

Equations (3.4) and (3.5) imply:

\[ C_t = a + 3C_{t-1} + Y_{dt}^M + u_t \]

(3.6)

Since one purpose of the exercise is to test the direct effect of foreign inflows on consumption, all of the above functions are modified by adding inflows to the structural form equations. All the data used are in domestic currencies and have been appropriately deflated and presented in per capita terms. 1/ Income is defined as GNP adjusted for changes in the terms of trade. Permanent disposable income is defined as a weighted average of present and the two previous periods' disposable income. Foreign inflows are defined as the current account deficit. Net revenue is defined as total revenue minus subsidies and transfers. Since consumption and income are simultaneously determined,

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1/ That is, consumption (both private and public) is deflated by the CPI, exports and imports are deflated by the export and import price indexes, respectively. All remaining variables are deflated by the GDP deflator.
all structural parameters have been estimated by using instrumental variables. None of the functional forms tested contained appropriately defined wealth variables due to lack of information in putting together time series on these variables.

The Keynesian functional form was selected in all four countries in the sample. The estimated equations are presented in Table 1. Real interest rates were also included in another version of

<table>
<thead>
<tr>
<th>Country</th>
<th>Disposable Income Y - T</th>
<th>Foreign Inflows D</th>
<th>Constant</th>
<th>$R^2$</th>
<th>D.W.</th>
<th>$\rho$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Malawi</td>
<td>0.3018 (5.67)</td>
<td>-0.1833 (1.43)</td>
<td>57.15 (9.13)</td>
<td>0.61</td>
<td>2.16</td>
<td>-0.32</td>
</tr>
<tr>
<td>2. Senegal</td>
<td>0.6938 (4.95)</td>
<td>0.2020 (1.06)</td>
<td>14126.60 (3.71)</td>
<td>0.97</td>
<td>1.38</td>
<td>0.76</td>
</tr>
<tr>
<td>3. Sudan</td>
<td>0.8321 (5.17)</td>
<td>0.7502 (2.52)</td>
<td>-6.95 (0.47)</td>
<td>0.92</td>
<td>1.65</td>
<td>0.59</td>
</tr>
<tr>
<td>4. India</td>
<td>0.6070 (5.27)</td>
<td>0.5038 (1.15)</td>
<td>0.1192 (3.58)</td>
<td>0.79</td>
<td>2.19</td>
<td></td>
</tr>
</tbody>
</table>

Figures in brackets are t-statistics.
the equations for Malawi, Senegal and India. The coefficients on the
interest rate variables were positive but insignificant for Senegal and
India and negative and insignificant for Malawi. 1/

For the three Sub-Saharan countries additional private
consumption functions with Y and T as separate variables were also
estimated. Although previous empirical and theoretical work has
generally specified private consumption functions with disposable income
as an explanatory variable the logic behind this separation was that for
the analysis in this paper we are interested in the propensity to
consume out of changes in disposable income due to taxation alone. The
quantitative impact of changes in disposable income due to other factors
may be different. The results are presented in Appendix 2 and do not
change the basic conclusions of the paper.

1/ For Senegal, the interest rate variable was the discount rate from the
IFS. For Malawi the bank rate was used and for India the interest rate on
time deposits.
4. PUBLIC CONSUMPTION FUNCTIONS

In the case of public consumption as against private consumption, it is not possible to rely on theory for selecting appropriate functional forms. The approach followed in this paper is to posit different desired behavioral functions and constraints to achieving the targeted levels of public consumption. The reduced-form functions for each of the different hypotheses is derived and estimated.

There are clearly two ways in which changes in net revenue can affect public consumption: (a) net revenues explicitly determine the targeted level of public consumption (b) the level of net revenue determines the adjustment of public consumption towards its targeted level. The targeted level of public consumption is determined independently or in relation to other macro-variables such as the level of income in the economy. In either case, public consumption would be a function of net revenue or conversely, public consumption would be independent of net revenues if net revenues do not determine either the targeted level of public consumption nor are a binding constraint in the adjustment of public consumption to its desired level. In both cases as will be shown below, the reduced-form equation for estimation purposes is the same.
Model 1

\[ BC^d = a_0 + a_1 T \quad \ldots \quad (4.1) \]

\[ \kappa (BC^d - BC_{-1}) = BC - BC_{-1} \quad \ldots \quad (4.2) \]

\[ BC = a_0 \kappa + a_1 \kappa T + (1 - \kappa) BC_{-1} \quad \ldots \quad (4.3) \]

Equation 4.1 states that the desired level of public consumption is a function of net revenue. Equation 4.2 states that due to various reasons the government can get to only a fraction \( \kappa \) of the desired level. Equation 4.3 is the reduced-form equation derived from 4.1 and 4.2.

Equation 4.1 in Model 1 can be generalized to include other macro-variables which might determine the desired level of public consumption such as income (GNP) or foreign inflows (D) (Equation 4.4). Using Equation (4.2) adjustment lag mechanism, results in a reduced-form Equation (4.6).

\[ BC^d = a_0 a_1 T + a_2 Y + a_3 D \quad \ldots \quad (4.4) \]

\[ \kappa (BC^d - BC_{-1}) = BC - BC_{-1} \quad \ldots \quad (4.5) \]

\[ BC = a_0 \kappa + a_1 \kappa T + a_2 \kappa Y + a_3 \kappa D \quad \ldots \quad (4.6) \]
Model 2

The alternative model, in which public consumption is based on past consumption but its adjustment towards the target value is determined by the availability of resources, also gives the same reduced-form equation.

\[ BC^d = a_0 + a_1 BC_{-1} \ldots (4.7) \]

\[ \kappa (BC^d - T) = BC - T \ldots (4.8) \]

\[ BC = a_0 \kappa + a_1 \kappa BC_{-1} + (1 - \kappa) T \ldots (4.9) \]

\[ BC = a_0 \kappa + a_1 \kappa BC_{-1} + a_2 TY + (1 - \kappa)T + (1 - \kappa) s.D. \ldots (4.10) \]

where \( s \) is the fraction of foreign inflows used for public consumption.

Note that it is not possible to distinguish between Equations 4.6, and 4.9 from the estimated parameters, despite the fact that the two models imply very different government behavior. In Model 1, the government fixes the desired level of public consumption on the basis of either the level of GNP or the availability of funds from domestic revenue and foreign borrowing, or both, but is constrained to a level of consumption dictated by public consumption in the previous year. Model 2, on the other hand, postulates that the desired level of public consumption is a function of income or last year's consumption or both but actual consumption is constrained to a different level by the availability of revenues and foreign borrowing opportunities.
Table 2: Public Consumption Functions (BC) 
(Two-Stage Least Squares)

<table>
<thead>
<tr>
<th>Country</th>
<th>Const.</th>
<th>GNP (Y)</th>
<th>Net Foreign Inflows (D)</th>
<th>Net Revenue (T)</th>
<th>Lagged Public Consumption (BC_{-1})</th>
<th>R^2, D.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi</td>
<td>13.24</td>
<td>0.1709</td>
<td>-0.0993</td>
<td>1.1273</td>
<td></td>
<td>0.77, 2.31</td>
</tr>
<tr>
<td></td>
<td>(3.79)</td>
<td>(1.81)</td>
<td>(0.63)</td>
<td>(3.42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>11.29</td>
<td>-0.0590</td>
<td>0.2716</td>
<td>0.4860</td>
<td>0.5594</td>
<td>0.44, 1.93</td>
</tr>
<tr>
<td></td>
<td>(0.72)</td>
<td>(1.05)</td>
<td>(1.65)</td>
<td>(1.42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senegal</td>
<td>2842.84</td>
<td>-0.0528</td>
<td>0.2782</td>
<td>0.8410</td>
<td>0.2182</td>
<td>0.91, 2.08</td>
</tr>
<tr>
<td></td>
<td>(0.86)</td>
<td>(0.92)</td>
<td>(4.81)</td>
<td>(2.16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>-0.1758</td>
<td>0.4132</td>
<td>-0.3901</td>
<td>-0.9956</td>
<td>0.3397</td>
<td>p = 0.70</td>
</tr>
<tr>
<td></td>
<td>(7.94)</td>
<td>(2.47)</td>
<td>(0.75)</td>
<td>(0.96)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figures in brackets are t-statistics.

Empirical Results

Estimates of the reduced-form public consumption functions for the four countries are presented in Table 2. Variables which were highly insignificant were removed from the equations presented in Table 2, e.g., lagged public consumption in Malawi.

Table 3: Long-Run Propensity to Consume Revenue a/

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi</td>
<td>1.12</td>
</tr>
<tr>
<td>Senegal</td>
<td>0.93</td>
</tr>
<tr>
<td>Sudan</td>
<td>1.15</td>
</tr>
<tr>
<td>India</td>
<td>insig.</td>
</tr>
</tbody>
</table>

a/ Derived from Estimates in Table 2.
The long-run propensities to consume revenue are presented in Table 3. The numbers indicate that these propensities are very high in the three Sub-Saharan countries in the sample — Malawi, Senegal and Sudan; but are insignificant in India. The close correlation between public consumption and net revenue can also be observed in the plots for Malawi, Senegal and Sudan in Figures 1 - 3. The plot for India (Figure 4), on the other hand, indicates the lack of correlation.

An important qualification to the above analysis is that governments often use inflationary taxation as an instrument for domestic resource mobilization. In such cases, the correlation between net revenues and public consumption may be low simply because the government uses an inflationary tax when actual revenues are lower than expected revenues. The analysis presented here does not therefore address the issue of choice between inflationary taxation and other "normal" forms of taxation.

Reversal of the Direction of Causality

In the estimated equations presented, the direction of causality has been assumed to be from revenues to public consumption. The direction of causality could with equal likelihood be in the opposite direction if governments fix a desired level of public expenditure and then attempt to raise revenues to finance that level of expenditure. Sims and Granger causality tests were used to determine the direction of causality. The results of these tests were inconclusive in determining the direction of causality. It should be noted that the consistency of these tests has been questioned in the
econometric literature. In order to account for the possibility that
the direction of causality is from public consumption to net revenue, a
net revenue equation was estimated for each of the four countries with
real GNP, public consumption and foreign inflows as the right hand side
variables. The estimated coefficients are presented in Table 4.

The results of the revenue function for Malawi, Senegal and
India are very similar to those for the public consumption function. A
unit change in public consumption is financed by 0.77 units of revenue
in Malawi, 0.79 units in Senegal, and an insignificant change in
India. In Sudan, the results of the revenue function are quantitatively
different from those of the public consumption function. The
coefficient of public consumption in the revenue function is 0.47, and
is not significant at the 5 percent level of significance. There has
been a general breakdown of the revenue collecting machinery largely due
to substantial declines in public sector salaries in Sudan.

The impact of net foreign inflows on domestic revenue is
negative in Sudan and Senegal but positive in Malawi. Therefore
slackening of the domestic fiscal effort in Sudan and Senegal is one
mechanism through which foreign inflows affect private consumption in
Sudan and Senegal but not so in Malawi. /

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  of net inflows on consumption.
Table 4: Net Revenue Functions

<table>
<thead>
<tr>
<th>Country</th>
<th>Const.</th>
<th>Y</th>
<th>BC</th>
<th>D</th>
<th>$R^2$</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi</td>
<td>-14.08</td>
<td>0.1235</td>
<td>0.7725</td>
<td>0.0781</td>
<td>0.94</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>(5.54)</td>
<td>(4.26)</td>
<td>(6.05)</td>
<td>(1.66)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senegal</td>
<td>-4028.63</td>
<td>0.0829</td>
<td>0.7859</td>
<td>-0.2330</td>
<td>0.85</td>
<td>2.18</td>
</tr>
<tr>
<td></td>
<td>(1.38)</td>
<td>(1.96)</td>
<td>(4.06)</td>
<td>(2.46)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>8.46</td>
<td>0.0430</td>
<td>0.4665</td>
<td>-0.2792</td>
<td>0.30</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>(0.49)</td>
<td>(0.75)</td>
<td>(2.07)</td>
<td>(2.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.90</td>
<td>0.0546</td>
<td>0.4698</td>
<td>-0.2074</td>
<td>0.69</td>
<td>1.61</td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(1.30)</td>
<td>(1.92)</td>
<td>(1.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>-0.0816</td>
<td>0.2583</td>
<td>-0.3063</td>
<td>-0.3238</td>
<td>0.89</td>
<td>1.60</td>
</tr>
<tr>
<td></td>
<td>(5.84)</td>
<td>(3.32)</td>
<td>(1.64)</td>
<td>(1.41)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$Y =$ GNP; $BC =$ Public Consumption; $D =$ Net Foreign Inflows.
5. INTERACTION BETWEEN PUBLIC AND PRIVATE EXPENDITURE

The analysis carried out so far neglects the possibility of substitution between public consumption expenditure and private consumption. Government expenditure on education, health and social security for example would in all likelihood affect private consumption and savings decisions. 1/ However the direction of changes in private consumption would depend on the perception of benefits received from government social expenditure and the investment opportunities available for the private sector. If the returns to savings are high, public expenditure — particularly on economic and social services — would tend to be a substitute for private expenditure. In other words, private expenditure on goods and services provided by the government would be reduced for higher savings rather than be re-allocated on other consumption goods and services.

The interaction between public and private expenditure would also depend both on the level and composition of public expenditure. However in order to account for the impact of public consumption (BC) on private consumption (PC) it is important to note that in the national accounts either public or private consumption is treated as a residual item. It is therefore difficult to separate the behavioral

1/ The bulk of the literature in this area has concentrated on the impact of social security on savings. See Feldstein (1982), Hu (1979), Shome and Squire (1983).
relationship, if any, between PC and BC from the statistical relationship generated by the accounting system.

In order to circumvent some of these problems, and to provide a further check on the robustness of the results of the previous section, total consumption functions were estimated. The specification of the total consumption functions was derived as follows:

\[ PC = a_0 + a_1 (Y - T) + a_2 D + a_3 BC \]  \hspace{1cm} (5.1)  
\[ 1 > a_1 > 0, \]

\[ BC = b_0 + b_1 Y + b_2 D + b_3 T \]  \hspace{1cm} (5.2)

\[ TC = c_0 + [a_1 + b_1 (1 + a_3)] Y + [a_2 + b_2 (1 + a_3)] D + [b_3 - a_1 + a_3 b_3] T \]  \hspace{1cm} (5.3)

where Equation 5.1 is a private consumption function with BC as an independent variable. The coefficient of BC; \( a_3 \) is negative if PC and BC are substitutes and vice versa. Equation 5.2 is the most general public consumption function. Adding Equation 5.1 and 5.2 and substituting for BC gives Equation 5.3. The sign of the coefficient on net revenue depends on the relative magnitude of \( b_3 \) (public propensity to consume revenues), \( a_1 \) the private propensity to consume disposable income and the sign of \( a_3 \) the substitution parameter between PC and BC.

The magnitude of \( a_3 \) is unlikely to be large because the nature of public expenditure is generally quite different from what would have
been spent by the private sector in the absence of taxation. The sign of $a_3$ could also be positive if private individuals must incur expenditures to benefit from government services, e.g., increased travel costs to hospitals, schools, etc.

Again, the best functional forms were selected with the help of F-tests. The partial adjustment Keynesian functional form was selected in Sudan and Senegal, and the simple Keynesian function in India and Malawi. The estimated equations are presented Table 5.

<table>
<thead>
<tr>
<th>Country</th>
<th>Const. (Y)</th>
<th>GNP (Y)</th>
<th>Foreign Inflows (D)</th>
<th>Net Revenue (T)</th>
<th>Lagged Consumption (TC_{-1})</th>
<th>$R^2$, D.W.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi</td>
<td>65.59</td>
<td>0.1709</td>
<td>-0.0993</td>
<td>1.1273</td>
<td></td>
<td>0.77, 2.31</td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>-14.86</td>
<td>0.6834</td>
<td>0.9991</td>
<td>0.8324</td>
<td>0.1190</td>
<td>0.97, 1.93</td>
<td></td>
</tr>
<tr>
<td>Senegal</td>
<td>-33201.5</td>
<td>0.9057</td>
<td>0.7993</td>
<td>0.6276</td>
<td>0.1517</td>
<td>0.996, 2.82</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>0.0415</td>
<td>0.8979</td>
<td>0.2998</td>
<td>-1.3846</td>
<td></td>
<td>0.85, 1.86</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Figures in brackets are t-statistics.
The results basically corroborate the findings of the previous section. The sign of the net revenue variable is positive for Malawi, Sudan and Senegal and negative for India. These results provide additional evidence that:

(a) The propensity to consume of the government in Malawi, Sudan and Senegal is greater than that of the private sector.

(b) The substitution between private and public consumption, if any, is not strong enough to reverse the conclusions of the previous section.
Conclusions and Limitations

This section summarizes the results of the estimated parameters, draws the savings implications and derives policy conclusions. It also presents limitations of the analysis in this paper and suggestions for further research.

Table 6 presents a summary of the results of the private propensity to consume disposable income, the public propensity to consume net revenue, and the increase in total consumption due to a unit increase in net revenue.

The following conclusions can be drawn from the results.

1. The public propensity to consume revenues is very high in the three Sub-Saharan countries — Malawi, Sudan and Senegal, but is insignificant in India.

2. In the two countries (Sudan and Senegal) in which tests indicate that the direction of causality runs from public consumption to revenues, the propensity to finance increases in public consumption from tax increases is also very high.

3. In general in Malawi, Sudan and Senegal the public propensity to consume revenue is at least as high or greater than the private propensity to consume disposable income.
Table 6: Summary of the Results

<table>
<thead>
<tr>
<th>Country</th>
<th>Private Propensity to Consume Disposable Income a/</th>
<th>Public Propensity to Consume Revenue b/</th>
<th>Increase in Total Consumption due to Increase in Net Revenue c/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malawi</td>
<td>0.30</td>
<td>1.12</td>
<td>1.13</td>
</tr>
<tr>
<td>Sudan</td>
<td>0.83</td>
<td>1.15</td>
<td>0.83</td>
</tr>
<tr>
<td>Senegal</td>
<td>0.69</td>
<td>0.93</td>
<td>0.63</td>
</tr>
<tr>
<td>India</td>
<td>0.61</td>
<td>insig</td>
<td>-1.38</td>
</tr>
</tbody>
</table>

*a/ From Table 1  
*b/ From Table 3  
*c/ From Table 5  

4. The above results imply that the impact of net revenue increases on total consumption should be positive for Malawi, Sudan and Senegal and negative for India. The estimates of the total consumption function corroborate these findings. The results of the total consumption function also negate the possibility that the interaction between private and public consumption would reverse the above conclusion.

5. The perennial advice to policymakers to raise taxes to finance budgetary deficit is not as the results of this
paper indicate a costless policy. If the development budget is largely financed by foreign inflows, a continuous increase in taxation to finance increasing current expenditure would reduce private savings and investment. The end result would in effect be an increasing shift in investments to the public sector.

6. The results of this paper do not necessarily imply an unequivocal endorsement for a reduction in taxation. Reduction in taxation unaccompanied by cuts in public expenditure would simply increase private disposable income where it would be consumed and invested in proportion to the propensities to consume and invest. The public expenditure program in the absence of other avenues for resource mobilization would be financed by foreign inflows. The net result would simply be a transfer of foreign borrowing to the private sector.

Limitations

The purpose of this paper has been to focus attention on the unintended effects of tax increases on private savings and consequently on aggregate savings. The emphasis in the past has been on raising public savings. However, the resultant reduction in private savings may reduce aggregate savings. At the same time, the composition of investment would shift from the private to the public sector, not necessarily a desirable outcome.
The results of the paper should however be considered a first step in understanding the complex relationship between taxation and savings. The poor quality of the data, the aggregative nature of the analysis, and the lack of precise knowledge about the interactions between private and public consumption are areas in which subsequent improvements can be made.

**Table 7: Upper Limit to Public Propensity to Consume Revenue to Maintain Aggregate Savings Rate Under Increased Taxation**

<table>
<thead>
<tr>
<th>Interest Elasticity of Savings</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.48</td>
<td>0.61</td>
<td>0.74</td>
</tr>
<tr>
<td>-0.1</td>
<td>0.46</td>
<td>0.59</td>
<td>0.72</td>
</tr>
<tr>
<td>-0.2</td>
<td>0.44</td>
<td>0.58</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Assumption: Average Savings Rate 0.2, Evasion Rate 0.30, i.e., for a unit increase in Taxes 0.3 units of income are unreported, and the propensity to consume unreported income is equal to unity.

However, incorporation of other channels would strengthen the results of this paper. For example, if the after tax interest elasticity of savings is positive, then increased taxation would lower
private savings further. In addition, if higher taxation increases underreporting of income and the propensity to consume out of unreported income is greater than out of reported income, private savings would be reduced even further. In order to illustrate this point, Table 7 presents upper limits on the public propensity to consume with alternate private consumption propensities which would just maintain the aggregate savings rate of the economy under different assumptions on the interest elasticity of savings and the rate of income evasion.

The results show that if taxation is to be an important instrument for raising the savings rate of the economy, the public propensity to consume revenue would need to be substantially lower than the private propensity to consume disposable income. However, in Malawi, Sudan and Senegal the public propensity to consume is, if anything, greater than the private propensity to consume disposable income.
REFERENCES


APPENDIX 1

TESTING ALTERNATE CONSUMPTION FUNCTIONS

The tests for selecting alternate functional forms are carried out by estimating the most general form of the consumption function.

\[ C_t = a + bY^P_\text{dt} + cY^T_\text{dt} + dC_{t-1} + eD + u_t \]

which will be used to test the following hypothesis:

\[ H^1_0: \ a = c = d = 0, \text{ against } H^1_a: \ H^1_0 \text{ is not true.} \]

A rejection of \( H^1_0 \) implies a rejection of the permanent income theory. The next test is,

\[ H^2_0: \ b = c; \ H^2_a: \ b \neq c \]

A rejection of \( H^2_0 \) means that the partial adjustment model is rejected.

The next test is,
\( H^3_0: \ a = b = c = 0 \)

\( H^3_1: \ H^3_0 \) is not true

A failure to reject \( H^3_0 \) implies a failure to reject the random walk specification. The following test is also carried out:

\( H^4_0: \ d = 0, \) and \( b = c \)

\( H^4_a: \ d \neq 0, \) and \( b \neq c \)

Failure to reject \( H^4_0 \) implies a failure to reject the Keynesian consumption function. Note that both the random walk and simple Keynesian specifications are nested in the partial adjustment model. Thus, whatever the test fails to reject \( H^3_0 \) or \( H^4_0 \), it must be true that it will also fail to reject \( H^2_0 \). Therefore, the partial adjustment model is chosen only if the test fails to reject \( H^2_0 \) while rejecting both \( H^3_0 \) and \( H^4_0 \). Of the above four null hypotheses, \( H^1_0, H^3_0, \) and \( H^4_0 \) must be tested by means of an F-test while \( H^2_0 \) can be tested by either a t-test or an F-test. In order to maintain consistency, the F-test is used throughout this paper. The test statistic is given by the following formula:
\[
\frac{R_u^2 - R_q^2}{1 - R_u^2} \cdot \frac{N - K}{q} \sim F_q, N - K
\]

where \( R_u^2 \) is the \( R^2 \) from the unconstrained regression, \( R_q^2 \) is the \( R^2 \) from the constrained regression, \( N \) is the number of observations, \( K \) is the number of explanatory variables and \( q \) is the number of constraints to be tested.
APPENDIX 2
SUPPLEMENTARY EQUATIONS

(1) Sudan

\[ PC = -56.3284 + 0.9770 Y + 0.4704 D \]

(1.58) (5.95) (1.22)

- 0.2338 NT

(0.41)

\[ R^2 = 0.96, D.W. = 1.74. \]

(2) Senegal

\[ PC = -37325.44 + 1.1124 Y - 0.5281 (T) + 0.7144 (D) \]

(5.39) (14.32) (1.65) (4.95)

\[ R^2 = 0.96, D.W. = 2.32 \]

(3) Malawi

\[ PC = 31.7592 + 0.5196 Y - 0.7977 (T) + 0.1443 (D) \]

(2.59) (5.08) (2.48) (1.34)

\[ R^2 = 0.72, D.W. = 2.22. \]