The Relationship of External Debt and Growth

Sudan’s Experience, 1975–1984

Y. Hossein Farzin
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The World Bank
Washington, D.C.
ABSTRACT

By using a simple open macro economic model and focusing on the external balance of a developing economy with structural rigidities, this paper derives an empirically testable condition to show when foreign borrowing can act as a "factor of growth" and when as a "burden on growth". The condition is then applied to the case of the Sudan to investigate whether or not its foreign borrowings during the 1975-84 period benefited economic growth, and to highlight some of the chief economic factors responsible for the outcome.
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INTRODUCTION

Foreign exchange scarcity has been well recognized as one of the major constraints on economic growth of many developing countries. One way of dealing with this constraint has been to resort to foreign borrowing either for the purpose of smoothening the consumption path in the face of transitory shocks or as a means of supplementing domestic savings to expand productive capacity and raise the long-run growth rate.

Since the sudden injection of petro-dollars in 1974, many developing countries have used the instrument of foreign borrowing to promote their economic growth. In fact, many of today's advanced industrial countries also resorted to foreign borrowing (especially after the World War II) to reconstruct and develop their economies. However, the wide spread and frequent debt reschedulings that have occurred since early 1980s have raised serious concern, at least in minds of policy makers in some of the heavily indebted countries, about the wisdom of adopting a "debt-led growth" strategy.

Unfortunately, faced with the imminent "debt crisis" so often heralded by the popular press, economic research has concentrated more on the short-run issues such as ability or willingness of a debtor country to honor its obligations than on the fundamental question of the relationship between foreign borrowing and long-term growth. Although there is wide
spread perception that the heavily indebted countries borrowed in excess of their economic capabilities, this has stemmed more from observation of numerous recent debt reschedulings than from a detailed examination of structural potentials and bottlenecks in those economies. The present paper attempts to accomplish the latter by quantitatively analyzing the impact of foreign borrowing on long-term growth with special reference to the Sudan during the 1975-84 period. The Sudan provides a useful case study because for many years it has exhibited a structural foreign exchange shortage which has acted to inhibit growth. In such a situation, the effect of foreign borrowing on growth is magnified.

The remainder of the paper is organized as follows. Section I presents a brief description of the Sudan's economic structure and especially her balance of payments and external debt situation over the 1975-84 period. Section II presents a simple open macroeconomic model of a developing economy with structural rigidities. By focusing on the external balance of such an economy, we derive a condition which shows when foreign borrowing can benefit long-run growth. The derived condition not only is well in accord with conventional view on a sound borrowing policy, it also has the desirable feature of embodying chief parameters that determine the actual performance of an economy. This allows one to obtain for each of those parameters the critical value that, ceteris peribus, should prevail in order for foreign borrowing to have a beneficial impact on growth. Section III tests the obtained condition for the case of the Sudan to investigate whether or not Sudan's foreign borrowings over the 1975-84 period favored her economic growth, and to highlight some of the key factors responsible for the outcome. Section IV contains some conclusions.
I. SUDAN'S BALANCE OF PAYMENTS SITUATION

With a GNP per capita of 440 dollars in 1982, Sudan ranked at the bottom of what the World Bank referred to as "lower middle-income countries". Yet by 1983, as its GNP per capita fell to 400 dollars it slipped into the "low-income economy" classification. In 1984 the figure dropped further to 340 dollars, partly due to continued drought. In fact, between 1975 and 1984 GDP showed little or no real growth while population grew at about 2.8 percent, so that Sudan's per capita real income declined by 2.8 percent a year on average. This highlights Sudan's present desperate economic situation and slim prospects for the future.

Sudan is primarily an agricultural economy. Agriculture accounts for over one third of GDP. Manufacturing sector barely accounts for 7 percent of GDP, and is mostly related to the processing of agricultural products. The rest, more than 50 percent of GDP since 1979, has come from a mushrooming services sector.

Due to the preponderance of agriculture in Sudan's non-services economy, exports consist almost entirely of primary sector products. In fact, about 95 percent of the country's export earnings are derived from agriculture, with the main item, cotton, representing half the value of exports in most years. The sharp decline in the world demand for cotton after 1976 and increased international competition (especially from China) have been a crippling blow to Sudan's export prospects. The share of exports in output averaged around 11 percent over the period.
Imports, on the other hand, are concentrated on goods not produced domestically. They fall into three categories of roughly equal importance: consumer goods (of which almost three-quarters are food products), intermediate goods (including petroleum accounting for half, and a whole range of other products dominated by metal manufactures and chemicals), and capital goods (two-thirds being machinery and the rest transport equipment).

Table 1 shows the large trade imbalance in Sudan. Throughout the period exports consistently amounted to less than half the value of imports, and between 1975 and 1982 trade balance seriously deteriorated. Although the external resources imbalance was slightly eased by sizeable private transfers from abroad (migrant workers' remittances) and, beginning in the 1980s, by significant amounts of foreign aid-in-grants, it was seriously aggravated by sharply increasing interest payments abroad. Consequently, the current account deficit rose steadily and reached the $1250 million in 1982. The mounting external finance gap could only be filled by resorting increasingly to medium- and long-term loans.

The cumulative effect of these chronic current account imbalances on the debt burden of Sudan created a unviable economic situation which is reflected clearly in the data presented in Table 2. The debt outstanding and disbursed (DOD), as a percentage of GNP, increased dramatically over the 1978-1984 period, from an already significant 24 percent in 1978 to a stunning 95 percent in 1984. Expressed as a percentage of exports, DOD more than doubled over the same period, and in 1982 was more than seven times larger than the total value of exports.
Table 1
SUDAN: Balance of Payments 1975-1984
(US$ million)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Exports (GNFS)</td>
<td>527</td>
<td>840</td>
<td>710</td>
<td>696</td>
<td>699</td>
<td>810</td>
<td>748</td>
<td>627</td>
<td>753</td>
<td>877</td>
</tr>
<tr>
<td>Imports (GNFS)</td>
<td>-1022</td>
<td>-1158</td>
<td>-1133</td>
<td>-1380</td>
<td>-1321</td>
<td>-1597</td>
<td>-1828</td>
<td>-2034</td>
<td>-1796</td>
<td>-1868</td>
</tr>
<tr>
<td>Trade Balance</td>
<td>-495</td>
<td>-528</td>
<td>-423</td>
<td>-684</td>
<td>-622</td>
<td>-787</td>
<td>-1080</td>
<td>-1407</td>
<td>-1033</td>
<td>-791</td>
</tr>
<tr>
<td>o/w: Interest Payments</td>
<td>-27</td>
<td>-31</td>
<td>-46</td>
<td>-53</td>
<td>-72</td>
<td>-70</td>
<td>-105</td>
<td>-190</td>
<td>-191</td>
<td>-389</td>
</tr>
<tr>
<td>Current Private Transfers</td>
<td>66</td>
<td>151</td>
<td>172</td>
<td>221</td>
<td>240</td>
<td>209</td>
<td>305</td>
<td>350</td>
<td>415</td>
<td>380</td>
</tr>
<tr>
<td>Official Transfers (Grants)</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>23</td>
<td>17</td>
<td>84</td>
<td>122</td>
<td>174</td>
<td>482</td>
<td>336</td>
</tr>
<tr>
<td>Direct Investment</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>60</td>
<td>70</td>
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<tr>
<td>Total Borrowing (Net MALT)</td>
<td>406</td>
<td>501</td>
<td>285</td>
<td>288</td>
<td>648</td>
<td>688</td>
<td>703</td>
<td>638</td>
<td>283</td>
<td>178</td>
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<tr>
<td>(Including IMF Credit)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Change in Reserves</td>
<td>67</td>
<td>67</td>
<td>6</td>
<td>78</td>
<td>-50</td>
<td>75</td>
<td>228</td>
<td>518</td>
<td>220</td>
<td>-141</td>
</tr>
<tr>
<td>(- Indicates Increase)</td>
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<td></td>
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</tr>
</tbody>
</table>

Memo. Item:

Current Account/GDP Ratio -12.2 -9.2 -5.0 -6.7 -5.4 -10.5 -12.3 -18.4 -13.1 -12.9


### Table 2
**SUDAN: External Debt Ratios, 1975-1984**
(Percentage)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Debt (DOD) to GNP</th>
<th>Total Debt Service to GNP</th>
<th>Total Interest Payments to GNP</th>
<th>Memo. Item: Actual Debt Service Payments to GNP</th>
<th>Memo. Item: Actual Interest Payments to GNP</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1975</td>
<td>26.8</td>
<td>23.5</td>
<td>24.5</td>
<td>23.7</td>
<td>23.4</td>
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<tr>
<td>1976</td>
<td>193.0</td>
<td>153.0</td>
<td>233.6</td>
<td>322.6</td>
<td>342.6</td>
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<tr>
<td>1977</td>
<td>20.4</td>
<td>20.8</td>
<td>28.8</td>
<td>38.8</td>
<td>48.8</td>
</tr>
<tr>
<td>1978</td>
<td>40.8</td>
<td>49.0</td>
<td>63.0</td>
<td>49.0</td>
<td>60.0</td>
</tr>
<tr>
<td>1979</td>
<td>30.0</td>
<td>51.7</td>
<td>73.5</td>
<td>51.7</td>
<td>70.8</td>
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<tr>
<td>1980</td>
<td>85.7</td>
<td>89.7</td>
<td>97.7</td>
<td>89.7</td>
<td>95.7</td>
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<tr>
<td>1981</td>
<td>78.1</td>
<td>94.6</td>
<td>94.6</td>
<td>94.6</td>
<td>94.6</td>
</tr>
<tr>
<td>1982</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
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<tr>
<td>1983</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
</tr>
<tr>
<td>1984</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
<td>78.1</td>
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### Table 3
**SUDAN: External Debt Composition, 1975-1984**
(As Percentage of DOD)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Debt (DOD) (million US$)</th>
<th>Official Creditors</th>
<th>Multilateral</th>
<th>IBRD</th>
<th>IDA</th>
<th>IMF</th>
<th>Bilateral</th>
<th>Private Creditors</th>
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<th>Financial Markets</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>1373</td>
<td>65.2</td>
<td>21.7</td>
<td>5.4</td>
<td>2.5</td>
<td>10.0</td>
<td>43.5</td>
<td>34.8</td>
<td>15.1</td>
<td>19.7</td>
</tr>
<tr>
<td>1976</td>
<td>1770</td>
<td>67.7</td>
<td>20.4</td>
<td>3.8</td>
<td>4.0</td>
<td>7.8</td>
<td>47.3</td>
<td>32.3</td>
<td>14.8</td>
<td>17.6</td>
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<tr>
<td>1977</td>
<td>2068</td>
<td>67.5</td>
<td>18.8</td>
<td>2.9</td>
<td>4.6</td>
<td>5.6</td>
<td>48.7</td>
<td>32.5</td>
<td>17.0</td>
<td>15.5</td>
</tr>
<tr>
<td>1978</td>
<td>2454</td>
<td>65.2</td>
<td>21.1</td>
<td>2.2</td>
<td>5.2</td>
<td>6.8</td>
<td>44.1</td>
<td>34.8</td>
<td>13.8</td>
<td>21.5</td>
</tr>
<tr>
<td>1979</td>
<td>3333</td>
<td>78.5</td>
<td>17.0</td>
<td>1.5</td>
<td>4.6</td>
<td>6.1</td>
<td>61.5</td>
<td>34.8</td>
<td>6.8</td>
<td>21.0</td>
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<tr>
<td>1980</td>
<td>4208</td>
<td>80.5</td>
<td>25.2</td>
<td>1.1</td>
<td>5.0</td>
<td>10.4</td>
<td>55.3</td>
<td>19.5</td>
<td>5.1</td>
<td>14.6</td>
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<tr>
<td>1981</td>
<td>5088</td>
<td>72.1</td>
<td>24.2</td>
<td>0.9</td>
<td>6.0</td>
<td>11.2</td>
<td>47.9</td>
<td>27.9</td>
<td>3.5</td>
<td>14.4</td>
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<tr>
<td>1982</td>
<td>5877</td>
<td>78.5</td>
<td>24.2</td>
<td>0.8</td>
<td>6.2</td>
<td>10.2</td>
<td>54.7</td>
<td>21.1</td>
<td>2.1</td>
<td>19.0</td>
</tr>
<tr>
<td>1983</td>
<td>6355</td>
<td>84.1</td>
<td>24.1</td>
<td>0.7</td>
<td>6.2</td>
<td>11.2</td>
<td>60.0</td>
<td>15.9</td>
<td>1.6</td>
<td>14.4</td>
</tr>
<tr>
<td>1984</td>
<td>7105</td>
<td>84.5</td>
<td>23.5</td>
<td>0.6</td>
<td>6.8</td>
<td>9.8</td>
<td>61.0</td>
<td>15.5</td>
<td>0.7</td>
<td>14.9</td>
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</table>

**SOURCE:** World Debt Tables, 1984-85 editions, World Bank, Sudan: Recent Economic Developments, Various Issues, IMF.
Sudan's external debt crisis did not arise merely from a need to offset temporary external shocks such as shortfalls in exports or increases in import costs; adverse domestic policies contributed to it importantly. In fact, after 1973, Sudan launched an ambitious development program which was expected, from its inception, to be financed largely by external loans. However, the situation did deteriorate rapidly in the early 1980s with the prevalence of high real interest rates, declining terms of trade, sluggish export demand, and the downturn in commodity prices.

Heavy foreign borrowing combined with very poor economic performance (particularly in the foreign trade sector) and unfavorable external economic conditions resulted in sizeable debt service obligations which climbed to over 20 percent of GNP in 1983 and 1984. Of course, Sudan was unable to meet her repayment obligations and began to build up debt service arrears as early as in 1977.3/

Rapid accumulation of arrears necessitated a series of debt reschedulings on increasingly concessional terms in 1979, 1981, 1982, 1983 and 1984. However, despite these successive reschedulings, the stock of arrears stood at about US$300 million by end 1984, and that of the official medium- and long-term debt at about US$7 billion.
Table 3, shows the change in composition of Sudanese debt over the period. Debt owed to official creditors rose from 65 percent of DOD in 1975 to nearly 85 percent in 1984, reflecting largely a sharp increase in bilateral credits and loans mostly from the United States and Saudi Arabia, Sudan's principal creditors. Loans from private creditors shrank accordingly after 1978 mainly as a result of the virtual disappearance of suppliers credits. In fact, new commitments from private sources were virtually cut off after 1982.

Clearly, the accumulation of external debt, even if incurred to finance economic development, can potentially impede economic growth if the borrowed amounts are massive and are allocated to uses which, relative to repayment terms, do not generate adequate economic return in a timely fashion. In such a situation, debt service payments can take a heavy toll of the national output and result in a shortage of domestic resources needed to maintain and expand productive capacity, thereby inhibiting economic growth or even leading to an economic decline. Sudan's poor economic performance in the face of massive foreign borrowing during the period under study naturally raises several important questions: Did Sudan incur too much foreign debt? Were the types and repayment terms of the loans that Sudan undertook suitable to its needs and economic realities? Were the borrowed resources used prudently to promote economic growth? To be able to answer these and other related questions, which are central to formulating a policy strategy of long-run growth-cum-debt, requires a better understanding of the relationship between foreign debt and long-run growth. The rest of the paper is devoted to an investigation of this relationship for the particular case of Sudan during the 1975-84 period.
II. THE MODEL 4/

To reflect some of the prominent features of Sudan's economic structure presented in the previous section, and in order to concentrate on the foreign debt-growth relationship, it would seem appropriate to consider the Sudanese economy as a simple open developing economy with a domestic output $X$ of a single (agricultural) commodity whose production requires, in fixed proportions, a capital good $K$, an imported intermediate material $M_i$, and labor. For the specific case of Sudan we may assume that conditions of labor surplus prevail, so that the supply of unskilled labor is taken to be infinitely elastic. The aggregate production function can then be stated as (for notational convenience all time-subscripts are suppressed)

$$x = \min \left\{ \frac{1}{\sigma} K, \frac{1}{a_i} M_i \right\}$$

where $\sigma$ is the constant capital-output ratio, which also equals the incremental capital-output ratio (ICOR), and $a_i$ is the imported intermediate material requirement per unit of output. In a capital-constrained economy like Sudan's, aggregate domestic output is thus proportional to the size of capital stock, so that the growth rate of the economy is given by

$$\dot{\sigma} = \frac{\dot{x}}{x} = \frac{\dot{K}}{K} = \frac{I}{K} = \frac{1}{\sigma} \frac{I}{x}$$

assuming for simplicity no depreciation of the capital stock. We can further specify that a fraction $\theta$ of total capital formation $I$ is
supplied by domestic output and the rest, \((1-\Theta)\) must be imported. Thus, the economy's productive capital is given by:

\[
K = \min \{ \frac{1}{\Theta} K_d, \frac{1}{1-\Theta} K_f \}
\]

One can think of the domestic good as an elementary equipment, and the imported capital good as a more technologically sophisticated one.

Foreign trade possibilities are open to this economy. It is assumed to export a share \(\xi\) of national output at the domestic price \(p\). Imports consist of a capital good \((K_f)\), an intermediate good \((M_i)\), and a consumer good \((M_c)\) at prices \(P_k\), \(P_i\) and \(P_c\) respectively.

On the capital account side, this economy receives foreign transfers, \(F\), in the form of official grants and remittances from migrant workers abroad, and incurs some borrowing, \(B\), at an interest rate \(r\). At any given point in time the country's stock of debt is given by \(D\). Interpreting \(B\) as borrowing net of amortization, one has

\[
B = \dot{D} = g_d D
\]

where \(g_d = D/D\) is the growth rate of debt. Foreign borrowing and transfers as well as import prices are denominated in the foreign currency (taken here to be US$), which can be converted into the local currency through the exchange rate, \(e\) (LS/US$).

External balance is characterized by the equality of the current and capital accounts, which in turn are the sum of the trade deficit and
interest payments on the debt and the sum of net foreign borrowing and transfers respectively. Using the assumptions and notation set above, we can represent the balance of payments equilibrium as:

\[ eB + eF = \{ eP^*_t q_t X + eP^*_k (1-\theta) I + eP^*_c M_c - P E \Xi^2 \} + reD \]  

Implicit here are the assumptions of no change in foreign reserves and no accumulation of arrears, so that the current account deficit has to be financed by borrowing.

Noting that in a steady-state situation the debt-output ratio remains constant \( \frac{5}{5} \), so that \( g_d = g \), dividing equation (5) through by \( PX \), and solving for the growth rate gives

\[ g = \left[ \frac{e - q^*_d q^*_t - q^*_e q^*_c + q f - rd}{q^*_k (1-\theta) \sigma - 2d} \right] \]

where \( f = F/X \), \( d = D/X \) and \( a_c = M_c/X \) are the ratios of foreign transfers, foreign debt, and imported consumer goods to domestic production, respectively, and \( q = \frac{\epsilon}{\hat{\beta}} \) is the real exchange rate.
Finally, as we want to address issues related to the effect of additional borrowing on growth, consider the expression for the derivative of \( g \) with respect to \( d \) given by

\[
\frac{\partial g}{\partial d} = q \left[ E - \frac{q}{\epsilon} \frac{\ddot{q}}{c} - \frac{q}{\epsilon} \frac{\dot{q}}{c} + qf - rq \frac{\dot{q}}{k} (1 - \sigma) \sigma \right] / \left[ \frac{q}{\epsilon} \frac{\dot{q}}{k} (1 - \sigma) \sigma - g \right]^2
\]

This is a marginal condition that states how the steady state growth rate will change when foreign debt, as a fraction of GDP, is increased. The interpretation of equation (7) is simple: increased debt, on the one hand, contributes to the growth rate by financing imports of capital goods needed for expanding the productive capacity, and on the other hand, it adds to the interest payments imputed to imported capital goods, thereby increasing (reducing) the current account deficit (surplus), and, ceteris paribus, reducing the foreign exchange available to finance capital goods imports in subsequent periods. (This latter effect is reflected by the term \( rq \frac{\dot{q}}{k} (1 - \sigma) \sigma \) in equation (7)). So, in order for increased debt to have a favorable impact on the long-run steady-state growth rate, it must have a net positive contribution to the current account balance, that is

\[
\frac{\partial g}{\partial d} > 0 \quad \text{if} \quad E - \frac{q}{\epsilon} \frac{\ddot{q}}{c} - \frac{q}{\epsilon} \frac{\dot{q}}{c} + qf > rq \frac{\dot{q}}{k} (1 - \sigma) \sigma
\]
One can provide a more conventional interpretation of equation (7) by noting from equation (6) that

\[ \varepsilon - \varphi \tilde{p}_t \tilde{q}_t - \varphi \tilde{p}_t \tilde{q}_t + \varphi f = \varphi (\varphi \tilde{p}_t (1-\vartheta) - \varphi d) + \varphi \tilde{d} \]

Substituting this in (7) gives

\[ (7a) \quad \frac{\partial g}{\partial d} = (\varepsilon - \varphi) / [\tilde{p}_t (1-\vartheta) - d] \]

Similarly, it can be verified that

\[ (7b) \quad \frac{\partial^2 g}{\partial d^2} = \frac{\partial g}{\partial d} / [\tilde{p}_t (1-\vartheta) - d] \]

Now, the denominator of (7b) is positive if \( d < \tilde{p}_t (1-\vartheta) \sigma \), which, upon using (1) and (3), can also be written as \( D < \tilde{p}_t \sigma \), i.e. at any point in time the stock of foreign debt should not exceed the stock value of imported capital good. This is in fact a solvency condition which, as a necessary condition for continued access to foreign borrowing, can be taken to be always satisfied.

It then follows from (7a) that

\[ (8') \quad \frac{\partial g}{\partial d} > 0 \quad \text{as} \quad g > \gamma \]
This is the conventional-wisdom rule of foreign borrowing which states that increased foreign debt can lead to an increase (decrease) in the growth rate of the borrowing economy if the borrowed amounts are so utilized as to generate a growth rate higher (lower) than the interest rate to be paid on the debt incurred.\footnote{It is also noted that so long as the borrowed amounts can yield a growth rate equal to the interest rate increasing (or decreasing) the debt/output ratio $d$, of course subject to the solvency condition $D < \frac{\mathbf{P}^* k}{\mathbf{r}^*}$, will not affect the growth rate of the economy.}

Noting from (7b) that $\frac{\partial g}{\partial d} < 0$ as $\frac{\partial g}{\partial d} < 0$, we can depict the steady-state relationship between $d$ and $g$ as in Figure 1.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Figure 1}
\end{figure}

Since we would like to highlight the key economic factors responsible for the impact of increased foreign debt on the long-run growth rate, it would
interest payments on the debt and the sum of net foreign borrowing and transfers respectively. Using the assumptions and notation set above, we can represent the balance of payments equilibrium as:

\[ eB + eF = \{ eP \alpha_c X + eP (1-\theta)I + eP M_c - PEX \} + rD \]  

(5)

Implicit here are the assumptions of no change in foreign reserves and no accumulation of arrears, so that the current account deficit has to be financed by borrowing.

Noting that in a steady-state situation the debt-output ratio remains constant \( \frac{g_d}{g} \), so that \( g_d = g \), dividing equation (5) through by \( PX \), and solving for the growth rate gives

\[ g = \left[ e - qP_c a_c - qP_c a_c + qf - rqd \right] / \left[ qP_c (1-\theta)\sigma - qd \right] \]

(6)

where \( f = F/X \), \( d = D/X \) and \( a_c = Mc/X \) are the ratios of foreign transfers, foreign debt, and imported consumer goods to domestic production, respectively, and \( q = \frac{e}{P} \) is the real exchange rate.
Finally, as we want to address issues related to the effect of additional borrowing on growth, consider the expression for the derivative of $g$ with respect to $d$ given by

$$
\frac{dg}{dd} = q\left\{ \varepsilon - q \tilde{P}_t^{*} \alpha_t - q \tilde{P}_c^{*} q + qf - r q \tilde{P}_k^{*} (1-\theta)\sigma \right\} / [q \tilde{P}_k^{*} (1-\theta)\sigma - q d]^2
$$

This is a marginal condition that states how the steady state growth rate will change when foreign debt, as a fraction of GDP, is increased. The interpretation of equation (7) is simple: increased debt, on the one hand, contributes to the growth rate by financing imports of capital goods needed for expanding the productive capacity, and on the other hand, it adds to the interest payments imputed to imported capital goods, thereby increasing (reducing) the current account deficit (surplus), and, ceteris paribus, reducing the foreign exchange available to finance capital goods imports in subsequent periods. (This latter effect is reflected by the term $r q \tilde{P}_k^{*} (1-\theta)\sigma$ in equation (7)). So, in order for increased debt to have a favorable impact on the long-run steady-state growth rate, it must have a net positive contribution to the current account balance, that is

$$
\frac{dg}{dd} > 0 \quad \text{if} \quad \varepsilon - q \tilde{P}_t^{*} \alpha_t - q \tilde{P}_c^{*} q + qf > r q \tilde{P}_k^{*} (1-\theta)\sigma
$$
One can provide a more conventional interpretation of equation (7) by noting from equation (6) that

\[ e - \frac{q}{\alpha} + f = \gamma \left[ \frac{\pi}{\alpha} (1 - \theta) \sigma + \nu \right] + \nu \alpha \]

Substituting this in (7) gives

\[ \frac{\partial g}{\partial d} = \frac{(e - \nu)}{[\frac{\pi}{\alpha} (1 - \theta) \sigma + \nu]} \]

Similarly, it can be verified that

\[ \frac{\partial^2 g}{\partial d^2} = \frac{\partial g}{\partial d} / \left[ \frac{\pi}{\alpha} (1 - \theta) \sigma + \nu \right] \]

Now, the denominator of (7b) is positive if \( \frac{\partial g}{\partial d} \) which, upon using (1) and (3), can also be written as \( D < \frac{\pi}{\alpha} \frac{K}{\sigma} \), i.e. at any point in time the stock of foreign debt should not exceed the stock value of imported capital good. This is in fact a solvency condition which, as a necessary condition for continued access to foreign borrowing, can be taken to be always satisfied.

It then follows from (7a) that

\[ \frac{\partial g}{\partial d} \to 0 \quad \text{as} \quad g \geq \gamma \]
This is the conventional-wisdom rule of foreign borrowing which states that increased foreign debt can lead to an increase (decrease) in the growth rate of the borrowing economy if the borrowed amounts are so utilized as to generate a growth rate higher (lower) than the interest rate to be paid on the debt incurred. It is also noted that so long as the borrowed amounts can yield a growth rate equal to the interest rate increasing (or decreasing) the debt/output ratio \( d \), of course subject to the solvency condition \( D < \frac{P^*}{K_f} \), will not affect the growth rate of the economy.

Noting from (7b) that \( \frac{\partial \tilde{g}}{\partial d} \approx 0 \) as \( \frac{\partial \tilde{g}}{\partial d} \approx 0 \), we can depict the steady-state relationship between \( d \) and \( g \) as in Figure 1.

Since we would like to highlight the key economic factors responsible for the impact of increased foreign debt on the long-run growth rate, it would
be more appropriate to concentrate on condition (8), rather than (8'), in the analyses that follow. From condition (8) it is immediately apparent that, everything else being equal, increased foreign borrowing is more likely to foster the growth rate if (a) the share of exports in aggregate output is larger; (b) interest rate on foreign debt is lower; (c) the ICOR is smaller; (d) the share of imported capital goods in domestic capital formation is smaller; (e) the per-unit-of-output requirement of imported intermediate input is smaller; (f) the share of imported consumer goods in GDP is lower; and (g) the ratio of foreign transfers to GDP is higher.
III. EMPIRICAL TEST OF DEBT-GROWTH CONDITION FOR SUDAN

In this section we use condition (8) to empirically test whether Sudan's foreign borrowing policy over the 1975-84 period benefited her economic growth, and to highlight some of the key factors responsible for the outcome.

The value of the key structural parameters for Sudan are given in Table 4. The year-to-year calculated values of $\sigma$ showed considerable volatility (including negative values in some years) and hence were of little use. To have a stable value of $\sigma$ that would more reliably reflect the output contribution of domestic investment, an econometric estimate was obtained for the entire period from a simple aggregate output-investment relationship. The estimate of $\sigma$ turned out to be around 6.7, which is used in the empirical test of condition (8) reported in Table 5.
Table 4

SUDAN: Values of Key Economic Parameters, 1975-84

<table>
<thead>
<tr>
<th>Year</th>
<th>( \epsilon )</th>
<th>( \theta )</th>
<th>( q )</th>
<th>( p_i^* )</th>
<th>( p_c^* )</th>
<th>( a_i )</th>
<th>( a_c )</th>
<th>( f )</th>
<th>( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>0.115</td>
<td>0.49</td>
<td>0.949</td>
<td>0.583</td>
<td>0.062</td>
<td>0.664</td>
<td>0.058</td>
<td>0.015</td>
<td>0.064</td>
</tr>
<tr>
<td>1976</td>
<td>0.148</td>
<td>0.55</td>
<td>0.977</td>
<td>0.628</td>
<td>0.047</td>
<td>0.664</td>
<td>0.038</td>
<td>0.028</td>
<td>0.047</td>
</tr>
<tr>
<td>1977</td>
<td>0.110</td>
<td>0.52</td>
<td>0.915</td>
<td>0.536</td>
<td>0.037</td>
<td>0.468</td>
<td>0.019</td>
<td>0.027</td>
<td>0.064</td>
</tr>
<tr>
<td>1978</td>
<td>0.102</td>
<td>0.29</td>
<td>0.652</td>
<td>0.541</td>
<td>0.037</td>
<td>0.366</td>
<td>0.017</td>
<td>0.029</td>
<td>0.042</td>
</tr>
<tr>
<td>1979</td>
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<td>0.61</td>
<td>0.698</td>
<td>0.600</td>
<td>0.046</td>
<td>0.433</td>
<td>0.018</td>
<td>0.038</td>
<td>0.046</td>
</tr>
<tr>
<td>1980</td>
<td>0.115</td>
<td>0.56</td>
<td>0.721</td>
<td>0.714</td>
<td>0.060</td>
<td>0.440</td>
<td>0.030</td>
<td>0.043</td>
<td>0.068</td>
</tr>
<tr>
<td>1981</td>
<td>0.094</td>
<td>0.59</td>
<td>0.638</td>
<td>0.638</td>
<td>0.063</td>
<td>0.638</td>
<td>0.033</td>
<td>0.064</td>
<td>0.074</td>
</tr>
<tr>
<td>1982</td>
<td>0.085</td>
<td>0.48</td>
<td>0.728</td>
<td>0.692</td>
<td>0.067</td>
<td>0.670</td>
<td>0.044</td>
<td>0.070</td>
<td>0.078</td>
</tr>
<tr>
<td>1983</td>
<td>0.098</td>
<td>0.56</td>
<td>0.766</td>
<td>0.736</td>
<td>0.067</td>
<td>0.498</td>
<td>0.084</td>
<td>0.128</td>
<td>0.065</td>
</tr>
<tr>
<td>1984</td>
<td>0.115</td>
<td>0.48</td>
<td>0.819</td>
<td>0.622</td>
<td>0.068</td>
<td>0.669</td>
<td>0.027</td>
<td>0.114</td>
<td>0.069</td>
</tr>
</tbody>
</table>

NOTES:

- \( \sigma = 6.68 \) (estimated from output-investment relation specified in Footnote 2/)
- \( \epsilon = \text{Value of exports/GDP (in constant 1981 prices)} \)
- \( \theta = 1 \) (value of capital goods imports/gross fixed capital formation) (in constant 1981 prices)
- \( q = e/p = \text{(exchange rate £/US$)/(GDP Deflator)} \)
- \( p_i^* = \text{price of imported intermediate goods (in US$)} \)
- \( a_i = \text{(value of intermediate goods imports)/GDP (in constant 1981 prices)} \)
- \( p_c^* = \text{price of imported capital goods (in US$)} \)
- \( a_c = \text{(value of consumer goods imports)/GDP (in constant 1981 prices)} \)
- \( f = \text{(private transfers + official grants)/GDP (in constant 1981 prices)} \)

Based on condition (8), it is evident from Table 5 that Sudan's economic growth did not benefit from additional borrowing in any of the years in the period except for 1976 when exports performance was at record high (nearly 15 percent of GDP) and probably 1983-1984 when in addition to substantial cuts in imports (about 18 percent) new lending by private creditors ceased and very concessional debt reschedulings (particularly in forms of grants) were granted by official creditors.

In the remainder of this section we shall examine the debt-growth condition (8) in more detail to shed some light on the chief factors underlying Sudan's failure to use foreign borrowing profitably to foster her economic growth. To this end, we investigate on a *ceteris paribus* basis each of the factors in condition (8) separately.

(a) **The interest rate** \( r \):

Condition (8) can be rearranged to obtain the following condition for \( r \), the average interest rate on foreign loans

\[
\frac{\partial g}{\partial r} > 0 \text{ if } r < \tau^* = \left[ e - \frac{g}{q} \dot{q} - \frac{g}{q} \ddot{q} + zf \right] \frac{g}{\Theta (1-\Theta)}
\]

(9)

This condition states that additional borrowing will be conducive to growth as long as the interest rate does not exceed a ceiling (maximum affordable)
be more appropriate to concentrate on condition (8), rather than (8'), in the analyses that follow. From condition (8) it is immediately apparent that, everything else being equal, increased foreign borrowing is more likely to foster the growth rate if (a) the share of exports in aggregate output is larger; (b) interest rate on foreign debt is lower; (c) the ICOR is smaller; (d) the share of imported capital goods in domestic capital formation is smaller; (e) the per-unit-of-output requirement of imported intermediate input is smaller; (f) the share of imported consumer goods in GDP is lower; and (g) the ratio of foreign transfers to GDP is higher.
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Table 4

SUDAN: Values of Key Economic Parameters, 1975-84

<table>
<thead>
<tr>
<th>Years</th>
<th>$\varepsilon$</th>
<th>$\theta$</th>
<th>$q$</th>
<th>$p_i^*$</th>
<th>$q_i$</th>
<th>$q_e$</th>
<th>$q_c^*$</th>
<th>$q_a$</th>
<th>$q_f$</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>0.115</td>
<td>0.49</td>
<td>0.949</td>
<td>0.883</td>
<td>0.002</td>
<td>0.664</td>
<td>0.035</td>
<td>0.815</td>
<td>0.054</td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>0.146</td>
<td>0.55</td>
<td>0.897</td>
<td>0.628</td>
<td>0.047</td>
<td>0.664</td>
<td>0.030</td>
<td>0.828</td>
<td>0.047</td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>0.115</td>
<td>0.52</td>
<td>0.815</td>
<td>0.636</td>
<td>0.037</td>
<td>0.455</td>
<td>0.019</td>
<td>0.827</td>
<td>0.054</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>0.102</td>
<td>0.29</td>
<td>0.632</td>
<td>0.641</td>
<td>0.037</td>
<td>0.365</td>
<td>0.017</td>
<td>0.829</td>
<td>0.042</td>
<td></td>
</tr>
<tr>
<td>1979</td>
<td>0.102</td>
<td>0.51</td>
<td>0.659</td>
<td>0.600</td>
<td>0.046</td>
<td>0.433</td>
<td>0.018</td>
<td>0.838</td>
<td>0.046</td>
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<tr>
<td>1980</td>
<td>0.115</td>
<td>0.55</td>
<td>0.721</td>
<td>0.714</td>
<td>0.060</td>
<td>0.446</td>
<td>0.030</td>
<td>0.843</td>
<td>0.068</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>0.084</td>
<td>0.59</td>
<td>0.630</td>
<td>0.630</td>
<td>0.063</td>
<td>0.630</td>
<td>0.033</td>
<td>0.864</td>
<td>0.074</td>
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</tr>
<tr>
<td>1982</td>
<td>0.086</td>
<td>0.48</td>
<td>0.720</td>
<td>0.692</td>
<td>0.067</td>
<td>0.676</td>
<td>0.044</td>
<td>0.870</td>
<td>0.070</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>0.098</td>
<td>0.48</td>
<td>0.706</td>
<td>0.798</td>
<td>0.067</td>
<td>0.498</td>
<td>0.034</td>
<td>0.128</td>
<td>0.055</td>
<td></td>
</tr>
<tr>
<td>1984</td>
<td>0.115</td>
<td>0.48</td>
<td>0.819</td>
<td>0.622</td>
<td>0.068</td>
<td>0.639</td>
<td>0.027</td>
<td>0.114</td>
<td>0.069</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:

$\sigma = 6.68$ (estimated from output-investment relation specified in Footnote 7/)

$\varepsilon$ = Value of exports/GDP (in constant 1981 prices)

$\theta = 1$ (value of capital goods imports/gross fixed capital formation) (in constant 1981 prices)

$q = e/p = (exchange\ rate\ £/US\$)/(GDP\ Deflator)$

$p_i^*$ = price of imported intermediate goods (in US$)

$a_i = (value\ of\ intermediate\ goods\ imports)/GDP\ (in\ constant\ 1981\ prices)$

$p_c^*$ = price of imported capital goods (in US$)

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$f = (private\ transfers + official\ grants)/GDP\ (in\ constant\ 1981\ prices)$

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(a) The interest rate $r$:

Condition (8) can be rearranged to obtain the following condition for $r$, the average interest rate on foreign loans

$$\frac{\partial g}{\partial d} > 0 \text{ if }$$

$$r < r' = \left[ e - \frac{\partial^2 q}{\partial x^2} - \frac{\partial^2 q}{\partial x^2} + \frac{\partial f}{\partial k} \right] \frac{\gamma k}{(1-\theta)\sigma}$$

(9)

This condition states that additional borrowing will be conducive to growth as long as the interest rate does not exceed a ceiling (maximum affordable)
TABLE 5
SUDAN: TEST OF CONDITION (8) FOR 1975-84

<table>
<thead>
<tr>
<th>Years</th>
<th>Left hand side of (8)</th>
<th>Right hand side of (8)</th>
<th>The Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>0.034</td>
<td>0.101</td>
<td>-0.067</td>
</tr>
<tr>
<td>1976</td>
<td>0.097</td>
<td>0.083</td>
<td>0.014</td>
</tr>
<tr>
<td>1977</td>
<td>0.087</td>
<td>0.099</td>
<td>-0.012</td>
</tr>
<tr>
<td>1978</td>
<td>0.077</td>
<td>0.084</td>
<td>-0.007</td>
</tr>
<tr>
<td>1979</td>
<td>0.076</td>
<td>0.106</td>
<td>-0.030</td>
</tr>
<tr>
<td>1980</td>
<td>0.068</td>
<td>0.109</td>
<td>-0.041</td>
</tr>
<tr>
<td>1981</td>
<td>0.052</td>
<td>0.127</td>
<td>-0.075</td>
</tr>
<tr>
<td>1982</td>
<td>0.044</td>
<td>0.139</td>
<td>-0.095</td>
</tr>
<tr>
<td>1983</td>
<td>0.125</td>
<td>0.119</td>
<td>0.006</td>
</tr>
<tr>
<td>1984</td>
<td>0.134</td>
<td>0.129</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Source: Author's Calculations based on the estimates presented in Table 4.

TABLE 6.
SUDAN: INTEREST RATES ON FOREIGN LOANS: CRITICAL vs ACTUAL RATES (percent)

<table>
<thead>
<tr>
<th></th>
<th>r*</th>
<th>ravg</th>
<th>r*-ravg</th>
<th>roff</th>
<th>r*-roff</th>
<th>rimf</th>
<th>r*-rimf</th>
<th>rpv</th>
<th>r*-rpvt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>1.8</td>
<td>5.4</td>
<td>-3.6</td>
<td>2.7</td>
<td>-0.9</td>
<td>5.1</td>
<td>-3.3</td>
<td>7.7</td>
<td>-5.9</td>
</tr>
<tr>
<td>1976</td>
<td>5.5</td>
<td>4.7</td>
<td>0.8</td>
<td>3.5</td>
<td>2.0</td>
<td>5.6</td>
<td>-0.1</td>
<td>7.9</td>
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<tr>
<td>1977</td>
<td>4.7</td>
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<td>-0.4</td>
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<td>8.0</td>
<td>-4.1</td>
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<td>1979</td>
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<td>4.6</td>
<td>-1.3</td>
<td>4.3</td>
<td>-1.0</td>
<td>5.9</td>
<td>-2.6</td>
<td>6.2</td>
<td>-2.9</td>
</tr>
<tr>
<td>1980</td>
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<td>5.8</td>
<td>-2.2</td>
<td>3.9</td>
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<td>7.0</td>
<td>-3.4</td>
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<tr>
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<td>4.9</td>
<td>-1.9</td>
<td>7.7</td>
<td>-4.7</td>
<td>17.6</td>
<td>-14.6</td>
</tr>
<tr>
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<td>7.0</td>
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<td>4.6</td>
<td>-2.4</td>
<td>9.4</td>
<td>-7.2</td>
<td>15.8</td>
<td>-10.0</td>
</tr>
<tr>
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<td>5.5</td>
<td>0.3</td>
<td>5.5</td>
<td>0.3</td>
<td>8.9</td>
<td>-3.1</td>
<td>15.8</td>
<td>-10.0</td>
</tr>
<tr>
<td>1984</td>
<td>7.2</td>
<td>6.9</td>
<td>0.3</td>
<td>5.2</td>
<td>0.2</td>
<td>9.0</td>
<td>-1.8</td>
<td>15.8</td>
<td>-8.6</td>
</tr>
</tbody>
</table>

rate, \( r^* \), given by the right-hand side of (9). Otherwise, the foreign exchange lost due to debt service payments will over offset any contribution of increased borrowing to growth.

Table 6 shows the critical values of \( r^* \) estimated from the data for Sudan, the actual weighted-average interest rate on Sudan’s debt, and the difference between these two rates for each year in the period. It is observed that, the actual interest rates on Sudan’s debt exceeded the maximum affordable rates \( r^* \) almost consistently throughout the period up until 1982. In these years Sudan borrowed at relatively high interest rates at the expense of accumulating a heavy debt service burden and without adequate increase in national output.

We have further decomposed the average interest rate into an average rate on loans from official sources (including multilateral loans from international organizations and bilateral loans from governments) and an average rate on loans from private creditors (including loans from suppliers and financial markets). These rates, and their differences from \( r^* \), are also shown in Table 6. A telling picture emerges from the table. Loans from private creditors were far beyond the ability of Sudanese economy to afford and should not therefore have been undertaken. Loans from official sources were affordable (or about affordable) for every year except for 1981 and 1982 when the interest rates on official loans, at 4.9 percent and 4.6 percent respectively, were about 1.9 and 2.4 percentage points above the rates that would have allowed Sudan to benefit from them.

It is important, however, to note, that \( r_{\text{off}} \) represents the average interest rate on a blend of both concessional and non-concessional loans
from official sources. Although the composition of the official debt as a whole might have been conducive to growth, it is nevertheless the case that the non-concessional official loans to Sudan excessively burdened the economy. For instance, it is seen from Table 6 that the average interest rate on loans from the International Monetary Fund (denoted by \( r_{\text{IMF}} \)), far exceeded the ceiling rates \( r^* \) in all of the years in the period. So, one cannot escape from the fact that IMF loans, like loans from private creditors, while probably mitigated Sudan's short-term balance of payments difficulties, imposed a drag on her longer-term growth capacity.

Additional borrowing would have been profitable if the stimuli that it provided to the economy was more than sufficient to finance the increased debt burden. Unfortunately, given Sudan's drastically poor economic performance over the last decade, the expensive terms of borrowing from the private creditors, the IMF, and some bilateral source have led to such heavy debt service burden that leave very little room for growth in the near future. The obvious policy implication is that a prudent foreign borrowing strategy for Sudan would seek to substitute official concessional loans (especially grants) for other forms of credits, and to refrain from any non-concessional borrowing, particularly private credits.

(b) The structural parameters: \( \sigma \), \( a_i \) and \( \theta \).

Condition (8) may also be rearranged as a condition on \( \sigma \), the incremental capital-output ratio, so that:

\[
\frac{\partial \sigma}{\partial d} > 0 \text{ if } \sigma < \sigma^* = \left[ \varepsilon - q^* \rho^* \right] / \sigma K^* (1 - \theta) \tau
\]
is then a ceiling such that any values of $\sigma$ larger than $\bar{\sigma}$ will result in additional debt having an adverse effect on growth; at such values of ICOR, the investment requirement per additional unit of output is too high, and since a fraction $(1-\theta)$ of domestic capital formation draws on imported capital goods, this strains the trade account and entails additional borrowing without sufficient increase in output to cover interest payments on additional borrowing. The first two columns of Table 7 show the critical values of ICOR and the difference between these and the actual value of ICOR, estimated to be around 6.70. It appears from these figures that the productivity of investment in Sudan was too low (as implied by too large an estimated value of ICOR) to permit additional borrowings to foster growth. Sudan's low investment productivity can be attributed to (a) very poor planning capabilities including project selection, intersectoral planning, project supervision and implementation, and (b) to the large share of investment in many economically unviable public enterprises. Sudan's economic policy makers should have adopted measures to improve the efficiency of investment. Broadly, such measures should have aimed, in the short-run, at (i) increasing capacity utilization (including improved land utilization in agriculture), (ii) improved efficiency of investment by selecting only investment projects with adequate economic rates of return, particularly those that would have helped rehabilitate existing productive capacity and would have emphasized production of tradeable commodities, and, in the long run, at (iii) concentration of production on less capital-intensive techniques within each
sector of the economy, and a structural change in the pattern of national production in favor of less capital-intensive sectors.

We can similarly investigate the effect of parameter $\theta$, the fraction of fixed investment drawing on domestically produced capital goods. From condition (8), it can be seen that the lower-limit of $\theta$ is given by $\theta^*$, such that if:

$$(11) \quad \theta > \theta^* = \frac{\varepsilon + q^* P - q^* a}{q^* + q^* - q^* f}$$

additional borrowing will induce further growth. The lower is $\theta$, the higher is the fraction of investment goods that must be imported and hence the greater is the strain on the foreign exchange requirements. The critical values of $\theta$, and its difference from actual values of $\theta$ are also shown in Table 7. It implies that Sudan's economy have been excessively dependent on imported capital goods for its domestic capital formation so that the allocation of scarce foreign exchange resources to debt service payments resulting from increased debt might have severely hampered imports of capital goods and spare parts and therefore impeded production growth. In any case it is clear that raising the value of $\theta$ through a carefully planned policy of efficient import-substitution and concentration on less capital-intensive technologies would alleviate the burden on foreign exchange availabilities and improve growth prospects.

One can also obtain a ceiling on coefficient $a_i$, the imported intermediate input requirement per unit of output, given by

$$(12) \quad a_i < \bar{a}_i = \frac{\varepsilon - q^* P - q^* f(1-\theta)}{q^* + q^* - q^* f}$$
The critical values $a_i^*$ and their differences from actual values $a_i$ are also shown in Table 7. The negative values of $a_i^*$ for 1975 and 1982 imply that in those years cutting down the imports of intermediate goods alone could not have been enough to straighten out Sudan's precarious balance of payments situation. Indeed, while the share of intermediate goods imports in GDP had been around 5-11 percent, a reduction of about 13 percent would have been necessary to ensure a positive value of $\frac{\partial g}{\partial d}$ throughout the period. A policy designed to reduce the imported intermediate goods requirements would focus on efficient import substitution possibilities and a shift from import-intensive activities (e.g., irrigated agriculture schemes) to activities which are less dependent on imported inputs (e.g., traditional rainfed farming).

(c) The foreign trade and transfers parameters: $\xi$, $a_c$ and $f$.

The critical values of $\xi$ and $a_c$, the shares of exported goods and imported consumer goods, respectively, in total output, are shown in Table 8. For increased debt to be beneficial to growth, the minimum value of throughout 1975-82 should not have fallen below the 11-18 percent range, whereas in 1983-84 it could have been as low as 10 percent chiefly due to significant cuts in imports and exceptionally high levels of concessionary aid, grants, and private transfers that complemented export earnings. On the other hand, $a_c^*$ shows some negative values. Again, this means that while cutting down imported consumer goods in those years would have been helpful, this could not, by itself, have solved Sudan's balance of payments problems. In those years when $\frac{\partial g}{\partial d}$ is positive, Sudan could have afforded a 5 to 8 percent share of imported consumer goods in GDP without risking growth.
### Table 7

**SUDAN: ECONOMIC STRUCTURAL PARAMETERS:**
**CRITICAL vs ACTUAL VALUE**

<table>
<thead>
<tr>
<th>YEARS</th>
<th>( \sigma )</th>
<th>( \sigma - \sigma )</th>
<th>( \alpha^c )</th>
<th>( \alpha^c - \alpha^c )</th>
<th>( \delta^c )</th>
<th>( \delta^c - \delta^c )</th>
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</thead>
<tbody>
<tr>
<td>1975</td>
<td>2.21</td>
<td>-4.47</td>
<td>-0.92</td>
<td>-9.93</td>
<td>83.06</td>
<td>-34.19</td>
</tr>
<tr>
<td>1976</td>
<td>7.82</td>
<td>1.14</td>
<td>9.72</td>
<td>2.27</td>
<td>46.87</td>
<td>7.77</td>
</tr>
<tr>
<td>1977</td>
<td>5.87</td>
<td>-0.81</td>
<td>3.93</td>
<td>-1.88</td>
<td>58.20</td>
<td>-5.73</td>
</tr>
<tr>
<td>1978</td>
<td>6.14</td>
<td>-0.54</td>
<td>5.60</td>
<td>-1.27</td>
<td>34.87</td>
<td>-5.78</td>
</tr>
<tr>
<td>1979</td>
<td>4.79</td>
<td>-1.89</td>
<td>2.73</td>
<td>-4.98</td>
<td>65.03</td>
<td>-13.81</td>
</tr>
<tr>
<td>1980</td>
<td>4.15</td>
<td>-2.53</td>
<td>2.70</td>
<td>-5.76</td>
<td>71.83</td>
<td>-17.12</td>
</tr>
<tr>
<td>1981</td>
<td>2.72</td>
<td>-3.96</td>
<td>-1.91</td>
<td>-11.92</td>
<td>83.43</td>
<td>-24.12</td>
</tr>
<tr>
<td>1982</td>
<td>2.13</td>
<td>-4.55</td>
<td>-4.06</td>
<td>-13.68</td>
<td>83.31</td>
<td>-35.56</td>
</tr>
<tr>
<td>1983</td>
<td>6.99</td>
<td>0.31</td>
<td>9.87</td>
<td>0.76</td>
<td>47.30</td>
<td>2.36</td>
</tr>
<tr>
<td>1984</td>
<td>6.98</td>
<td>0.30</td>
<td>11.89</td>
<td>0.92</td>
<td>46.12</td>
<td>2.30</td>
</tr>
</tbody>
</table>

Source: Author's calculations based on Table 4 and estimation in Footnote 7.

### Table 8

**SUDAN: FOREIGN TRADE AND TRANSFERS:**
**CRITICAL vs ACTUAL PERFORMANCE**

<table>
<thead>
<tr>
<th>YEARS</th>
<th>( \varepsilon^c )</th>
<th>( \varepsilon^c - \varepsilon^c )</th>
<th>( \alpha^c )</th>
<th>( \alpha^c - \alpha^c )</th>
<th>( f^c )</th>
<th>( f^c - f^c )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>18.26</td>
<td>-6.79</td>
<td>-4.99</td>
<td>-10.22</td>
<td>8.76</td>
<td>-7.15</td>
</tr>
<tr>
<td>1976</td>
<td>13.13</td>
<td>1.42</td>
<td>6.63</td>
<td>2.14</td>
<td>1.58</td>
<td>1.59</td>
</tr>
<tr>
<td>1977</td>
<td>12.77</td>
<td>-1.20</td>
<td>1.46</td>
<td>-2.57</td>
<td>4.81</td>
<td>1.47</td>
</tr>
<tr>
<td>1978</td>
<td>10.89</td>
<td>-0.69</td>
<td>2.69</td>
<td>-1.88</td>
<td>5.54</td>
<td>-1.05</td>
</tr>
<tr>
<td>1979</td>
<td>13.23</td>
<td>-2.99</td>
<td>-2.73</td>
<td>-6.91</td>
<td>9.71</td>
<td>-4.28</td>
</tr>
<tr>
<td>1980</td>
<td>15.63</td>
<td>-4.11</td>
<td>-2.49</td>
<td>-9.35</td>
<td>11.68</td>
<td>-5.71</td>
</tr>
<tr>
<td>1983</td>
<td>9.22</td>
<td>0.56</td>
<td>8.02</td>
<td>1.12</td>
<td>16.01</td>
<td>0.73</td>
</tr>
<tr>
<td>1984</td>
<td>10.96</td>
<td>0.57</td>
<td>5.09</td>
<td>0.90</td>
<td>13.21</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Source: Author's calculations based on Table 4.
One can also derive critical value for $f$, the share of foreign (official and private) transfers in GDP. The higher is the share of foreign transfers the less stringent is the foreign exchange constraint, given the country's net foreign trade position. As the last column of Table 8 indicates except for 1983-84, the flow of official grants and workers' remittances were never sufficiently large to remedy the severe foreign exchange resource imbalance during the period. For instance, in 1982, everything else being equal, foreign transfers should have been at least about 23 percent of GDP (compared to an actual ratio of nearly 10 percent) to ensure a positive value of $\frac{\partial g}{\partial d}$
IV. CONCLUSION

Using a simple open macroeconomic model and focusing on the external balance of a developing economy with structural rigidities, we have derived an empirically testable conditions that shows when foreign borrowing can act as a "factor of growth" and when as a "burden on growth". In addition to being well in accord with the conventional wisdom on a prudent borrowing policy, the derived condition has the desirable feature of embodying key parameters that underlie the actual performance of an economy. As such, the condition can provide useful information to both creditors and decision makers in the borrowing country. To the former it provides a measure of creditworthiness based on underlying economic parameters such as exports share in GDP, investment productivity, the degree of import dependency, etc. To the latter it indicates what terms of borrowing the economy can most afford, given its prevailing fundamental conditions, or, inversely, what types (and extent) of policy changes would be needed if long-run growth is to benefit from borrowings on specified terms.

Testing the condition in the case of Sudan, we have shown that Sudan's foreign borrowings during the 1975-84 period not only failed to contribute to growth, it in fact took a heavy toll of the economy. A chief reason for the failure was shown to lie in the fact that the scale and terms of loans that Sudan contracted during the period (specially unconcessional loans from private creditors, IMF, and some official bilateral sources) were out of line with her economic realities as marked by, inter alia, very low returns on investments, poor export performance,
and a high degree of dependency on imports to finance domestic investment, in turn due to an extremely high consumption propensity and lack of domestic savings.

Finally, for our purpose of reflecting some of the main structural features of the Sudanese economy, the model used in this paper has been adequate. However, depending on the chief characteristics of other economies to which the model may be applied, it may require some modifications. In particular, where the labor market cannot be characterized by the labor-surplus condition and where the production technology of the economy permits some degree of substitution between different factors of production (labor, capital, and intermediate inputs) and/or between domestic and imported inputs, the use of some type of neoclassical (instead of fixed-coefficients) production function would be appropriate.

Also, the present model has assumed away the possible effect of foreign exchange rate adjustment on the trade balance. In the case of Sudan this is a plausible assumption based on empirical findings of Hussain and Thirlwall (1984) (1986) who show that because of Sudan's low export supply elasticity and inelastic imports demand (particularly imported intermediate inputs) exchange rate devaluation has at best been neutral in its effect on trade balance. However, in the case of economies where foreign trade components may be significantly responsive to exchange rate adjustments, the model should be modified to explicity account for such effects.
REFERENCES


IMF, "Sudan: Recent Economic Developments," Several issues.


FOOTNOTES

1/ For a survey of the literature on external debt in developing countries, see McDonald (1982).


3/ As shown in Table 2, debt service payments that Sudan actually made fell considerably short of accrued debt service obligations.

4/ The model presented here resembles in some respects the one used in Taylor (1985), Chapter 7.

5/ A sustainable external debt situation is defined here by a steady-state situation in which the debt-output ratio remains constant over time. We therefore analyse the impact on the long-run growth rate of economy when it moves from one steady-state with a lower debt-output ratio to another steady-state situation characterized by a higher debt-output ratio.

6/ This is analogous to the neoclassical rule of optimal foreign borrowing that requires the marginal rate of return to investment be equal to the marginal cost of borrowing. See, e.g., Bardhan (1967) and Sachs (1983).

7/ Using the definition of ICOR, and allowing for one period investment-gestation lag, one has:

\[ X_t - X_{t-1} = \frac{1}{\sigma} I_{t-1} \]

Solving this difference equation yields

\[ X_t = \alpha + \frac{1}{\sigma} \sum_{i=t_0}^{t-1} I_i + \varepsilon_t \]

where \( \alpha \) is the constant of solution to the difference equation, \( t_0 \) is a date sufficiently far back to proxy the infinite past and \( \varepsilon_t \) is the error term. Using time-series on GDP and gross fixed investment (both in local currency and in constant 1981 prices) and, due to data limitations, taking 1965 as an approximation for \( t_0 \), the relationship was estimated by OLS method and was corrected for auto-correlation by Orcutt-Chocran procedure. The estimation result was

\[ X_t = 327.5 + 0.4797 \sum_{i=1965}^{t-1} I_i \]

\[ R^2 = 0.61 \] , D.W. = 1.8

(figures in brackets are t statistics)

8/ The yearly average interest rate on IMF loans was computed by weighing the interest rate on each kind of IMF facility by the share of each facility in Sudan's debt to IMF.
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