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The Impact of External Debt on Economic Growth in Sub-Saharan Africa*

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Previous studies have examined the impact of external debt on saving and investment levels as a way of assessing the influence of debt on economic growth in less developed countries. Empirical evidence on this "indirect" debt effect has been mixed, however, exhibiting contradictory results for various debt measures (e.g., debt service versus debt outstanding). Employing World Bank data over the 1970 - 1986 period in the augmented production framework, the current study estimates the "direct" impact of debt on economic growth for African LDCs. The results support the hypothesis that the burden of debt, whether measured as debt service or debt outstanding, has on average been deleterious to growth in Sub-Saharan Africa (SSA). While its effect on the **level** of investment is rather weak, debt apparently adversely influences the nature, and hence productivity, of investment undertaken. The paper estimates, for example, that annual economic growth is lowered by an average of 1.1 percentage points, *ceteris paribus*, if a country is classified as high-debt. This translates to about one-third of the sample mean GDP growth rate of SSA. Meanwhile, the impact of debt is found to be non-monotonic: positive at low levels of investment and, after a GDI/GDP threshold of about 16 percent, it becomes negative.

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I. Introduction

It is generally assumed that external debts have burdened the economies of sub-Saharan Africa (SSA)[1]. Surprisingly, not much empirical light has been shed on this hypothesis. Several authors have discussed the possible causes of the African external debt problem and its implications for development (e.g., Lancaster (1991), Danso (1990), Greene (1989)). However, no actual empirical estimates of the impact of the debt problem on indicators of economic development have been provided for African countries.

Much of the available published research on the economic impact of external debt in less developed countries (LDCs) employs samples with relatively few African countries. This lack of research focus on Africa has occurred despite the preponderance of evidence revealing that among the LDCs, SSA as a whole has probably experienced the least economic progress especially as of the 1970s,[2] about the same time that the region's debt burden has been unusually high (*ibid.*).

Furthermore, existing studies that actually analyze the debt effect for developing countries generally concentrate on the impact on investment or saving levels rather than on economic growth per se (e.g., Savvides (1992), Hoffman and Resen (1991), Faini and DeMelo (1990), Fry (1989)). While a drag on the level of investment would be translated to reduced economic growth, such studies, nevertheless, omit an additional important channel through which debt could influence growth. External debt might also affect the productivity of investment, which influence economic growth even if the rate of investment is little affected.

The above phenomenon might be particularly relevant to African countries whose major source of investment is likely to be of the public type, and whose investment rate may not necessarily decrease with debt. Indeed, to continue to service external debt in the long run, some form of investment is ultimately required. The present paper argues that it is possible to uncover a significant impact of external debt on

1. According to U.N. Secretary Perez de Cuellar, for example, the debt burden "has become one of the most important factors constraining recovery and development in the continent." (United Nations (pp. 23)). See also World Bank (1989).

2. Using World Bank data covering the 1970-1986 period, Fosu (1992, Table 3) presents annual average GDP growth rates of 3.2 percent and 3.8 percent for SSA and non-African LDCs, respectively.

economic growth - even if there is little evidence of a debt effect on the rate of investment per se.

Although the economic performance of SSA countries as a whole has been dismal especially since the 1970s, it has been less than uniform across the continent. Indeed, there is evidence of greater variability in economic growth among SSA than among non-African LDCs.[3] In one extreme, Botswana registers an average annual GDP growth rate of over 10 percent, and several other countries (Kenya, Lesotho, Malawi, and Mauritius) exhibit rates of about 5 percent during this period. In the other extreme, several countries have stagnated with growths of at most 1 percent (Chad, Ghana, Liberia, Mauritania, Niger, Sierra Leone, Zaire, and Zambia).[4] To what extent might this intra-African growth disparity be explained, at least in part, by differences in the external debt burden?

The present paper examines the role of external debt in economic growth and provides empirical evidence for a sample of SSA countries over 1970-1986 period. We begin by theoretically discussing the importance of debt in the growth process (section II). Empirical models regarding the implications of external debt for growth are subsequently presented in section III. In section IV, the relative severity of the debt "problem" is examined by comparing external debts of SSA countries among themselves, and also as a group against those of non-SSA countries. The debt economic growth models are, then, estimated for a sample of SSA and the results are provided in section V. Section VI concludes the paper.

II. Theoretical Issues - Role of External Debt in the Growth Process

The Direct Effect of Debt Hypothesis (DEDH)

Nations borrow in order to augment current or future consumption. The former rational has little impact on capital formation, whereas generating future consumption requires investment. Lenders often insist

3. For instance, Fosu (1992, Table 3) reports statistics, based on World Bank data, showing a coefficient of variation of 84 percent for GDP growth over the 1970-1986 period for a sample of 30 SSA countries, compared with 58 percent for non-African LDCs.
4. These statistics are based on World Bank data used in the present study; details of the data sources are subsequently provided in the text and in Table 3.

on the use of loans for investment purposes as a way of reducing the risk of default.

The type of investment undertaken would depend in great part on the nature of the loan, however. For example, longer-term loans would make possible relatively productive investment projects that may require longer gestation periods. Yet, such loans are likely to be riskier to lenders, necessitating that relatively stringent terms be imposed. Indeed, concerns for future uncertainties, including the possibility of unilateral debt cancellations by the debtor, would render shorter lending periods preferable to potential lenders.

Historically, the bulk of loans to African nations, especially in the 1960s and early 1970s, has been provided by external governments, usually long-term and on concessional terms. Thanks in great part to the oil supply shocks and falling commodity prices, or simply to mismanagement, however, African countries experienced balance-of-payments problems during much of the 1970s and in the 1980s. In response, SSA nations have increasingly borrowed to service existing debts or to finance their current account deficits. Such foreign exchange liquidity constraints might reduce the availability of investment funds. These constraints could also adversely alter the investment mix, however, as they may necessitate increased reliance on relatively short-term investment projects in order to service the debt. For example, loans would probably be used for generating short-term export proceeds in order to be able to meet repayment obligations rather than for long-term improvements in the infrastructure whose payoff may be larger but farther off in the future. Moreover, burdensome debt service levels are likely to result in the substitution away from relatively productive investments requiring expensive imported materials critical to the growth process.

It is hypothesized here, therefore, that a country facing large debt servicing payments, relative to its available resources, is likely to exhibit a relatively low productive investment mix. Thus even if onerous debt service payments do not reduce saving and investment levels substantially, they could, nonetheless, decrease output growth "directly" by diminishing productivity, as a result of the adverse change in investment mix. We refer to this as the "Direct Effect of Debt Hypothesis" (DEDH).

In the presence of a debt overhang, DEDH could still hold even if

the liquidity flow constraint was not binding in the short run. For example, the existence of an outstanding debt burden may lead potential investors, in attempts to avoid the future tax liability and implications of possible future repayment difficulties, to shun longer-term investment projects that might otherwise prove to be relatively productive. Thus, DEDH suggests that both debt outstanding and debt service may be burdensome and deleterious to growth even if they do not affect investment levels.

In contrast, traditional hypotheses trace the effect of debt through its influence on investment levels. These are the "Debt Overhang" and "Liquidity Constraint" hypotheses. First, the "Debt Overhang Hypothesis" (DOH) states that high indebtedness acts as a tax on future output and hence reduces the incentive for saving and investment (e.g., Krugman (1988), Corden (1988), Froot (1989), Sachs (1989)). The implication of this hypothesis, as generally discussed in the literature, is that a large debt burden, measured as debt outstanding, would reduce investment and presumably output.

Second, the "Liquidity Constraint Hypothesis" (LCH) states that the requirement to service debt reduces funds available for investment purposes (e.g., Hoffman and Reisen (1991)). Hence, a negative effect of debt service on investment would result under a binding liquidity constraint.

Empirical studies bearing on DOH and LCH examine the extent to which measures of the debt burden affect saving and/ or investment levels. The results are generally mixed. For example, IMF (1989) cites evidence in support of DOH by observing that countries with larger debt levels also experienced smaller rates of capital formation in the 1980s. Applying a more comprehensive framework that controls other factors influencing investment, however, Hoffman and Reisen (1991) discover little evidence for DOH on the basis of outstanding debt; however, they find liquidity availability to be an important determinant of the level of investment. In contrast, Faini and DeMelo (1990) and Fry (1989) uncover negative impacts of outstanding debt/exports and outstanding debt/GNP rations on investment, respectively.

Despite the mixed empirical support, DOH and LCH both imply an "indirect" adverse impact of debt on economic growth, via reductions in investment levels. In contrast, DEDH suggests that debt can additionally influence economic growth via its influence on the

productivity of investment. Hence, even if debt is found to be inconsequential in the investment or saving equation, it may still have important implications for output growth. That is, given a production function framework, debt could affect output even if the levels of the production inputs are controlled.

III. Model Specification

To test the above proposition, DEDH, we specify the following cross-national "augmented production function":[5]

$$q_i = b_1 + b_2 l_i + b_3 k_i + b_4 x_i + e_i,\ i = 1, 2, \cdots, n \qquad (1)$$

where q_i, l_i, k_i and x_i are growth rates of production, labor, capital, and exports, respectively, in country i ; b_j (j = 1, 2, 3, 4) are parameters to be estimated i e_i is the error term ; and n is the number of countries in the sample. The slopes b_2 and b_3 are both expected to be positive according to neoclassical theory, whereas the anticipated positive sign of b_4 is based upon the generally avowed beneficial effects of exports (*ibid.*).

The above proposition suggests that debt burden may enter into equation (1) "directly", that is, after controlling for the effects of production input levels. In particular, it implies that the capital coefficient b_3 is endogenous with respect to debt. To simplify the analysis, assume this investment productivity-debt function is linear and can be represented as:

$$b_3 = b_{31} + b_{32} d_i\ ;\ b_{31} > 0 \text{ (neoclassical)},\quad b_{32} < 0 \text{ (DEDH)} \qquad (2)$$

5. The literature is replete with studies based on this production function specification, where output is not only a function of the traditional inputs of labor and capital but also of exports, which are assumed to reflect international forces not captured in this neoclassical functional arguments. For an elaboration of this point, the adoption of the term "**augmented** production function", and an application to African countries see, for example, Fosu (1990).

Though only results based on the fuller model including exports are reported here, findings regarding the importance of debt in the growth equation are invariant to the inclusion status of the export variable. However, the goodness of fit of the model improves substantially when the effect of exports is controlled for.

where d_i is the debt burden for country i, and the b's are the coefficients to be estimated. Incorporating equation (2) into equation (1), and separating out terms, we have:

$$q_i = b_1 + b_2 l_i + b_{31} k_i + b_4 x_i + b_{32} k_i d_i + e_i, i = 1, 2, \cdots, n \quad (3)$$

The effect of debt on output growth may then be written as:

$$f = b_{32} k_i. \quad (4)$$

Thus equation (3) assumes that the influence of debt is through the marginal effect of investment only, and it equals zero if k_i is zero.

To allow for the possibility of an independent effect of debt, equation (3) is generalized as:

$$q_i = b_i + b_2 l_i + b_{31} k_i + b_4 x_i + b_{32} k_i d_i + b_5 d_i + e_i, \quad (5)$$
$$i = 1, 2, \cdots, n$$

where b_5 is the impact of debt on output growth when investment is zero. Hence, the effect of debt may be rewritten as

$$f = b_{32} k_i + b_5. \quad (6)$$

Since the incidence of debt under zero investment has the potential of infusing critical resources into the economy, b_5 should be positive. We term equations (3) and (5) as the "continuous interactive model" (CIM).

Alternatively, the investment productivity-debt function may be discontinuous, since a sufficiently large debt level will probably have to be reached in order for the debt to be perceived as burdensome. If so, then b_3 may be rewritten as

$$b_3 = a \text{ if } d_i < d^*; \quad (7a)$$

$$b_3 = a + c, \text{ otherwise.} \quad (7b)$$

where d^* is a threshold value of debt, with $a > 0$ under neoclassical

theory, and $c<0$ under DEDH. Incorporating equations (7a) and (7b) into equation (1), and allowing for the possibility of an independent effect of debt burden, we have

$$q_i = b_1 + b_2 l_i + a k_i + b_4 x_i + e_i, \quad i = 1, 2, \cdots, n* \tag{8a}$$

$$q_i = b_1 + b_2' + b_2 l_i + (a+c) k_i + b_4 x_i + e_i,$$
$$i = n^* + 1, n^* + 2, \cdots, n \tag{8b}$$

where n^* is the frequency of cases satisfying equation (7a) ; and b_2' is the independent impact of debt, which should be positive if debt potentially provides critical resources when investment is zero. The effect of debt ("high" - rather than "low" - debt) may now be written as

$$f = c k_i + b_2. \tag{9}$$

Equations (8a) and (8b) constitute the analysis of covariance model which, for ease of contrast with CIM equations (3) and (4), is termed here as the "discontinuous interactive model" (DIM).

Ⅳ. Sample Period, Debt Data and Summary Measures

The empirical analysis is conducted using 1970-86 data. By design, the sample period excludes the more recent period in order to avoid the structural adjustment era when substantial additional debt (relief) was acquired by many African countries in exchange for macroeconomic adjustments. The present paper examines the implications of the debt prior to the bulk of these adjustments. We analyze this relatively long sample period in order to focus on the "long term" effects of debt. Thus the paper should shed light on the degree to which the impact of external debt over this period of a decade and a half has been deleterious for SSA. Meanwhile, the nonlinear specification of the debt-growth nexus provides a basis for assessing the possibility that by providing critical resources, debt could actually be beneficial to some SSA countries.

Debt data are obtainable from World bank, *World Debt Tables,*

1982-83 and 1988-89 issues. table 1 presents summary statistics based on annual values of several debt measures for a sample of 29 sub-Saharan African (SSA) LDCs for which sufficiently complete data exist over the sample period. For comparative purposes, similar statistics are additionally reported for samples of 33 African (AF) and 32 non-African (NAF) LDCs. The various measures of the debt burden are: debt outstanding and disbursed as a proportion of GNP (DODY), debt outstanding and disbursed as a percentage of exports (DODR), debt service as a percentage of GNP (DSY), and debt service as a proportion of exports (DSR).

According to the statistics in Table 1, the debt burden over the 1970-1986 period varied greatly among SSA countries, irrespective of the measure used. The debt distributions also generally exhibit positive skewness, implying the existence of a small number of countries with unusually large debt burdens. For example, using additional statistics not reported here, Mauritania has a DODY value of 116.0 percent, which is nearly 3.0 standard deviations above the sample mean. Similarly, Somalia shows a value of 553 percent for DODR, which is more than 3.0 standard deviations above the mean of the sample. Congo also has a rather large debt service/GNP ratio of 9.2 percent, nearly 3.0 standard deviations above the mean of the sample. The debt service ratio (DSR) exhibits little skewness, however, suggesting disparate distributions for the various debt burden measures.

The summary measures for AF countries are generally similar to those for SSA countries, as to be expected, since only four countries: Algeria, Egypt, Morocco, and Tunisia belong to the AF sample but not to the SSA subsample. The data suggest, however, that the four countries exhibit appreciable larger debt service ratios than SSA on average. Such a disparity might be explained by the greater ability of these non- SSA countries to pay their debts, or simply by better concessional terms for SSA.

Statistics in Table 1 further show that the 1970-1986 average debt burden for non-African (NAF) LDCs, as measured by DODY and DODR, seems appreciably smaller than for SSA or AF countries. For example, while debt outstanding and disbursed constitutes approximately 40 percent of GNP in SSA and AF on average, it represents about 30 percent in NAF LDCs. The corresponding figures for debt outstanding as a proportion of exports show a similar pattern. In contrast, the debt

service ratios, DSY and DSR, both appear larger for NAF than especially SSA LDCs, perhaps suggesting that SSA countries experienced greater difficulties with meeting their debt service obligations.[6]

Table 2 presents the sample of SSA LDCs along with their rankings within the sample, using the various measures of debt burden. While several countries enjoy consistent rankings based on the various debt measures (e.g., Congo, Mauritania, and Zambia as highly indebted; Lesotho and Rwanda with low indebtedness), different measures of the debt burden generally result in different ratings. This is to be expected, since the export share of GNP varies by country and certain nations may have greater debt service capabilities.

Table 2 additionally categorized the SSA sample into "high" and "low" debt-burden countries. The classification is based on DODY, where a country is categorized as high-debt is DODY exceeds the sample mean of 42.5 percent; as low-debt otherwise.[7] The process results in 12 of the 29 countries classified as high-debt. Although this categorization method may seem rather arbitrary, there appears to be a break in the distribution around the mean rather than the median, rendering the former average a better threshold.[8]

The above classification scheme is based on debt outstanding rather than debt service, since in a world where debt rescheduling is allowed, the latter is relatively sensitive to a country's ability to pay. Hence, the actual debt service may not be indicative of the extent to which the foreign exchange liquidity constraint is binding. That is, high **actual** debt service may or may not be symptomatic of a high debt burden. Nevertheless, of the 12 high-debt countries, only two

6. Smaller debt service ratios for SSA might also be explained in part by differences in the compositions of debt. For example, the majority of SSA debt is owed to other governments. Therefore, it might be weighed more heavily toward concessional and low-interest loans than those of NAF.

7. It is striking to note that this classification is very similar to that advocated by some specialists who "generally consider a debt-GNP ratio of more than 40 percent as likely to indicate a serious economic problem." Lancaster (1991, pp.24).

8. Using the median instead as the threshold results in two additional countries (Botswana and Senegal) being added to the high-debt subest. However, the threshold should not be defined by position, as in the case of the median, which is relatively susceptible to sampling fluctuations. Instead, "high" debt should entail large enough indebtedness in excess of the mean, which exceeds the median in virtue of the positive skewness of the debt mean over the median as the threshold for the present classification.

(Mali and Somalia) have extremely low debt service payments as proportions of GNP; and only three (Kenya, Mauritius, and Senegal) would have been classified as high-rather than low-debt countries if DSY had similarly served as the basis for classification.

The use of the export-denominated outstanding debt measure, DODR, might also result in different rankings. However, only three currently defined high-debt countries (Cote d'Ivoire, Liberia and Togo) would have lost their classification, and only one country (Burundi) would have now been categorized as high-debt if DODR, instead of DODY, had served as the basis for classification.

The above discussion reveals that disparate rankings are generally indicated by different measures of the debt burden. Moreover, a dichotomous classification of the SSA sample into high-and low-debt groups does not appear to substantially depend on the particular measure used. That is, a majority of the countries would not change places regardless of which measure is applied. However, on theoretical grounds, it appears that DODY is probably the most appropriate basis for classifying countries into groups of indebtedness.[9] To bolster the reliability of results, though, we shall experiment with the different debt-burden measures in the empirical estimation of the regression equations.

V. Estimation and Results

The above regression equations are estimated using the debt measures and additional World bank data over the 1970-1986 period for the sample of 29 sub-Saharan African LDCs for which sufficient data were available. Detailed definitions of the regression variables and data

9. The outstanding debt measures, DODR and DODY, are preferable to the debt service variables, DSY and DSR, since the latter may reflect the ability to pay rather than the debt burden. Furthermore, if resources are sufficiently substitutable between the export and nonexport sectors then, in the long run, it is probably GNP, rather exports, that serves as the appropriate denominator. Hence, DODY is likely superior to DODR.

The severe difficulties experienced by many SSA countries in meeting payments on their outstanding debts are very likely indicative of the overhang nature of these debts. We deduce, for instance, that 21 out of the 29 SSA countries in our sample incurred arrears or resorted to debt rescheduling during 1984-1986. The only eight exceptions are : Botswana, Burundi, Ethiopia, Kenya, Lesotho, Mauritius, Rwanda, and Zimbabwe. (Greene (1989, pp. 865, footnote 16))

sources are given in Tables 3 and 4.

For each country, growths of output q, labor l, and exports x are measured as the average annual percent growth rates of GDP, labor force, and merchandise exports, respectively. As is now rather standard in the literature (e.g., Fosu (1990, fn.11), Ram (1985, fn.6)), capital growth k is proxied by the mean annual gross fixed capital formation as a percentage of GDP.[10]

The estimating technique is OLS; however, given the cross sectional nature of the analysis, the likelihood ratio test is employed to examine the error structure for possible heteroscedasticity. According to the Bartlett likelihood ratio statistic (B) reported with the regression results in Tables 3 and 4, however, there is no evidence of heteroscedasticity in any of the estimated equations.[11]

Results form estimating the basic model of equation (1), with and without the export variable, are given in Table 3 as equations A.1 and A.2. These results are similar to those provided in other studies on Africa over roughly the same period (see, e.g., Fosu (1992, Table 2)). That is, the effect of labor force growth l is statistically weak; export growth x is important variable in the economic growth equation, and incorporating x into the regression reduces the magnitude and statistical significance of the investment variable k.

The debt-augmented "continuous interactive model" (CIM) of equations (3) and (5) is now estimated. The results are reported in Table 3 for all of the four measures of the debt burden. First, we note, on the basis of the SEE and adjusted R^2, that each model containing the debt variable exhibits greater goodness of fit (GOF) than the basic model. Second, the effect of k is estimated with higher precision under CIM than under the basic model. Third, the coefficient of the debt-investment interactive variable D*k is negative, as expected, regardless of the debt measure used. It is, moreover, significant in at

10. This measure transforms the coefficient of the capital variable to the marginal product of capital, since then dQ/Q = b(dK/Q) ; where dQ/Q is the growth rate of GDP, dK/Q) is capital formation as a proportion of GDP, and b is the coefficient. It follows easily that b = dQ/dK.

11. Under the null hypothesis of homoscedasticity, B is distributed as chi-square with (c-1) degrees of freedom where c is the number of groups formed from the sample (e.g., Kmenta (1986, pp. 297-298)). For the present sample, c equals 3, so that we fail to reject the null hypothesis of homoscedasticity even at a relatively large risk of type 1 error of .25 (critical value equals 1.39).

least one of the pairs of models specified for each debt-burden measure. Fourth, though positive, the independent effect of debt (coefficient of D) is generally insignificant. The only exception is the specification based on DODR where the coefficient of D is statistically positive, as to be expected if debt provides critical resources when the rate of investment is dismal.

The above results from Table 3 support the Direct Effect of Debt Hypothesis (DEDH) that external debt is deleterious to growth via its adverse impact on (capital) productivity. Furthermore, except for DODR, evidence for the independent effect of debt is rather weak.

Selecting the equation that provides the greater GOF for each debt-burden measure, we observe form Table 3 that models based on debt outstanding perform respectively better, in terms of GOF, than those involving debt service (B1.1 vs. B3.1, B2.2 vs. B4.1 or B4.2). This result provides some support for the above conjecture that debt outstanding is a superior indicator of debt burden than is **actual** debt service.

Results from estimating the Discontinuous Interactive Model (DIM) of equations (8a) and (8b) are reported in Table 4. The results are very similar to those based on CIM. First, the DIM models are all statistically superior to the alternative basic model (A.1 and A.2 of Table 3). Second, with a significant negative coefficient for the interactive variable, DD*k, for each of the debt-burden measure, the evidence supports the prediction of DEDH that debt would "directly" influence economic growth via its reduction of (capital) productivity. Third, the results appear consistent with the theoretical argument that the debt-outstanding and GNP-denominated measures may be better indicators of the long term debt burden, respectively, than the debt service and export-denominated variables.

The generally statistically positive coefficient of the high debt dichotomous variable DD suggests, however, that the effect of debt is nonmonotonic. That is, at sufficiently low investment levels, debt could be beneficial. This finding makes sense if one views debt acquisition as possibly contributing to resources or to Hicks-neutral technological change for growth, so that at very low levels of investment, debt injection might actually be growth inducing. At relatively high investment levels, however, debt inhibits growth.

Specifically, using the results of Table 4 based on the fuller model

(including both DD and DD*k), the threshold investment level is calculated as 16.5 percent and 16.3 percent for the models based on DODY and DODR (equations (B1.2 and (B2.2)), respectively.[12] The implied threshold is 15.1 percent for the equation based on DSY (equation (B3.2)); the DSR-based equation (B4.2) yields statistically insignificant coefficients for DD and DD*k, however.[13]

Being a high-debt country is growth-inhibiting if capital formation exceeds the above threshold values. Choosing equation (B1.2), based on DODY, as the best model on the basis of GOF, we note that all but nine of the 29 countries in the sample meet this criterion; that is, their GDI/GDP ratios exceed the 16.5 percent threshold. Note that of the nine that do not, all but one (Sudan) are classified as low-debt.[14] Thus, though debt levels appear inimical to growth in most SSA countries, assuming additional debt could be beneficial for a small number of mostly low-debt countries.

Debt-Burden Effects on Growth : Numerical Estimates

Table 5 reports estimates of the debt-burden effects on economic growth using the CIM and DIM results of Table 3 and 4. For the CIM results, since the marginal effects are not directly comparable across debt measures (note that the magnitudes of the debt measures differ), corresponding partial elasticity estimates are also reported in brackets. These estimates range from .21 to .34, which are not inconsequential. For instance, they are comparable to the export elasticity estimates, which range from .19 to .18.[15] Using the DODR-based equation (B2.2), which exhibits the highest GOF, the debt-burden elasticity is .33, compared with the export elasticity of .19. Thus, on average, 1 percent

12. Although results based on CIM (Table 3) generally indicate that the nonlinear version containing D is not significant, it is interesting to note that in the only equation where D is found to be important (DODR-based equation (B2.2)), the implied investment threshold is 16.3 percent, which is strikingly close to the DIM estimates based on DODY and DODR. This result appears to further support the reliability of the estimate of the threshold effect.

13. These threshold values with the sufficiently low capital formation are Burundi, Chad, Ethiopia, Ghana, Niger, Rwanda, Senegal, Sierra Leone, and Sudan.

14. The nine countries with the sufficiently low capital formation are Burundi, Chad, Ethiopia, Ghana, Niger, Rwanda, Senegal, Sierra Leone, and Sudan.

15. These estimates are derived from the selected debt-augmented equations of Table 3. The export elasticities are the estimated coefficients in the equations used to calculate the debt-burden elasticities reported in Table 5.

increase in the debt outstanding/export ratio would be associated with roughly 3 percent reduction in the GDP growth rate, *ceteris paribus*, whereas an equivalent increase in export growth would result in a rise in the GDP growth rate of about 2 percent.

With reference to the debt effect based on the DIM results, the estimates in Table 5 show that being in a high-debt group, *ceteris paribus*, results in a reduction of output growth of between .8 percentage point to 1.6 percentage points (25 percent to 52 percent of GDP growth), depending on what debt measure is used. Selecting the model based on DODY as the "best" model in terms of GOF (equation (B1.2)),[16] we infer that a high-debt country, on average, would suffer a reduction in economic growth of about 1.1 percentage points, which is about 35 percent of the sample mean GDP growth (see Table 6 for summary statistics).

Debt and Investment : Some Preliminary Evidence

How strong is the relationship between the level of investment and debt? This question is relevant, since much of the argument regarding the deleterious effect of debt is cast in terms of debt's negative impact on the rate of investment, consistent with the traditional hypotheses of DOH and LCH. As preliminary evidence, Table 7 reports zero-order correlation coefficient (r) between the different measures of the debt burden and the remaining regression variables.

Note that the r values involving the debt measure are generally positive. Obviously, part of this correlation is probably attributable to the fact that k shares the same denominator with DODY and DSY, namely, GDP (or GNP).[17] Nevertheless, the high-debt dummy variable DD is also positively correlated with k, regardless of the measure of

16. Incidentally, this equation also exhibits the highest goodness of fit among all the models estimated, thus bolstering the use of DODY as the basis for classification into low and high-debt countries (see Table 2). The finding also suggests that the debt- capital productivity relationship might be discontinuous.

17. Indeed, DODR, which uses exports as the denominator, exhibits a negative, though statistically insignificant, correlation with k. Nevertheless, part of the DODR negative correlation with k could also be introduced by the observation that DODR is expressed as a proportion of exports, coupled with a high positive correlation between x and k. Furthermore, note that the r value involving DSR and k is positive, though is statistically insignificant.

debt burden used. This result, then, suggests that an appreciable portion of the positive correlation between k and the debt indicators might not be attributable to the common-denominator problem. That is, investment is not lower, and may actually be higher, in high-debt than in low-debt countries.[18] Thus, the preliminary evidence presented here does not, for our SSA sample at least, seem to favor the traditional hypothesis of an inverse relationship between debt and the level of investment.

VI. Conclusion

To examine the effect of external debt on the developing countries of Africa, the present study has advanced and tested the hypothesis that debt may adversely influence economic growth even if it has little effect on investment. Such an impact is channelled "directly" via the deterioration of (capital) productivity associated with high debt. We term this the "direct effect of debt hypothesis" (DEDH).

The study estimates the extent to which debt might have adversely influenced economic growth of sub-Saharan African (SSA) nations over the "long term" by examining data for the 1970-1986 period. Regardless of the debt-burden measure used, the results are in concert with DEDH, suggesting that debt negatively influenced GDP growth via a reduction in the marginal productivity of capital. On average, associated with a high-debt country is a fall in GDP growth of about 1 percentage point annually. This constitutes approximately one-third of the sample mean growth of GDP.

The results here also suggest that the "long term" impact of debt is non-monotonic. It is positive at low levels of investment and, after a GDI/GDP threshold of about 16 percent, it becomes negative. This finding reveals the complicated nature of debt in the growth process. Nevertheless, on average, most of the countries in our sample exhibit

18. From our SSA sample, k averaged 22.4 percents, 20.8 percent 24.0 percent, and 20.7 percent in high-debt countries, according to classifications based on DODY, DODR, DSY, and DSR, respectively. These compare with the overall sample mean of 19.3 percent.

That investment may not be adversely affected by debt is further buttressed by the finding by Borensztein (1991, pp. 27), for example, that debt with **official creditors (both international and bilateral)** did **not** adversely influence private investment in the Philippines. The reliance of SSA on official creditors may, thus, help to explain the generally weak negative correlation between debt and investment.

the adverse effect of debt.

Meanwhile, preliminary evidence presented here for sub-Saharan Africa does not appear to support the hypothesis of an adverse effect of debt via investment levels : the "indirect" effect of debt. While this channel of the debt impact calls for additional investigation, two major implications appear to emanate from the present findings for SSA.

First, the external debt effect need not be via investment levels. Indeed, as suggested here, this impact of debt may actually be less important than the "direct" one, at least for SSA countries. Hence, in analyzing the debt effect on economic growth, the traditional research emphasis on the role of debt on investment **level** determination is not totally advisable. Second, the non-monotonicity in the debt-economic growth relationship observed here implies that countries might require differential treatments in addressing their debt problems. Although the study finds debt to be inimical to economic growth generally, it also suggests that for the relatively small number of SSA nations with unusually low investment levels, additional debt would be beneficial.

Table 1 Annual Average Debt Burden, 1970–1986: Summary Measures Sub-Saharan African (SSA), African (AF), and Non-African (NAF) LDCs*

	Min	Max	Mean	Median	S. Dev.	Skew.
DODY	11.8	116.0	42.5	36.5	26.2	1.0
	11.8	116.0	43.3	38.4	25.0	1.0
	11.2	93.2	33.6	28.2	19.1	1.3
DODR	34.4	552.6	173.7	153.2	118.3	1.5
	34.4	552.6	171.3	153.2	111.8	1.6
	29.7	478.1	153.2	123.4	109.5	1.6
DSY	0.4	9.2	3.0	2.5	2.3	1.2
	0.4	9.2	3.4	2.6	2.4	0.8
	0.8	10.2	3.9	3.4	2.1	1.1
DSR	2.6	17.9	10.0	9.9	4.6	0.1
	2.6	24.0	11.1	10.9	5.4	0.3
	5.6	34.6	14.9	12.8	7.2	0.9

* Statistics in rows 1, 2, and 3 are for SSA, AF, and NAF, respectively. DODY and DODR are the respective total debt outstanding and disbursed as percentages of GNP and exports; DSY and DSR denote debt service as percentages of GNP and exports, respectively. All debt data are from *World Debt Tables* (1982-83 and 1988-89 editions). The statistics are for 29 SSA, 33 AF, and 32 NAF.

The SSA sample is shown in Table 2; the AF sample additionally includes: Algeria, Egypt, Morocco, and Tunisia. The NAF sample consists of: Argentina, Bangladesh, Brazil, Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, India, Indonesia, Israel, Jamaica, Korea (Republic of), Malaysia, Mexico, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Sri Lanka, Thailand, Trinidad & Tobago, Uruguay, Venezuela, Yemen, Yugoslavia.

Table 2 Sample of Sub-Saharan African Countries and Rankings by Debt Burden Measure

	RANK # BASED ON			
	DODY	DOOR	DSY	DSR
Benin	15	19	13	10
Botswana	16	2	17	1
Burkina Faso	11	8	5	6
Burundi	5	24	3	21
Cameroon	9	6	14	11
Chad	8	12	6	4
Congo*	28	20	29	26
Cote d'Ivoire*	20	11	27	28
Ethiopia	6	18	9	15
Ghana	10	13	12	13
Kenya	14	10	23	22
Lesotho	2	1	7	2
Liberia*	23	14	21	8
Malawi*	21	23	24	29
Mali*	26	26		
Mauritania*	29	25		
Mauritius	7	3		
Niger	12	17		
Nigeria	3	5		
Rwanda	1	7		
Senegal	17	9		
Sierra Leone	13	16		
Somalia*	19	29		
Sudan*	22	28		
Tanzania*	18	27		
Togo*	25	15		
Zaire*	24	21		
Zambia*	27	22		
Zimbabwe	4	4		

High rank signifies high debt. See Table 1 for the definitions and data sources for DODY, DODR, DSY, and DSR.

* Classified as having a "high" external debt burden, that is, if DODY exceeds the sample mean. For details, see the text.

Table 3 Debt and Growth is Sub-Saharan Africa, 1970-1986 Regression Results: Basic Model and Continuous Interactive Model (CIM) (absolute values of the t ratio in parentheses)

Eqn.	Cons.	I	k	x	D	D*K	R^2/Adj.R^2	SEE	B
A. Basic Model									
(A.1)	-1.27	.546 (0.58)	.160[b] (2.41)	--	--	--	.212/.151	2.43	1.21
(A.2)	1.01	.519 (0.73)	.014 (0.23)	.327[a] (4.47)	--	--	.562/.509	1.85	.200
B. Debt-Augmented Model									
B1. Debt-Burden Measure : DODY									
(B1.1)	-.822	.496 (0.82)	.204[b] (2.64)	.268[a] (4.15)	--	-.002[a] (3.27)	.697/.646	1.57	.002
(B1.2)	-1.82	.340 (0.53)	.260[b] (2.50)	.268[a] (4.12)	.038 (0.81)	-.003[c] (1.75)	.706/.642	1.58	.004
B2. Debt-Burden Measure : DODR									
(B2.1)	1.16	.511 (0.72)	.038 (0.59)	.306[a] (4.02)	--	-.000 (0.99)	.579/.509	1.85	.015
(B2.2)	-4.38	.357 (0.60)	.359[a] (3.26)	.195[b] (2.71)	.031[a] (3.36)	-.002[a] (3.55)	.718/.657	1.55	.046
B3. Debt-Burden Measure : DSY									
(B3.1)	-.257	.737 (1.14)	.173[b] (2.10)	.281[a] (4.12)	--	-.018[b] (2.58)	.657/.600	1.67	.171
(B3.2)	-.462	.931 (1.42)	.153[b] (2.19)	.264[a] (3.93)	-.380 (0.64)	0.005 0.23)	.663/.590	1.69	.287
B4. Debt-Burden Measure : DSR									
(B4.1)	-.139	.753 (1.12)	.124 (1.63)	.265 (3.57)	--	-.007[b] (2.15)	.633/.572	1.73	.462
(B4.2)	-.242	.554 (0.79)	.240[c] (1.80)	.243[a] (3.16)	.261 (1.06)	-.018 (1.68)	.650/.574	1.73	.398

The dependent variable is q, GDP growth, measured as the mean annual percent GDP growth rate; l is the average annual percent growth of the labor force; k denotes the mean annual gross fixed capital formation, expressed as a percentage of GDP; x is the average percent growth rate of real merchandise exports; D measures the debt-burden (DODY, DODR, DSY, or DSR), defined in Table 1; q, l, and x are based on average annual data from several issues of *World Development Report,* World Bank; k is the mean based on annual data from *National Accounts Statistics,* United Nations; debt-burden measures are from World Tables. World Bank. R^2, Adj. R^2, and SEE are the coefficient of determination, adjusted R^2, and standard error of estimate, respectively; B denotes the Bartlett likelihood ratio statistic to test for possible heteroscedasticity in the error term of the respective estimated equation (degrees of freedom equal 2 in each case). The sample size equals 29 countries.

[a] Statistically significant at the .01 level (two-tailed).
[b] Statistically significant at the .05 level (two-tailed).
[c] Statistically significant at the .10 level (two-tailed).

Table 4 Debt and Growth in Sub-Saharan Africa, 1970-1986 Regression Results : Discontinuous Interactive Model(DIM)
(absolute values of the t ratio in parentheses)

Eqn.	Cons.	l	k	x	D	DD*K	R^2/Adj.R^2	SEE	B
B1. Debt-Burden Measure Based on: DODY									
(B1.1)	-.926	.775	.140[b]	.245[a]	--	-.100[a]	.680/.627	1.61	.376
		(1.23)	(2.07)	(3.52)					
(B1.2)	-1.82	.139	.267[a]	.198[a]	6.28[a]	-.381[a]	.784/.737	.104	1.35
		(0.25)	(3.91)	(3.31)	(3.34)	(4.28)			
B2. Debt-Burden Measure Based on: DODR									
(B2.1)	.813	.376	.067	.304[a]	--	-.063[c]	.617/.555	1.76	.056
		(0.55)	(1.05)	(4.30)		(1.89)			
(B2.2)	-.659	.146	.172[b]	.253[a]	4.15[c]	-.254[b]	.675/.604	1.66	.150
		(0.22)	(2.15)	(3.54)	(1.99)	(2.52)			
B3. Debt-Burden Measure Based on: DSY									
(B3.1)	-.93	1.04	.163[b]	.243[a]	--	-.109[a]	.687/.635	1.60	1.33
		(1.64)	(2.30)	(3.54)		(3.09)			
(B3.2)	-2.30	.684	.230[a]	.210[a]	4.63[c]	-.306[b]	.724/.664	1.53	.673
		(1.06)	(2.95)	(3.10)	(1.76)	(2.61)			
B4. Debt-Burden Measure based on : DSR									
(B4.1)	-.436	.820	.099	.270[a]	-	-.084[b]	.655/.597	1.67	1.34
		(1.25)	(1.54)	(3.86)		(2.54)			
(B4.2)	-1.39	.730	.161[c]	.239[a]	2.02	-.180	.668/.596	1.68	1.88
		(1.10)	(1.76)	(3.10)	(0.96)	(1.71)			

Except DD, all variables are defined in Table 3. DD is a dummy-variable measure of debt-burden, which equals 1 if the respective debt measure (DODY, DODR, DSY, or DSR) exceeds its sample mean ; zero otherwise. Relevant data sources are also referenced in Table 3.

[a] Statistically significant at the .01 level (two-tailed).
[b] Statistically significant at the .05 level (two-tailed).
[c] Statistically significant at the .10 level (two-tailed).

Table 5 Estimated Debt-Burden Effects on Growth

Debt Measure	Model: CIM*	Model: DIM**
DODY	-.0194 (.267)	-1.03 (35.3)
DODR	-.0059 (.330)	-.764 (24.7)
DSY	-.3464 (.336)	-1.29 (41.7)
DSR	-.0654 (.212)	-1.62 (52.4)

* The figures are based on the results in Table 3. The non-bracketed values are marginal effects and the bracketed figures are absolute partial elasticities at the sample means. The marginal effect are calculated as $b_5 + b_{32}k$ (see equation (5) of text), where b_5 and b_{32} are the coefficients of D and D*k, respectively, and k is measured at the sample mean. However, b_5 is assumed to be zero if: (1) the estimated coefficient is insignificant, or (2) the model containing D and D*k exhibit less goodness of fit than the alternative model containing D*k alone and the two coefficients are relatively imprecisely estimated. Given this criterion, the fuller model is selected only for the DODR-based measure.

** The figures are based on the results in Table 4. The non-bracketed values are the estimated effects of being classified highly indebted; the bracketed values are these effects expressed as percent of the mean sample GDP growth rate. The effects are computed as $ck + b_2'$ (see equation (9) of text), where b_2' and c are the coefficients of DD and DD*k, respectively, and k is measured at the sample mean. The fuller specification is used for all calculations except in the case of the DSR-based model (equation (B4.2)), where the coefficient of DD is not significantly different from zero and b_2' is, therefore, assumed to be zero.

Table 6 Summary Statistics of Regression Variables (Means with Standard Deviations in Parentheses, 1970-1986)

q		3.09 (2.64)
l		2.31 (0.50)
k		19.35 (7.04)
x		1.87 (5.73)
DODY		42.55 (26.20)
DODR		173.75 (118.32)
DSY		3.00 (2.30)
DSR		9.99 (4.57)
DD :	(DODY)	.413 (.501)
	(DODR)	.345 (.487)
	(DSY)	.379 (.494)
	(DSR)	.448 (.506)
DD*k:	(DODY)	9.27 (11.96)
	(DODR)	7.17 (11.06)
	(DSY)	9.09 (12.28)
	(DSR)	9.28 (11.59)

* See Tables 3 and 4 for definitions of variables and data sources.

Table 7 Zero-Order Correlation Coefficients Debt Variables vs. Other Relevant Variables*

	q	l	k	x
DODY	-.145	.176	.536[a]	.112
DODR	-.198	-.039	-.235	-.230
DSY	-.040	.341[c]	.636[a]	.181
DSR	-.276	.248	.141	-.157
DD : (DODY)	-.172	.280	.371[b]	-.028
(DODR)	-.110	-.016	.152	.049
(DSY)	-.100	.380[b]	.521[a]	.085
(DSR)	-.236	.240	.175	-.036

* See Tables 3 and 4 for definitions of variables and data sources.

[a] Statistically significant at the .01 level (two-tailed).

[b] Statistically significant at the .05 level (two-tailed).

[c] Statistically significant at the .10 level (two-tailed).

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