The External Debt-Servicing Constraint and Public-Expenditure Composition in Sub-Saharan Africa

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Abstract

In the light of the current global financial and economic crises, how would governments in sub-Saharan Africa (SSA) allocate their budgets across sectors in response to a binding debt-servicing constraint?   Within a framework of public-expenditure choice, the present paper estimates constraint-consistent debt-service ratios and employs them in Seemingly Unrelated Regression involving five-year panel for up to 35 African countries over 1975-94, a period preceding the Highly Indebted Poor Countries (HIPC) initiatives. While observed debt service is found to be a poor predictor of expenditure allocation, constraining debt servicing shifts spending away from the social sector, with similar impacts on education and health. The implied partial elasticity of the sector's expenditure share with respect to debt is estimated at 1.5, the highest responsiveness by far among all the explanatory variables considered, including external aid. Thus, if the social sector is to be protected, sufficient debt relief for SSA countries should be pursued.

 Key words: Debt-servicing constraint, public-expenditure composition, sub-Saharan Africa

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1.   Introduction

Amidst the current global financial and economic crises, many developing and developed countries face financing challenges. In particular, it appears quite plausible that there will be cutbacks on external assistance, which will likely result in debt-servicing problems for a number of developing countries. To better understand the possible implications for sub-Saharan Africa (SSA), the current paper examines the historical evidence, paying particular attention to the potential inter-sector budget allocation by SSA governments in the light of such fiscal difficulties.

External debt-servicing difficulties have historically afflicted SSA countries. Most of these countries were not able to generate the requisite resources to meet repayment obligations especially since the early 1980s (Greene, 1989). There is a large cross-country variance in both the debt service rate and arrears, however, suggesting disparities in the liquidity-constraint situation among African countries. In 1998, for instance, just prior to the Enhanced 1999 Highly Indebted Poor Countries (HIPC) initiative, the debt service rate ranged from 1 per cent or less in the Democratic Republic of Congo and Eritrea to 30 per cent or more in Angola and Zimbabwe. Similarly, arrears as a proportion of total debt stocks, further reflective of debt-burden differences, varied from 1 per cent or less in Botswana, Eritrea, Gambia, Ghana, Mauritius, Senegal, Swaziland, and Zimbabwe, to 56 percent in Ethiopia, 59 per cent in Nigeria, 67 per cent in the Democratic Republic of Congo, 68 percent in Somalia, 78 percent in Liberia, and 80

percent in Sudan (World Bank, 1999).

The deleterious impact of debt constraints on growth has been noted for developing countries generally and for African countries in particular (e.g., Clements et al., 2003; Cohen, 1993; Elbadawi et al., 1997; Fosu, 1996, 1999; Greene, 1989; Pattillo et al., 2002). The basis of the growth impact of debt servicing might be attributable, in part, to the diminution of government expenditure resulting from debt-induced liquidity constraints (Taylor, 1993). In this paper, we explore how this liquidity constraint might have influenced the composition of public spending with respect to the functional sectors of government. For instance, might effective debt-servicing requirements shift the budget away from the social sector or public investment? This is an important issue, for public expenditures are likely to be a salient determinant of the economic activities in many functional sectors, with implications for social welfare. In many developing countries, government spending is dominant in the education and health sectors, for example, while public investment in infrastructure is a key to determining productive private investment. To what extent, then, might fiscal constraints posed by debt servicing affect the fiscal allocation in the developing economies, particularly in Africa where the constraint has been historically binding?

A number of studies have examined the relationship between government spending and revenues in developing countries (Bleaney, Gemmell, and Greenaway, 1995; Lim, 1983), while others focus on the determinants of government expenditures (Dao, 1995; Fielding, 1997). Studies on the fiscal implications of external inflows in low-income developing countries tend, however, to emphasize the role of external aid rather than of debt (Cashel-Cordo and Craig, 1990; Devarajan, Rajkumar, and Swaroop, 1998; Feyzioglu, Swaroop, and Zhu, 1998; Gang and Khan, 1990; Gbesemete and Gerdtham, 1992; Ouattara, 2006). Such a focus reflects the historical importance of aid relative to debt in these countries. Nevertheless, a significant portion of aid is tied to loans and, hence, to the accumulation of external debt. Isolating the debt impact

is, therefore, an important objective in its own right, though existing studies generally do not emphasize this objective.

The few studies that estimate the external debt impact on fiscal allocation include Cashel-Cordo and Craig (1990). While they focus on the impact of aid, the authors also include debt service among the variables explaining government expenditures and revenues. They find a negative effect of debt service on total government spending; however, with the exception of defence, the study does not disaggregate public expenditure. Mahdavi (2004) deals specifically with the impact of external debt on the composition of government spending, but disaggregates public expenditure into: wages and salaries of public employees, non-wage purchases of goods and services, interest payments, subsidies and other current transfers, and other (residual) economic categories. While such categorization is useful, it does not shed light on spending in the functional sectors such as the social sector (health and education), economic services, public investment, or agriculture.[1] Yet, it is such functional expenditures that may convey information about the social-welfare "preferences" of these countries.

The present paper attempts to answer the following question: How would governments shift expenditures across functional sectors in response to a debt-servicing constraint? An answer to this question is important, for it can reveal the extent to which the various sectors could benefit from an effective debt relief that relaxed the debt-induced liquidity constraint for governments. As part of the HIPC initiatives, for instance, it was anticipated that a significant portion of debt relief would be channelled into the social sector. Achieving this implied objective would certainly be more likely if the ex-ante preferences of the recipient countries were consistent with the objective.

Evidence on the impact of debt on the composition of functional-sector expenditures is

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[1] Mahdavi (2004) rather employs the (relative) spending on the functional sectors as explanatory variables for

scant. One possible exception is Ouattara (2006), who reports estimates of debt-servicing impacts on sector expenditures, though the main objective was to assess the effects of external aid. Based on actual debt servicing, the study reports an insignificant debt effect on social sector spending (ibid, table 4). In contrast, Fosu (2007, 2008) find that servicing that reflects the debt constraint exerts negative impacts on education and health expenditures, respectively. To examine the effects of a binding debt-servicing constraint on sector spending composition generally, the present study extends the analysis to a multiple-sector model and simultaneously estimates a system of expenditure-share equations involving up to six functional sectors: agriculture, capital, economic services, public investment, as well as education and health.

The section immediately following this introduction presents a static model for public-expenditure choice. Based on this theoretical framework, section 3 specifies an empirical model for the sector-expenditure allocation. The sample and data are defined in section 4, where the constraint-consistent debt-servicing ratio is also estimated. Section 5 then estimates the empirical model including this ratio in a system of sector expenditure equations. The summary and conclusion follow in section 6.

2. Theoretical Framework

The government is assumed to choose the level of expenditure for each functional sector j, G^j, in order to maximize a social welfare function, U.[2] Unlike the usual individual utility function, however, the present functional arguments are expenditures rather than quantities of commodities. The implicit assumption, then, is that public spending provides consumable services to the citizenry and thus utility to society. In the public choice literature, government

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the above categories.
2 The present model represents a generalized version of the single-expenditure model in Fosu (2007, 2008).

officials seeking to maximize the probability of being maintained in office would make choices consistent with the preferences of the median voter (Buchanan, 1989; Tullock, 1971). The median-voter model is probably unsuitable for developing countries, though, where the democratic process is rarely operational. Instead, the social welfare function is likely to entail a weighted average of the preferences of various political coalitions in the country. In the current analysis, therefore, a more generic welfare function is presumed, with the government maximizing, for J sectors:

(1) $U(G^1, G^2, \ldots, G^J)$,

subject to the budget constraint

(2) $\Sigma_j G^j = R$,

with R denoting government revenue, which may be expressed as

(3) $R = N + F - D$,

where N is national (domestic) revenue, F is foreign (external) aid, and D is debt service. With U_j defined as the marginal "utility" (marginal change in the social welfare function) of expenditure on sector j, the first-order conditions are:

(4) $U_1 = U_2 = \ldots = U_J$

(5) $\Sigma_j G^j = R = N + F - D$

Assuming that the social welfare function has the usual properties of strict quasi-concavity, then the second-order conditions are satisfied, and we can employ the Implicit Function Theorem to write the demand functions:

(6) $G^j = G^j(R^X; \mathbf{W})$, j=1, 2,…,J

where R^X is the exogenous component of R and $\mathbf{W}$ is a vector of variables defining the country-specific social welfare function.

Explored now is the response of a sector-specific expenditure, G^j, to revenue, particularly

the change in G^j following a marginal change in debt service. On the assumption that a given sector-commodity j is a normal good, then the partial derivative $\partial G^j/\partial R^X > 0$. Furthermore, from the revenue equation (5), we have the partial derivative $\partial R^X/\partial D^X < 0$, where D^X is the exogenous component of D. Hence, by the Chain Rule, we obtain $\partial G^j/\partial D^X < 0$. Thus, for a 'normal' sector j, we should expect the partial effect of an increase in debt service to be negative. The degree to which that occurs depends on the strength of the income effect, however.

Since we are interested in the relative fiscal responses of the various sectors, a pertinent question is: how would expenditure *shares* change for a given increase in D? The answer would depend on the Engel properties of the sector. For example, the social sector might be viewed as a relative "luxury" in the budgeting process, in that other sectors may be considered priority areas. Hence, a reduction in R attributable to an increase in D may lead to a shift of expenditures away from this sector, especially if other government spending in the non-social sectors is relatively fixed by the political process. Strictly speaking, though, as the Engel properties are not precisely known for the various sectors, the nature of each sector's response is an empirical issue.

Before proceeding to the empirical model, however, it is important to note that because public action can determine revenue levels, R may be endogenous. In particular, debt servicing is likely to reflect government decision. Although D could be exogenous if debt servicing reflected past borrowing decisions and borrowers honoured previously established contracts (Cashel-Cordo and Craig, 1990), the reality is that governments can decide how much of the debt obligations to honour. The degree of endogeneity would depend on the size of the penalty governing default, relative to the shadow price of debt servicing. Where the penalty is sufficiently high, the likelihood of default would be minimal. As has often been the case, however, governments do default, especially on bilateral debt. Actually, the historic preponderance of debt arrears in many SSA countries suggests that actual debt servicing rarely

conforms to schedule. Countries are also usually able to circumvent their liquidity constraint by having their debts rescheduled. Observed debt payments may, therefore, not reflect their debt-servicing requirements. Hence, the system of demand equations (6) may be re-specified as:

$$(7^j) \qquad G^j = G^j (D^X, F; \mathbf{W}), \; j=1, 2,\ldots,J;$$

where D^X and F are the exogenous components of R and, as above, $\mathbf{W}$ defines the social welfare function.

3.   The Empirical Model

The institutional framework for government decision-making could provide an appropriate basis for specifying the set of equations (7^j), thus suggesting the desirability of a structural model (Shepsle, 1979). Several studies have applied such modelling to examining the importance of external aid for public choice in developing economies (e.g., Heller (1975); Mosley, Hudson and Hornell (1987)). As is well recognized in the literature, however, the estimation of structural models tends to be sensitive to specification. Meanwhile, the process of government budgetary decision-making is not very well understood, especially in developing countries where democratic processes tend to be embryonic. Existing structural models of public expenditure choice are, thus, often plagued with nontrivial problems (Inman, 1979).

A number of studies have, therefore, relied on reduced-form models (e.g., Cashel-Cordo and Craig, 1990; Feyzioglu et al., 1998; Fosu, 2007, 2008). Craig and Inman (1986), for instance, show that results from such models can be relatively robust across different types of public choice mechanisms. Adopted in the present study, then, is a reduced-form

specification, where the exogenous component of debt servicing, the main variable of interest, is included in the expenditure model, together with other exogenous variables that serve as controls.

Societal preferences, represented by socioeconomic variables such as income and the level of development, may reflect the welfare function and, hence, the demand for sector expenditures. In addition, factors determining total government revenue, R, including both external aid and debt, should have impacts on G^j. Although domestic revenue is a component of R, it is likely to be endogenous with respect to government expenditure,[3] and is therefore excluded from the reduced-form model.[4] In contrast, external aid probably reflects donor preferences and can reasonably be considered to be exogenous.[5] As argued above, however, allocation for debt service is an outcome of the domestic government's decision and is likely to be endogenous with respect to expenditure choice. Consequently, only the exogenous component of D should be included in the reduced-form model.

We employ as dependent variables the sector expenditure shares resulting from the government budget process, $g^j(j=1,2,..,J)$. The use of expenditure shares should reflect directly on the shift in the budget in response to changes in a given revenue component, particularly debt service. In addition, such a specification should further help mitigate any

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3 For example, much of the tax revenue in many developing countries is actually derived from civil servants' pay as tax by government as the main employer. Other tax and non-tax revenues would also likely depend on the propensity to pay, which would in turn be contingent upon public provision of sector services and hence spending.

4 Other studies interested in the role of domestic revenue have incorporated this component of R. Devarajan et al. (1998), for instance, estimate a domestic-resource equation and augment the expenditure model with the residuals. Choosing appropriate instruments is difficult, though. For example, Fielding (1997) employs the value of imports, expressed as a proportion of nominal GDP, as an instrument in estimating the revenue equation. How well this variable serves as an appropriate instrument is unclear, however, especially given that imports themselves are likely to be endogenous with respect to revenues.

5 Where donor conditionality applies with respect to spending allocation, this assumption may be untenable. Given sufficient fungibility in the government allocation of the budget, however, as in the case of education and health (Fosu, 2007, 2008), such a situation should not pose a major problem. Although aid administered as "budget support" may be influenced by the recipient's budget, the 1975-94 sample period employed for the present study precedes this particular innovation, making ODA relatively exogenous in the current sample.

potential omitted-variable problems emanating from the budgeting process that may affect the level rather than the composition of expenditures.[6] Hence, the reduced-form set of equations to be estimated can be written as:[7]

$$(8^j) \quad g^j = g^j(D^X, F; Q, A, P, \mathbf{T}; u^j), \; j=1,2,\ldots,J$$

where g^j is sector j's share of the public expenditure; D^X is the exogenous component of the external debt service rate; F is foreign aid, defined as Official Development Assistance (ODA) as a proportion of GDP; Q is income, measured as Gross National Product (GNP) per capita; A is the share of the population engaged in agriculture; P represents the political structure; $\mathbf{T}$ is a vector of time dummy variables intended to reflect particularly global trends; and u^j is sector j's stochastic disturbance term. D^X and F represent the exogenous revenue variables and Q, A, P, $\mathbf{T}$ are the variables shaping the social welfare function. Note that as functional arguments of the reduced-form equation, all the explanatory variables are assumed to be exogenous. The focus of the current paper, though, is on the debt-servicing variable, D^X.

As discussed above, the expected sign of the coefficient of D^X on a given sector's expenditure share, $\partial g^j / \partial D^X$, would depend on the respective Engel properties of that sector. The social sector may be particularly vulnerable to a binding debt-servicing constraint, however, if governments consider the sector as a 'luxury', that is, if other sectors are viewed as priority spending areas. If so, then we should expect $\partial G^j / \partial D^X < 0$. Generally, though, the sign of $\partial G^j / \partial D^X$ need not be unambiguous and remains an empirical issue.

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6 Fosu (2007, 2008) and Mahdavi (2004), for instance, also employ expenditure shares.
7 Assuming that equation (5) holds, the set of equations (8^j, j=1,2,…,J) may be obtained from the set (7^j, j=1,2,…,J) by denominating both sides of the latter by R.

Discussed now are the expected effects of the remaining variables in the set of equations (8^j, j=1, 2,…,J). Consistent with other studies (e.g., Cashel-Cordo and Craig, 1990; Devarajan, Rajkumar, and Swaroop, 1998; Feyzioglu, Swaroop, and Zhu, 1998; Gang and Khan, 1990; Gbesemete and Gerdtham, 1992; Ouattara, 2006), F is included in the model to capture the special role of ODA in the budget process. In general, the impact of foreign aid will be contingent on the relative degree of its fungibility. Via the income effect, a higher ODA level should increase revenue and, hence, spending in every "normal" sector. Whether a given expenditure share increases or not in response to ODA, however, depends on the nature and extent of the effective conditionality placed on the aid. Detailed panel data on sector aid is seldom available, though.**[8]** Besides, given sufficient fungibility, disaggregating external aid may not be consequential either; as Fosu (2007) for instance observes, education-specific ODA is extraneous in the education expenditure-share equation, suggesting complete fungibility. To the extent that it reflects donors' preferences, though, external aid is unlikely to exert a neutral impact on the composition of expenditures. As donors have traditionally favoured the social sector, an increment in ODA should shift the budget toward that sector, though aid fungibility should reduce ODA's positive impact.

Intended to reflect the social welfare function, **W**, the variables Q, A, P and **T** are likely to vary across countries and over time. Consistent with preference aggregation, socioeconomic characteristics such as income and the level of development may help shape the welfare function and, hence, the sector expenditures.**[9]** Though these variables have not previously proved particularly potent in the expenditure model,**[10]** Q and A are included in the regression model as

8 For example, ODA data for health are unavailable for most of the countries in the sample until 1990 (see the OECD data source, **http://www.oecd.org/dac/stats/idsonline).**
9 For the importance of these variables for the social sector spending, see for instance (Baqir, 2002).
10 Refer, for instance, to Cashel-Cordo and Craig (1990), Fosu (2007, 2008), and Gbesemete and Gerdtham (1992) for the extraneousness of socioeconomic variables generally in models involving public expenditure overall, on education, and on health, respectively.

control variables, for their respective effects might be sector-specific. [11]

The political structure, indicated by P, may also influence societal allocation of expenditures (Fardmanesh and Habibi, 2000; Gupta et al., 2002; Habibi, 1994; Keefer and Knack, 2007; Mauro, 1998; Tanzi and Davoodi, 1997). In particular, corruption has been observed to belong in the expenditure equation, with the tendency to shift spending away from the social sector (Goel et al., 1998; Gupta et al., 2000; Gupta et al., 2001; Mauro, 1998), and toward the capital sector (Keefer and Knack, 2007; Tanzi and Davoodi, 1997). As corruption data do not sufficiently extend to the earlier period for most countries in our sample, however, we employ as an indicator of the political structure XCONST, which measures the degree of constraint on the executive branch of government (Marshalls and Jaggers, 2002). Indeed, Keefer and Knack (2007) use a similar variable in their finding that less restrictive political checks and balances tend to raise public investment with questionable productivity. Similarly, it is expected that a higher level of XCONST would reduce corruption and thus shift the budget away from the capital sector where corruption's expected value is relatively high.

The set of time dummy variables, **T**, is also included as explanatory variables to reflect global trends or internal inter-temporal factors not sufficiently captured in the existing independent variables. For example, **T** may pick up time-variant trends such as the possibility of externally-driven increasing emphasis over time on the importance of the social sector even prior to the HIPC Initiative. The inclusion of **T** in the regression will also help to test the popular belief that African countries have been reducing their social-sector spending over time, especially in response to the structural-adjustment programs starting in the 1980s.[12]

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11 As in other studies (e.g., Cashel-Cordo and Craig, 1990; Fosu, 2007; Gbesemete and Gerdtham, 1992), we also included in the regression the structure of the population, measured as the share of the population under 14 years of age; however, this variable proved extraneous, as was the case in the above studies as well.

4.   Sample and Data

The sample comprises 35 sub-Saharan African countries (Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Cote d'Ivoire, Ethiopia, Gabon, Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, Sudan, Swaziland, Tanzania, Togo, Uganda, Zaire, Zambia, and Zimbabwe). The sample period is 1975-1994, which is selected in part on the basis of available comparable data.[13] More importantly, though, the HIPC Initiative began in the late 1990s (initially in 1996 and enhanced in 1999) and tended to favour social-sector expenditures in exchange for debt relief. An appropriate test of the debt-service impact should, therefore, precede the initiative, that is, if estimates are to be bereft of such donor preferences.

Composition of public expenditures

Fiscal allocation varies considerably across budget categories in the developing countries of Africa. The social sector (education plus health) has averaged about 20 percent of the total public budget, compared with nearly 30 percent for capital, one-quarter for economic services, and roughly 10 percent each for public investment and agriculture.[14] Yet, there are also differences across countries and over time. For example, public expenditure for the social sector ranged from less than 10 percent of the total budget in the Sudan and Nigeria to nearly 30 percent in Benin and Ghana; from below 10 percent in Zimbabwe to over 40 percent in Burundi and Chad, in the case of capital; from 11 percent in Mali to 40 percent in the Sudan for economic services; from less than 5 percent in the Congo, Ivory Coast, and Zaire (DRC) to over 20 percent in Chad

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12 Refer, for instance, to Cogan (2002).
13 Recent sources do not contain sector expenditure data for the earlier periods, while data for the latter 1990s vary between the more recent and earlier sources (see World Bank, 1998/1999, 2004).
14 Statistics are computed using the current sample for the study.

for agriculture; and, in the case of public investment, from below 5 percent in Senegal and Zaire to over 30 percent in Lesotho in the case of public investment.[15]

Inter-temporal public expenditure differences have not been as dramatic, though. Reported in Figure 1 are graphs of expenditure shares by sector based on panel averages for the four half-decadal sub-periods, 1975-79, 1980-84, 1985-89, and 1990-94. For SSA as a whole, the share of the public budget allocated to the social sector increased from 20 percent in 1975-79 to 23 percent in 1990-94, and 25 percent to 26 percent for capital; meanwhile, the share of the budget allocation for agriculture decreased slightly from 9 percent to 8 percent, but rather considerably for the economic-services and public-investment sectors, from 26 percent to 19 percent and from 15 percent to just 8 percent, respectively.[16]

FIGURE 1 ABOUT HERE

It is noteworthy that trends in the shares of social spending are slightly upward, and the expenditure shares for capital and agriculture have not changed very much either, though there was a considerable dip in the latter during the early 1980s (from 8.7 percent to 6.9 percent) but with an apparent recovery thereafter. In contrast, the expenditure shares for economic services and public investment indicate considerable trends downward. The preliminary evidence, therefore, seems to indicate that on the whole the priorities of African countries have not been diverted away from the social sector over time, even following the structural adjustment programs of the 1980s and prior to the HIPC initiatives of the latter-1990s, contrary to the general view.

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15 Due to missing data, these statistics may not accurately reflect country comparisons. The important point currently is that there are considerable disparities across countries over the period of analysis.
16 Note that the SSA averages are non-weighted in order to avoid likely biases toward the larger economies, such as Nigeria, whose expenditure shares for agriculture (4.8 percent vs. 8.0 percent for SSA) and the social sector (9.5 percent vs. 20.6 for SSA) have been quite low compared to the rest of SSA.

In addition to expenditure shares, have the actual *real* expenditures per capita also trended upward for the social sector? The graphs presented in Figure 2 shed some light on this question. As these graphs show, real per-capita expenditures in the sector have also been increasing over time, and more so for health than educational expenditures. The result is, thus, consistent with that provided in Sahn (1992) based on the author's 1980-89 sample period showing generally non-declining trends in social-sector spending in Africa during 'post-adjustment'. The present result from an extended sample period appears to support Sahn's earlier finding. Moreover, that the current sample includes 1990-94 is especially meaningful, given that by 1989 many African countries were still undergoing structural adjustments, so that 1990-94 could more appropriately be characterized as post-adjustment.[17]

FIGURE 2 ABOUT HERE

The debt-servicing variable

The primary explanatory variable of interest deserves special treatment. As already argued above, debt servicing is likely to be endogenous, in that a government's spending priorities might be such as to militate against meeting its debt obligations. Similarly, a government with greater ability to pay could service its debt at a faster rate than required. Actual debt service payments will, therefore, reflect the country's ability and, indeed, willingness to pay.[18] A larger payment may simply be an indication that a given nation can afford to pay more, rather than a reflection of a greater debt burden. Similarly, a country with a lower

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17 Note that Figures 1 and 2 both use non-weighted means, in order to avoid likely biases toward the larger economies, such as Nigeria, whose expenditure shares for agriculture (4.8 percent vs. 8.0 percent for SSA) and the social sector (9.5 percent vs. 20.6 for SSA) have been quite low.

18 For example, during the oil price collapse of the early 1990s, the government of Nigeria unilaterally adjusted the country's scheduled debt service, illustrated by its decision in 1993 to limit the debt payments to no more than 30 percent of net oil revenues, thus drastically reducing Nigeria's actual debt-service rates (Iyoha, 2004).

financial capability will tend to only minimally service its debt, even though the debt burden

is relatively high.[19] Thus, the actual debt service payment is unlikely to reflect the degree of

the liquidity constraint (Fosu, 1999).

To obtain a more accurate measure of constraining debt servicing, 'predicted debt

service' (PREDSR) is obtained by regressing actual debt service on 'net debt', defined as the

debt stock less international reserves. A greater debt outstanding indicates larger debt-

servicing obligations, ceteris paribus, while a higher level of international reserves, in

contrast, signifies a greater ability of a country to service its debt, thus making the debt

constraint less binding. Conceptually, therefore, net debt is a more accurate indicator of the

external debt burden (ibid.). Hence, the liquidity-constraint debt-servicing rate is based on net

debt. Unlike observed debt service, furthermore, this predicted debt measure is unlikely to be

endogenous with respect to sector budgetary allocation decisions by government.[20]

We employ half-decadal panel data for the 35 SSA countries in the sample over the

1975-94 sample period (World Bank, 1988/89, 1999) to estimate the debt equation:[21]

(9) $D = 16.00 + 0.015 \text{ NETDEBTX}$ $n = 94$, $R^2 = 0.597$
         (8.32) (4.31)

where D is the debt service ratio (percent),[22] NEDEBTX is net debt, expressed as a percent of

exports (ibid.); n is the sample size; R^2 is the coefficient of determination; and the t ratios are

in parentheses. The above estimated equation is based on the random-effects (RE) model,

which is found to be statistically superior to the alternate fixed-effects (FE) model on the

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19 While debt-service expenditure could also be lower for a given debt stock due to greater concessionality, this case would be reflected as a higher ODA.
20 To the extent that the debt stock and international reserves are stocks from past action, they are unlikely to be influenced by current allocation across sectors.
21 This section borrows generously from Fosu (2007, 2008).
22 The debt service ratio, expressed as a proportion of exports, is employed to reflect the usual concept that it is export earnings, rather than GDP, that define the foreign-exchange constraint. Note also that other specifications were experimented with, but the linear appeared to provide the best fit.

basis of efficiency; the Hausman chi-square test statistic equals 0.292, with a p-value of 0.588, thus maintaining the null hypothesis that the more efficient RE estimates are also consistent. It is noteworthy that in spite of its relative simplicity, equation (9) appears to provide a rather good fit. In particular, the coefficient of the net debt variable displays very high significance. By attenuating the 'noise' in actual debt service, as discussed above, equation (9) should better reflect the true nature of the debt-servicing constraint.

Summary Statistics

Descriptive statistics of the regression variables used in estimation are presented in table 1. Given the above depiction of the sector expenditures, we now focus on the debt-servicing variables, which constitute the main regressors of interest. The predicted debt service rate, PREDSR, is expectedly less variable than is the actual debt service rate, DSR, as evident in the much smaller standard deviation associated with the former. Of course, this observation does not imply that PREDSR will be a better explanatory variable than DSR in the expenditure equations. On the contrary, the larger standard deviation of DSR could actually translate to better precision for the estimated effect of debt servicing,[23] provided DSR was the correct variable reflecting the debt-servicing constraint. If, however, the higher variance associated with DSR embodied primarily greater 'noise' as argued above, then PREDSR would be statistically superior to DSR in the expenditure equations.

TABLE 1 ABOUT HERE

5.   Estimation

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23 This is because, as is well known in the statistical literature, a larger standard deviation of an explanatory

Five-year panel data are used in the estimation, consistent with the current literature that this type of data is preferable to pure time-series or cross-sectional data, as it marries possible inter-temporal dynamics and important cross-country variation. Five-year averaging is, moreover, likely to minimize non-systematic errors in the data.

In order to estimate the set of equations (8^j, j=1,2,…,J), we note the likelihood of cross-equation correlation due to the inter-sector budgeting process. That is, it is assumed that COV (u_j, u_k) is nonzero for j not equal to k, so that the appropriate model is the Seemingly Unrelated Regression (SUR) (Zellner, 1962), where the cross-equation correlation is accounted for.[24]

Presented in table 2 are the SUR results based on the multiplicative (log-linear) specification of the set of equations (8^j, j=1,2,…,J).[25, 26] According to the Breusch-Pagan statistic, the cross-sector perturbations are indeed correlated, suggesting that SUR is the appropriate estimating procedure. Furthermore, note that the respective equations for expenditures in the social, agriculture, and public investment sectors provide good fits based on the chi-square test statistics presented in the table. In contrast, the model for economic-services spending does not, while the goodness of fit for the capital expenditure equation appears rather weak.

TABLE 2 ABOUT HERE

variable translates to a lower standard error of the associated estimated coefficient.

24 Note, with inclusion of **T,** that the specification becomes a one-way temporal fixed-effects model.

25 The time-period dummy variables are specified as (0, 1), however. The double-log specification follows others such as Dao (1995), Fosu (2008), Gbesemete and Gerdtham (1992), and Ouattara (2006). Results based on the linear and quadratic (with respect to PREDSR) specifications show similar importance of the debt – servicing variable and are available upon request; however, the log-log specification appears to provide the best fit and additionally yields coefficients (elasticities) that are comparable across variables.

26 The set of equations that include the social-sector expenditure variable, GESS, and the non-social sectors is estimated, and then the set with the disaggregated social-sector variables, GEE and GEH, together with the non-social sectors is also estimated. Note that the estimates for the non-social sector expenditures are identical between the two sets of equations.

Regarding the main focus of the present paper, the effect of debt servicing varies substantially across sectors. While the estimated coefficient of the debt variable, PREDSR, is negative and highly significant for the social sector, it is generally insignificant in the remaining equations, except possibly in the public investment (PUINV) model where it is negative with a relatively high magnitude, though is statistically insignificant. In addition, the estimated impacts in the education and health sectors do not seem to be statistically different from each other. These results suggest that a debt-servicing constraint would shift government spending away from the social sector, and possibly from public investment as well. The servicing constraint, however, appears inconsequential for the other sectors.[27]

Considered next are the effects of the remaining regressors. The external aid variable, ODAGDP, exhibits significantly positive coefficients, with similar magnitudes, for the social sector and public investment. The estimated aid effects on education and health are both significantly positive, and appear, furthermore, to be statistically indistinguishable from each other. Hence, aid tends to shift public expenditure in favour of the social sector and public investment. The results are similar to those of Ouattara (2006), for instance, who finds positive aid effects for public investment and development expenditures (health and education expenditures combined). The results here also provide support for Gbesemete and Gerdtham (1992), who report a positive aid effect on health spending based on 1984 cross-country analysis of African countries. Nonetheless, it is notable from our results that the aid impact on the social sector is small relative to that of debt servicing. We attribute this difference to the use currently of constraint-consistent debt servicing rather than the 'noisy' observed debt service, a point that is further amplified below.

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27 Note that not all functional sectors are represented here. The expenditure shares add up to 88 percent; there is a residual 'other' category that is excluded from the SUR estimation, as it should be in order to render the system estimable.

On the importance of the level of development, it is observable from table 2 that the impact of per-capita income, PGNP, seems rather little; it is only weakly significant in the education and agricultural sectors, where it is positive and negative, respectively. The former suggests the 'luxury' nature of education, in that a higher PGNP would shift expenditure in favour of education. In contrast, a larger PGNP appears to reduce the expenditure share in agriculture, suggesting that agriculture is a 'non-luxury'. The other level-of-development variable, AGCON, the relative population size of agriculture, appears to have little cross-sector effects, however.

The political constraint variable, XCONST, displays a negative and significant coefficient in the capital expenditure equation but a statistically positive one in the case of agriculture. These results suggest that an increasing degree of constraint on the government executive would shift public expenditure away from capital but into agriculture. This is an interesting finding that seems to support the view that corruption is more likely to be prevalent in those sectors where its expected value is higher as in the case of capital projects (Tanzi and Davoodi, 1997). Indeed, it is noteworthy that the coefficients of XCONST are nearly identical in magnitude between agriculture and capital expenditures while remaining insignificant in the remaining sectors, suggesting a one-to-one expenditure substitution between these two sectors. The result is also consistent with the finding by Keefer and Knack (2007) of a negative effect of political checks and balances on public investment.

Results involving the time-dummy variables point to some cross-sector differences as well. The only sector where these variables appear to matter, and most strongly when the 1975-79 period is compared with the early 1990s, is the social sector, where there seems to be an upward trend of expenditure shares. This finding is in concert with the preliminary 'gross' results reported above in Figure 1.

To verify that the above results on the relatively strong effect of debt on the social sector are attributable to the better measurement of debt servicing presented here, we additionally report in the appendix table the counterpart of table 2, but with DSR, the actual debt service rate, replacing PREDSR.[28] We note that the coefficients of this debt-servicing variable in the health and education-expenditure equations are no longer significant while their magnitudes also fall substantially, suggesting that debt servicing is inconsequential, contrary to our earlier finding. Meanwhile, the coefficients of ODAGDP and PCCNP in the social-sector (GEE and GEH) equations increase in both significance and magnitude, respectively; thus, these variables appear to pick up the effects of constraining debt-servicing, which is poorly represented by DSR. Finally, it is noteworthy that replacing PREDSR with DSR results in considerable reductions in the goodness-of-fit for all the equations (see *RSQ*), and especially for the social-sector. Appropriately measuring the debt-servicing constraint, therefore, seems critical for properly assessing the impact of debt.

Estimating the sector system of equations above limited the sample to those observations that were simultaneously available for all sectors. Unfortunately, this restriction reduced the sample size to only 41. Having observed above that the deleterious impact of the debt-servicing constraint is essentially a social-sector phenomenon, we now explore the robustness of this finding using a larger sample involving just the social sector. We do this by applying SUR to re-estimating the system of two equations involving only the social sector (education and health), which now entails a much larger sample size of 79, nearly twice the size of that for estimating all the six sectors.[29] Results of the estimation are presented in table 3, for the debt-servicing

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28 We do not re-estimate the set of equations where GEE and GEH are combined into GESS, as such results would be extraneous for the current exercise (the GESS results would represent simply an average of the GEE and GEH results).

29The larger sample is made possible by the use of expenditure data for only health and education; the smaller sample resulted from the prevalence of a greater number of missing values due to the requirement that all values for a given observation be available for the five or six equations to be simultaneously estimated. Alternatively,

constraint variable, PREDSR (3.I), and for actual debt service, DSR (3.II). As earlier, the purpose of the additional set of results involving DSR is to shed light on the relative performance of these two debt-servicing variables, in order to verify the basic premise that PREDSR is a better measure of the debt constraint.

TABLE 3 ABOUT HERE

As the results of table 3.I indicate, the external debt-servicing constraint would shift public expenditure away from both health and education, consistent with the above result based on the smaller sub-sample involving all sectors. Indeed, the estimated coefficients and significance are comparable to the smaller-sample estimates, though the estimated impact on the health expenditure share appears smaller in the larger sample, while that for education has risen slightly. The important point to stress here, though, is that the estimates based on the larger sample are comparable to those from the smaller sample. These results, then, provide additional support for robustness of the results involving the impact of debt servicing on social-sector spending.

Several of the other variables, however, display considerable differences between the results for the larger sample and those of the sub-sample, though the qualitative findings reported above appear immutable. This is the case particularly for the external aid variable, ODAGDP, whose estimated effects are now lower in both magnitude and significance, though the estimated coefficients remain statistically positive. However, the impacts of the executive constraint variable, XCONST, remain positive for both education and health, but even with improved

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we could have estimated the unbalanced simultaneous equation by scaling the data to, in effect, estimate the missing values. Such a procedure would have improved the efficiency of the estimation, but at the risk of introducing cross-equation biases, rendering estimated cross-sector effects relatively unreliable.

precision for the latter. Finally, the earlier observation that expenditure shares have trended upward in the social sector is actually supportable more strongly in the larger sample. Despite these differences, however, it must be emphasized that the results here are generally similar to those in the smaller sub-sample reported in table 2.

To highlight the importance of the predicted, rather than actual, debt servicing as reflecting the binding debt-service constraint, we now turn to table 3.II, where actual debt servicing is employed in the estimation. As in the case of the smaller sub-sample involving all the sectors, we observe, first, that the respective equations are relatively poorly estimated, as evidenced by the coefficient of determination, for instance. Second, the positive impact of PCGNP is overestimated. Finally, and most important for the main objective of the present study, the coefficients of actual debt servicing, measured by DSR, are of very low magnitudes and are statistically insignificant. This finding is similar to that of Ouattara (2006, table 4), for example, who estimates insignificant impacts of debt based on observed (actual) debt servicing on 'development expenditures', a variable that comprises education and health spending. Using observed debt-servicing data then appears to underestimate the impact of the debt-servicing constraint, as argued above, thus once again underscoring the better performance of PREDSR over DSR in the sector expenditure model.

Selecting the coefficients in table 3.I as the 'best' estimates of the impacts of the respective variables on social-sector expenditures, several observations are in order. First, the estimated debt-servicing impacts on both education and health are negative, suggesting that the debt service burden would siphon expenditure from the social sector. Second, and of special note, the respective elasticities of 1.6 and 1.4 for education and health represent, by far, the largest impacts among all the variables in the expenditure shares equations. Third, these estimated elasticities for education and health are statistically indistinguishable from each other.

Finally, at an elasticity of 1.5,[30] the fiscal response of the social sector to the debt-servicing constraint is quite high. For example, if the constraining debt service, measured by PREDSR, rises by one standard deviation (4.5 percentage points) from its mean of 20.2 percent of exports to roughly 24.7 percent, we should expect the spending share for the social sector to be reduced by some 31.5 percent ([ln24.7-ln20.2]1.5=0.315). This estimate does not seem paltry by any means, especially in many African countries where spending on the sector is quite modest.

6. Summary and Conclusion

Given the current global and financial crises, the possibilities that SSA countries will again face debt-financing difficulties are indeed real. Examining the historical evidence, the current paper has explored the impact of a binding debt-servicing constraint on the fiscal response across sectors in SSA, where the debt burden has historically been evident. Within a framework of public-expenditure choice, the paper highlights the importance of debt servicing in sector spending allocation and argues that observed debt servicing is too 'noisy'. It then estimates constraint-consistent debt-service ratios and employs these estimates in seemingly unrelated regression applied to 1975-1994 five-year panel involving up to 35 SSA countries for which data are available.

The paper finds that while observed debt service is a poor predictor of sector spending allocation, constraining debt servicing would shift public expenditure away from the social sectors of health and education, and possibly from public investment. The deleterious debt impact on the social sector is particularly strong and represents the largest fiscal response among all the variables in the set of equations that also include explanatory variables

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30 It should be noted, however, that the debt-servicing impact on social-sector spending does not change appreciably between the SUR results based on the smaller sample and those based on the larger sample. Hence, using the debt-service coefficient for GESS from table 2, as we do in the current computation, is defensible.

measuring external aid, income, agrarian concentration, governance, and inter-temporal factors. The partial elasticity of the expenditure share with respect to constraining debt servicing is estimated at 1.5 for the social sector (education and health). This estimate is about the same between education and health, and translates to a reduction by nearly one-third of the social sector's allocation in response to a one-standard deviation increase in constraining debt-servicing.

As in other studies, external aid is observed to exhibit positive effects on the expenditure shares of the social and public investment sectors, though the impacts are rather small, especially in comparison with the debt effects. The positive impact of aid may reflect the favorable preferences of donors toward these sectors. However, the relatively small responsiveness of the sector's expenditures to aid may be indicative of considerable fungibility of ODA.

Another variable that has inter-sector expenditure implications is the restraint on the government executive. The paper finds that a higher level of executive constraint, presumably reflecting less corruption, shifts the budget allocation from capital expenditures to agriculture and, possibly, toward health.

The study has also uncovered inter-temporal effects of sector expenditure allocation, but not in line with the popular view that spending on this sector has waned over time, especially as a result of IMF/World Bank-administered structural adjustment programs starting generally in the 1980s. What our results show instead is that not only have the expenditure shares of education and health both increased over time, but also that real per-capita expenditures on these sectors have trended upward.

With respect to the main objective of the study, the findings suggest that a debt-servicing constraint would have inter-sector consequences. In particular, the fiscal response

of the social sector to 'debt relief' that relaxes the debt constraint would be positive and substantial. From a policy perspective, the response would be considerably higher than that attributable to external aid. That the sample period employed in this study precedes the HIPC debt-relief initiatives beginning in the latter 1990s, moreover, lends support to the credibility of the results, which are unlikely to be influenced by the prescriptions of those initiatives. Instead, the countries' own budget allocation preferences appear to be ex-ante consistent with the tendency of donors to favor the channeling of debt relief into social spending as part of the HIPC objectives. Conversely, future debt-servicing difficulties, precipitated by the current financial and debt crises, for instance, would likely siphon off public resources from particularly the social sector.

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Table 1: Summary Statistics – Debt Servicing and Expenditure Composition in African Economies, 1975-94

Variable	Mean	Std. Dev.	Min	Max
GEC	26.64	11.96	6.60	63.40
GEH	5.38	1.98	0.50	11.10
GEE	14.84	4.55	1.80	24.50
GESS	20.28	5.88	2.30	34.50
GEEC	23.50	8.56	7.70	44.50
GEAG	7.96	3.69	1	24.30
PUINV	9.36	6.22	-0.60	45.70
DSR	20.21	12.36	1.45	56.69
PREDSR	20.21	4.46	14.93	49.53
ODAGDP	12.30	9.95	0.10	53.90
PCGNP	579.42	732.6	94.00	4428
AGCON	33.55	14.88	4.29	71.88
XCONST	2.44	1.66	1	7

Notes:

Definitions of Variables:
GEC: Share of government expenditure on capital, in % (source: World Bank, 1992, 1996, 1998/99).
GEH: Share of government expenditure on health, in % (source: ibid.).
GEE: Share of government expenditure on education, in % (source: ibid.).
GESS: Share of government expenditure on social sectors: education and health, i.e., GEE+GEH, in % (source: ibid.).
GEEC: Share of government expenditure on economic services, in % (source: ibid.).
GEAG: Share of government expenditure on agriculture, in % (source: ibid.)
PUINV: Share of government expenditure on public investment, in % (source: ibid.).
DSR: Debt service ratio, defined as debt service payment as a percent of exports (source: World Bank, 1988/89, 1999).
PREDSR: Predicted debt service ratio (estimated by author using data from World Bank, 1988/89, 1999; see text for details).
ODAGDP: Official Development Assistance as percent of GDP (source: World Bank, 1999).
AGCON: Percentage of the population in agriculture (source: World Bank, 1992, 1996, 1998/99).
PCGNP: Per capita GNP, expressed in 1987 US dollars (source: World Bank, 1992, 1996, 1998/99).
XCONST: Degree of constraint on the executive, ranging from 1 to 7, with 7 as the greatest constraint (source: Polity IV Dataset).

Sample:
The sample comprises 1975-1994 half-decadal panel data for 35 sub-Saharan African countries. Due to missing data, the maximum sample size is 85 (maximum number of observations associated with at least one dependent variable); however, 41 usable observations were available for the estimation of the full Seemingly Unrelated Regression (see table 2).

Table 2: Seemingly Unrelated Regression Results - Debt Servicing and Expenditure Composition in African Economies, 1975-94 (dependent variables = logarithmic sector expenditure shares)

VAR/EQ.	GEE	GEH	GESS	GEC	GEEC	GEAG	PUNIV
CONST	4.632[b]	6.580[b]	5.603[a]	0.946	4.651	4.940	7.901[b]
	(2.15)	(2.34)	(2.80)	(0.25)	(1.47)	(1.58)	(2.03)
PREDSR	-1.497[a]	-1.824[a]	-1.551[a]	0.320	0.014	0.003	-1.244
	(-2.98)	(-2.79)	(-3.33)	(0.36)	(0.02)	(0.00)	(-1.38)
ODAGDP	0.212[a]	0.199[a]	0.212[a]	0.041	-0.015	0.117	0.215[b]
	(3.66)	(2.64)	(3.94)	(0.40)	(-0.18)	(1.39)	(2.06)
PCGNP	0.232[c]	0.039	0.189	0.162	-0.215	-0.364[c]	-0.145
	(1.80)	(0.23)	(1.58)	(0.72)	(-1.13)	(-1.95)	(-0.62)
AGCON	0.241	0.003	0.173	0.196	-0.082	-0.370	-0.348
	(1.50)	(-0.01)	(1.16)	(0.69)	(-0.35)	(-1.57)	(-1.20)
XCONST	0.026	0.142	0.052	-0.256[b]	0.074	0.250[b]	-0.092
	(0.38)	(1.58)	(0.81)	(-2.12)	(0.73)	(2.48)	(-0.75)
D7579	-0.396[b]	-0.564[a]	-0.441[a]	0.050	0.119	0.124	-0.117
	(-2.43)	(-2.66)	(-2.92)	(0.17)	(0.50)	(0.53)	(-0.40)
D8084	-0.158	-0.323[c]	-0.206	-0.357	-0.089	-0.076	-0.305
	(-1.14)	(-1.79)	(-1.60)	(-1.46)	(-0.44)	(-0.38)	(-1.22)
D8589	-0.122	-0.163	-0.139	-0.430[c]	-0.064	0.186	-0.305
	(-0.84)	(-0.87)	(-1.03)	(-1.67)	(-0.30)	(0.89)	(-1.17)
RSQ	0.51	0.49	0.57	0.20	0.15	0.40	0.33
ChiSQ	42.05 {.00}	38.82 {.00}	54.15 {.00}	10.52 {.23}	7.17 {.52}	26.82 {.00}	20.14 {.00}
Breusch_Pagan 1*	64.76 {.00}						
Breusch_Pagan 2**	78.45{.00}						

* Based on SUR estimation involving GESS (instead of GEE and **GEH**) and the other variables.

** Based on SUR estimation involving GEE and GEH (instead of **GESS**) and the other variables.

[a] significance at the 0.01 two-tailed level
[b] significance at the 0.05 two-tailed level
[c] significance at the 0.10 two-tailed level

Notes:

D7579, D8084, and D8589 are time-period dummy variables, respectively, assuming unity for sub-periods 1975-79, 1980-84, and 1985-89, and zero otherwise; the excluded time variable is D9094 for the 1990-94 sub-period. All other variables are defined in table 1. Each explanatory variable, except the time-period dummies, is in logarithms.

Z-values are in parentheses, and *p-values* in braces. *RSQ* is the coefficient of determination; *ChiSQ* is the chi-squared test statistic for the null hypothesis of 'no model fit'; *Breusch_Pagan* is the test statistic for the null hypothesis of cross-equation error independence, which is distributed as chi-squared with degrees of freedom equal to the number of equations. Note that GESS is first run together with GEC, GEEC, GEAG, and PUINV; GEE and GEH are then run together with these other non-social sector variables; however, the estimates are identical for the non-social sector variables in both estimations.

Sample size equals 41.

Table 3: Seemingly Unrelated Regression Results - Debt Servicing and Expenditure Composition in African Economies, 1975-94; The Social Sector (dependent variables = logarithmic sector expenditure shares)

I. Predicted Debt Service

VAR/EQ.	GEE	GEH
CONST	6.144[a]	5.006[b]
	(3.88)	(2.51)
PREDSR	-1.615[a]	-1.370[a]
	(-4.16)	(-2.80)
ODAGDP	0.072[c]	0.134[a]
	(1.94)	(2.90)
PCGNP	0.127	0.047
	(1.32)	(0.39)
AGCON	0.194[c]	0.070
	(1.84)	(0.53)
XCONST	0.009	0.148[b]
	(0.17)	(2.15)
D7579	-0.397[a]	-0.337[b]
	(-3.30)	(-2.23)
D8084	-0.291[a]	-0.310[b]
	(-2.73)	(-2.31)
D8589	-0.208[c]	-0.134
	(-1.85)	(-0.95)
RSQ	0.33	0.31
ChiSQ	39.21{.00}	35.92{.00}
Breusch_Pagan	20.93{.00}	

II. Actual Debt Service

| VAR/EQ.	GEE	GEH
CONST	0.900	0.501
	(0.90)	(0.25)
DSR	-0.062	-0.032
	(-1.25)	(-0.52)
ODAGDP	0.081[c]	0.144[a]
	(2.02)	(2.96)
PCGNP	0.255[b]	0.160
	(2.57)	(1.33)
AGCON	0.141	0.02
	(1.23)	(0.14)
XCONST	-0.018	0.124[c]
	(-0.30)	(1.74)
D7579	-0.249[c]	-0.187
	(-1.90)	(-1.18)
D8084	-0.232[b]	-0.256[c]
	(-2.01)	(-1.84)
D8589	-0.216[c]	-0.143
	(-1.76)	(-0.96)
RSQ	0.20	0.25
ChiSQ	19.85{.01}	25.91{.00}
Breusch_Pagan	25.70{.00}	

[a] significance at the 0.01 two-tailed level
[b] significance at the 0.05 two-tailed level
[c] significance at the 0.10 two-tailed level

Notes:

Sample size equals 79. See table 2 for other notes.

Figure 1: Trends in Sector Expenditure Shares in African Economies, 1975-94
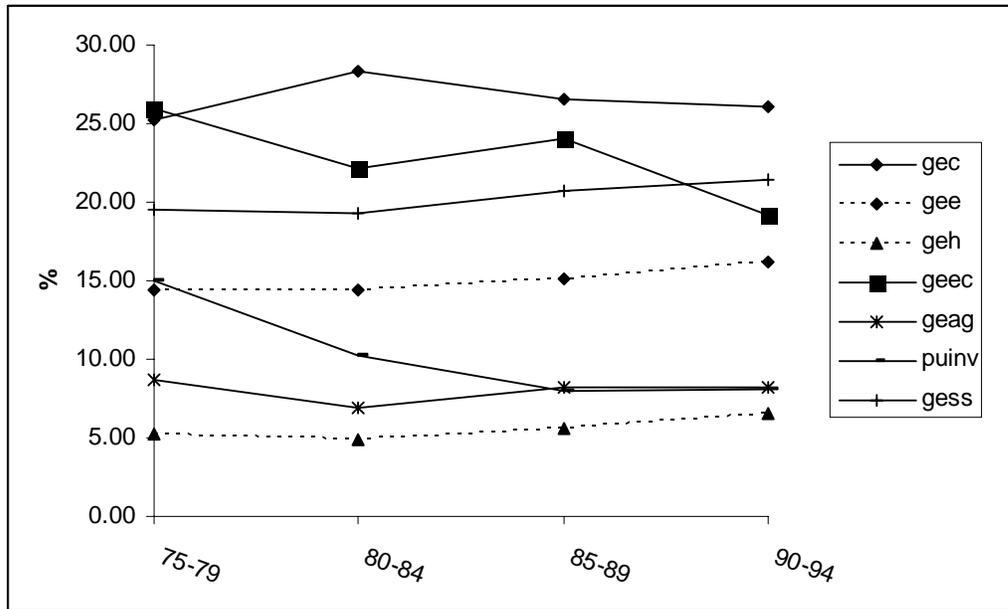
Notes: Non-weighted means of country expenditure shares. See table 1 for the variables' definitions and data sources.

Figure 2: Trends in Real Sector Expenditures on the Social Sector in African Economies, 1975-94
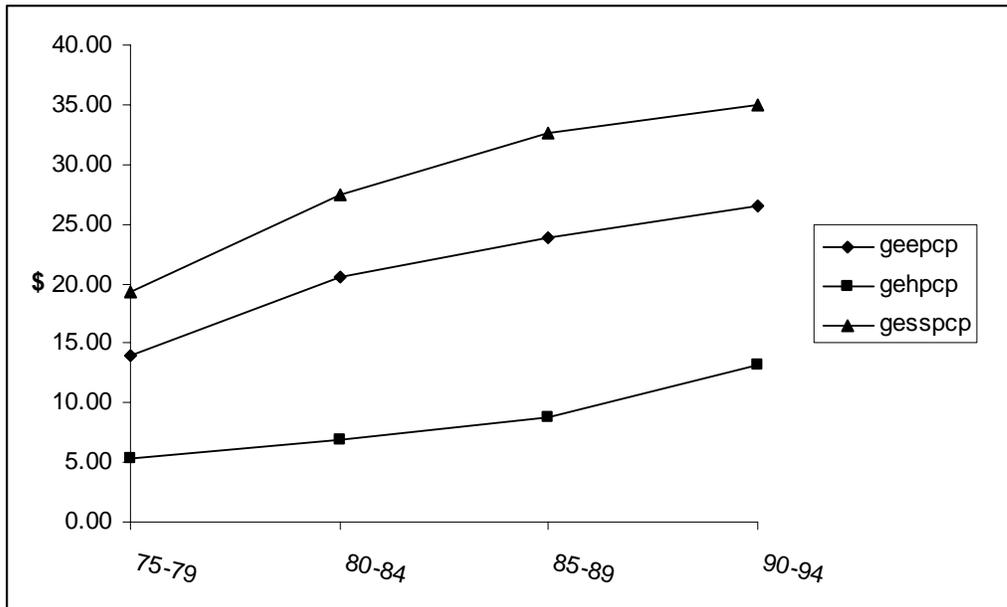
Notes: Non-weighted means of country per-capita expenditures, in 1987 US dollars; *geepcp*, *gehpcp* and *gesspcp* are real per capita expenditures on education, health and social sector (education and health), respectively. Data sources are the same as those for GEE, GEH and GESS (see table 1).

Appendix Table

Seemingly Unrelated Regression Results - Debt Servicing and Expenditure Composition in African Economies, 1975-94, with **DSR** as debt-servicing variable (dependent variables = logarithmic sector expenditure shares)

VAR/EQ.	GEE	GEH	GESS	GEC	GEEC	GEAG	PUNIV
CONST	-0.747	0.033	…	2.643	4.660[a]	4.785[a]	4.175[c]
	(-0.53)	(0.02)	…	(1.18)	(2.48)	(2.59)	(1.80)
DSR	0.022	0.025	…	-0.138	0.010	0.040	-0.164
	(0.23)	(0.20)	…	(-0.91)	(0.08)	(0.32)	(-1.04)
ODAGDP	0.259[a]	0.255[a]	…	-0.007	-0.013	0.128	0.202[c]
	(3.81)	(2.92)	…	(-0.06)	(-0.14)	(1.44)	(1.80)
PCGNP	0.407[a]	0.252	…	0.082	-0.214	-0.351[b]	-0.058
	(3.09)	(1.49)	…	(0.39)	(-1.22)	(-2.04)	(-0.27)
AGCON	0.159	-0.101	…	0.281	-0.086	-0.386	-0.325
	(0.87)	(-0.43)	…	(0.98)	(-0.36)	(-1.62)	(-1.08)
XCONST	-0.039	0.062	…	-0.235[b]	0.074	0.244[a]	-0.136
	(-0.54)	(0.67)	…	(-2.06)	(0.77)	(2.59)	(-1.14)
D7579	-0.172	-0.294	…	-0.155	0.130	0.170	-0.145
	(-0.86)	(-1.15)	…	(-0.49)	(0.49)	(0.65)	(-0.44)
D8084	-0.075	-0.223	…	-0.422[c]	-0.086	-0.061	-0.301
	(-0.49)	(-1.13)	…	(-1.73)	(-0.42)	(-0.30)	(-1.18)
D8589	-0.155	-0.204	…	-0.424[c]	-0.064	0.188	-0.339
	(-0.97)	(-0.99)	…	(-1.68)	(-0.30)	(0.90)	(-1.29)
RSQ	0.400	0.389	…	0.217	0.148	0.396	0.316
ChiSQ	27.35 {0.00}	26.12 {0.00}		11.40 {0.18}	7.17 {0.52}	26.98 {0.00}	18.97 {0.01}
Breusch_Pagan	80.86{0.00}						

[a] significance at the 0.01 two-tailed level
[b] significance at the 0.05 two-tailed level
[c] significance at the 0.10 two-tailed level

Notes:

D7579, D8084, and D8589 are time-period dummy variables, respectively, assuming unity for sub-periods 1975-79, 1980-84, and 1985-89, and zero otherwise; the excluded time variable is D9094 for the 1990-94 sub-period. All other variables are defined in table 1 of the text. Each explanatory variable, except the time-period dummies, is in logarithms.

Z-values are in parentheses, and *p-values* in braces. *RSQ* is the coefficient of determination; *ChiSQ* is the chi-squared test statistic for the null hypothesis of 'no model fit'; *Breusch_Pagan* is the test statistic for the null hypothesis of cross-equation error independence, which is distributed as chi-squared with degrees of freedom equal to the number of equations. Sample size equals 41.