Import Dependency and Structural Adjustment in Sub-Saharan Africa

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One of the effects of structural adjustment programs in Sub-Saharan Africa has been the reduction of imports in the face of scarce foreign exchange. This article takes the analysis of import demand beyond the traditional income and price determinants to account for factors likely to be important to Sub-Saharan African countries in the 1990s. First, the effect of demand on imports is reflected by the level of absorption rather than the less direct income variable. Second, because adjustment programs may cut government consumption and, through increases in interest rates, reduce investment, these components of absorption are also considered independently to assess their differential effect on imports. Third, import barriers are often set in dollar terms to limit the use of foreign exchange. Because reliable and complete data for import restrictions are not available, the ratio of exports to debt is included as an indicator of foreign exchange availability to reflect its effect on trade barriers and thus imports. The findings suggest that this more comprehensive assessment of import demand will be needed if the size and even direction of changes in import demand in response to policy reform is to be understood and anticipated.

In response to the crises in trade and foreign currency flows in the 1980s, most Sub-Saharan African countries adopted structural adjustment programs. Given the external sector constraints, substantial declines in imports result, at least in the short term. But traditional analysis has not been able to anticipate the extent—and sometimes even the direction—of changes in imports in response to the adoption of adjustment policies. We extend the coverage of earlier models of import determination to account for the factors that often lead to the adoption of adjustment programs, particularly changes in terms of trade and foreign exchange shortages, and the policy changes that are commonly included in them—reductions in the level of and shifts among the components of absorption, and devaluation of the exchange rate.

Most empirical analyses of aggregate imports have used a static, single equation specification in which the value of imports is determined by real income...
and the relative price of imports. The price of imports is commonly defined as
the nominal exchange rate times the international price of the import deflated
by a domestic price index. Implicit in the conventional model are the assump-
tions that there are no binding import quotas and that absorption (public and
private investment and consumption), which is a more direct determinant of
import demand than is income, varies proportionally with real income. But if
the ratio of absorption to real income varies, as has been the case in the
countries examined here, the model would yield an unstable coefficient of the
real income variable and thus could not determine import values adequately.
Furthermore, if there are binding import quotas, they prevent domestic prices
of imports from being determined directly by the exchange rate and the inter-
national price. Import quotas are often used not only to protect domestic
industry but also to limit the use of scarce foreign exchange. Thus quotas are
often set in value terms, and foreign exchange availability will affect both the
exchange rate and the value of import quotas, neither of which is reflected in
the traditional model. (Excellent discussions concerning the traditional import
demand models are contained in Leamer and Stern 1970, Magee 1975, and
Goldstein and Khan 1985; Agbonyitor 1986 and Pritchett 1987 estimate im-
port demand in Sub-Saharan Africa using the traditional approach.)

The model developed here explicitly accounts for the existence of binding
quotas set in value terms, for the effect of foreign exchange availability on
quota levels, for changes in the level and composition of absorption relative to
real income, and for the conventional demand variables. Thus this model draws
from and expands upon both the traditional import demand models that treat
imports as demand-determined and the more recent models that assume that
imports are determined by foreign exchange availability (Hemphill 1974; Sun-
dararajan 1986; Winters 1987; and Moran 1989).

We consider the role of international debt and export receipts as determinants
of the degree of restrictiveness and scope of import restrictions. It is assumed
that as the availability of foreign exchange decreases, governments gradually
extend the coverage of import quotas and reduce their dollar value. By includ-
ing the stock of debt as an explanatory variable in the import equations, we
account for its effects on both foreign exchange availability and on net inter-
national assets, which, as an important component of wealth, is a factor
determining expenditure decisions and thus imports (see Sachs 1981, 1982;
Dornbusch 1983). We further strengthen the analysis through the disaggrega-
tion of absorption into government consumption, private consumption, and
aggregate investments—changes in each of which can have a different impact
on imports. An important consequence of the existence of value import quotas
affecting a subset of the imports is that the effects of exchange rates and border
prices on aggregate imports are not identical as usually assumed.

This framework is used to estimate import demand for 1966–86 for seven
Sub-Saharan African countries: Côte d'Ivoire, Kenya, Madagascar, Nigeria,
Tanzania, Zaire, and Zambia. In these countries, the lack of external financing in the 1980s has limited import growth. Import levels have been compressed considerably, which has contributed to declines in growth rates of gross domestic product (GDP). The countries have, to varying degrees, cut absorption, devalued their real exchange rates, and reduced trade restrictions. Thus their situation, and the analytical framework that reflects it, are relevant to macroeconomic policy reform in many developing countries in the 1990s.

I. POLICY VARIABLES AND THE ECONOMETRIC SPECIFICATION

Macroeconomic Policy

Capital and final goods imports have a more direct relationship with real levels of absorption (consumption and investment) than with total income. Imported intermediate goods, as inputs into production, are related more directly to real income than to absorption.

During adjustment programs, it is likely that all components of absorption will decline: cuts in government expenditures and the contractionary effects of those cuts will decrease both public and private consumption and investment, whereas increased interest rates (common in adjustment programs) will independently discourage investment but may raise savings levels. Trade policy reform often includes exchange rate devaluation, which both encourages exports and discourages imports. Thus absorption would grow at a slower pace than real income during adjustment, and the share of imports in overall growth would also decline, at least in the short term. When the import intensities of the components of total absorption are significantly different, changes in the structure of absorption also have important effects on imports. The changes in the relative shares of public and private investment and consumption that often result from adjustment programs may have a more significant effect than changes in the total level of absorption.

Import Specification with Import Restrictions

We consider both freely importable commodities and imports subject to quantitative restrictions (QRS) set in foreign value terms (dollars). The total value of transactions for each restricted import \((ir)\) is set by the dollar-denominated quota ceiling, \(\theta_i\), and is the product of the border price, \(p_{ir}^*\), times the quantity of real net domestic demand, \(D\):

\[
\theta_i = p_{ir}^* \cdot D \left( p_{ir}, \ldots, p_{ir}, \ldots, p_{Nir}, p, Y, \frac{A}{Y} \right); \quad i = 1, \ldots, N
\]

Demand is determined by the domestic prices of the \(N\) quota-restricted imports, \(p_{ir}, \ldots, p_{Nir}\), the prices of unrestricted imports (the vector \(p_i\)), GDP, income \(Y\), and absorption, \(A\). All domestic prices \(p_i\), \(p\), \(Y\), and \(A\) are deflated by a GDP deflator which includes export prices.
The solution of equation 1 gives the domestic prices of restricted imports:

\[
\rho_{ir} = \Phi \left[ \rho_f, Y, \frac{A}{Y}, \frac{\theta_1}{p^{*}_f}, \frac{\theta_2}{p^{*}_f}, \ldots, \frac{\theta_i}{p^{*}_f}, \ldots, \frac{\theta_N}{p^{*}_f} \right] \quad i = 1, \ldots N
\]

In some of the countries studied, several quota-restricted imports are also subject to domestic price controls so that equation 1 would not be valid. However, the existence of parallel or black markets for goods subject to price controls is well documented in Africa. Thus, equation 1 could still be used to determine the relevant \( \rho_{ir} \) for parallel rather than the official markets. Because these prices are endogenous and do not enter directly into the empirical estimation below, the lack of data on parallel market prices poses no problem.

Under the commonly used assumption of demand substitutability, it can be shown that

\[
\frac{\partial \rho_{ir}}{\partial \theta_j} \leq 0, \frac{\partial \rho_{ir}}{\partial p^{*}} \leq 0, \text{ for all } i, j, k.
\]

We also assume that the domestic prices of freely importable commodities are equal to their foreign currency prices, \( p^*_f \) times the exchange rate, \( e \), adjusted by the average tariff rate, \( t \):

\[
p_f = e(1 + t)p^*_f.
\]

In the aggregate, both demand for merchandise imports, \( m \), and the average price of restricted imports, \( \rho_f \), are functions of domestic prices of unrestricted and quota-restricted imports, income, and absorption:

\[
m = m \left[ \rho(p_f, p_r), Y, \frac{A}{Y} \right]
\]

\[
\rho_r = \Phi \left( \rho_f, p^*_f, Y, \frac{A}{Y} \right)
\]

where \( \rho(p_f, p_r) \) is a price index for aggregate imports, normalized by the price of exportables; \( \theta \) is the total value of imports subject to QRS; and \( p^*_f \) is an index of world prices of value-restricted imports.

Equations 4-6 can be combined into the following aggregate import specification:

\[
m = b_0 + b_1 Y_r + b_2 \left( \frac{A}{Y} \right) - b_3 \left[ e(1 + t)p^*_f \right] + b_4 \left( \frac{\theta}{p^*_r} \right) + b_5 m_{t-1}
\]

in which all variables are expressed in log form, all coefficients (except the intercept) are expected to be positive, and we include \( m_{t-1} \) to allow for a lagged adjustment. Assuming that the world prices \( p^*_f \) and \( p^*_r \) move approximately proportionally, we can consider one world foreign currency price, \( p^*_f \). (Note that this does not imply that domestic prices \( p_f \) and \( p_r \) also move together.)
Thus equation 7 can be rewritten as

\begin{equation}
    m_t = b_0 - b_3(1 + t) + b_3\theta + b_4Y_t \\
    + b_2\left(\frac{A}{Y_t}\right) - b_3e_t - (b_3 + b_4)p^* + b_5m_{t-1}
\end{equation}

Equation 8 yields a specification in which imports are simultaneously determined by demand factors and foreign exchange constraints.

In our initial estimation, we incorporated the terms \( b_3(1 + t) \) and \( b_4\theta \) into the constant term because we assume no change in total quota values of restricted imports and because African tariff rates changed little during the period of analysis:

\begin{equation}
    m_t = b_0 + b_1Y_t + b_2\left(\frac{A}{Y_t}\right) - b_3e_t - (b_3 + b_4)p^* + b_5m_{t-1}
\end{equation}

Later we relax the assumption that \( \theta \) is constant by using measures of foreign exchange availability as proxies for \( \theta \).

It is important to note that in equation 9 the elasticity of demand with respect to the world price is greater than the elasticity with respect to the exchange rate, as would be suggested by equation 7. When import quotas are set in foreign currency values, devaluation (an increase in \( e \)) will have no direct effect on the real imports of quantity-restricted goods (equation 6). Devaluation will have only an indirect effect due to the increase in the domestic price of freely importable goods. An increase in \( p^* \), however, will reduce the physical quantities of imports subject to quotas as well as the imports of freely importable commodities. The conventional specification that ignores the effect of absorption and assumes equal exchange rate and international price elasticities can be verified by testing the null hypothesis \( b_2 = 0 \) and \( b_4 = 0 \), respectively.

Because we use real income and absorption as explanatory variables, equation 9 may seem to come close to being an identity. But the left-hand side covers only merchandise imports, which have been less than 70 percent of all imports in most countries, and this share has fluctuated substantially during the period. Furthermore, exports are not exogenous and have also varied significantly. Also, we consider the share of absorption in income rather than simply absorption, which is likely to mitigate this potential problem.

To account for the endogeneity of absorption, we estimated equation 9 using lagged values of absorption and fiscal deficits as instruments and obtained a pattern of results quite similar to those reported here, with some loss in efficiency. It appears that the variability in the absorption-GDP ratio in most African countries is largely related to changes in exogenous fiscal expenditures and monetary policy. This makes the problem of endogeneity of absorption less serious. Use of GDP less exports instead of absorption as an explanatory variable would reduce the likelihood of spurious correlation resulting from the endogeneity of explanatory variables. In many African countries, however, the
export data are particularly weak because of widespread smuggling and under-invoicing (see Yeats, this issue) and hence this procedure would have added considerable noise to the estimation.

II. Estimation of Aggregate Imports

The Initial Specification

We estimated import demand for the seven Sub-Saharan African countries using annual data for 1966–86 (see the appendix for data definitions and sources). Table 1 shows both the estimated long-run elasticities of imports with respect to each of the explanatory variables and the F-test for the hypothesis that the elasticities with respect to exchange rate and international import prices are the same, \( b_4 = 0 \).

The long-term import elasticities for 1966–86 in table 1 show the expected signs and are generally significant. The GDP coefficients, which serve as the estimates of real income elasticities, have an average value greater than 1. Similarly, however, with the exception of Madagascar and Zaire, the coefficients of absorption are positive and highly significant. This therefore suggests that the value of the GDP coefficient is conditional on absorption remaining as

<table>
<thead>
<tr>
<th>Country</th>
<th>Real GDP, Y</th>
<th>Absorption/GDP, A/Y</th>
<th>Exchange rate, e</th>
<th>Dollar import prices, p*</th>
<th>( R^2 )</th>
<th>Equality of effects of e and p**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Côte d'Ivoire</td>
<td>0.97</td>
<td>1.01</td>
<td>-0.58</td>
<td>-0.61</td>
<td>0.94</td>
<td>Accept</td>
</tr>
<tr>
<td>(2.88)</td>
<td>(2.49)</td>
<td>(-2.88)</td>
<td>(-2.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>0.55</td>
<td>1.74</td>
<td>-0.51</td>
<td>-0.36</td>
<td>0.87</td>
<td>Accept</td>
</tr>
<tr>
<td>(3.82)</td>
<td>(6.65)</td>
<td>(-3.02)</td>
<td>(-3.05)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madagascar</td>
<td>3.34</td>
<td>0.39</td>
<td>-0.74</td>
<td>-0.83</td>
<td>0.77</td>
<td>Accept</td>
</tr>
<tr>
<td>(3.33)</td>
<td>(0.24)</td>
<td>(-2.11)</td>
<td>(-2.97)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>1.07</td>
<td>2.50</td>
<td>-0.59</td>
<td>-0.66</td>
<td>0.96</td>
<td>Reject</td>
</tr>
<tr>
<td>(2.38)</td>
<td>(5.27)</td>
<td>(-2.52)</td>
<td>(-1.92)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>0.74</td>
<td>2.96</td>
<td>-0.21</td>
<td>-0.54</td>
<td>0.48</td>
<td>Reject</td>
</tr>
<tr>
<td>(1.63)</td>
<td>(3.25)</td>
<td>(-0.81)</td>
<td>(-2.06)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zaire</td>
<td>2.79</td>
<td>-0.32</td>
<td>-0.24</td>
<td>-0.74</td>
<td>0.92</td>
<td>Reject</td>
</tr>
<tr>
<td>(4.42)</td>
<td>(-0.95)</td>
<td>(-2.16)</td>
<td>(-5.46)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>-0.04</td>
<td>0.96</td>
<td>-0.27</td>
<td>-0.35</td>
<td>0.95</td>
<td>Reject</td>
</tr>
<tr>
<td>(-0.04)</td>
<td>(3.56)</td>
<td>(-1.59)</td>
<td>(-1.25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median(^b)</td>
<td>1.07</td>
<td>1.74</td>
<td>-0.51</td>
<td>-0.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: t-statistics are in parentheses. Ordinary least squares estimates were calculated for Kenya, Tanzania, Zaire, and Zambia; others are first-order Cochrane-Orcutt. Variables are deflated by the GDP deflator, except the import price index, \( p^* \). Using the t-statistic, the null hypothesis of no autocorrelation could not be rejected at a 5 percent significance level for every country except Madagascar.

\( a. \) F-statistics for the restriction that the coefficients of the exchange rate and dollar import prices are equal; \( H_0: b_4 = 0 \).

\( b. \) Excludes those coefficients that have the "wrong" sign.

Source: World Bank data (see appendix).
a constant share of GDP. If the absorption-GDP ratio varies by even a small
amount as GDP changes, the net impact on imports is likely to be strongly
affected, as indicated by the generally high coefficient for the absorption-GDP
variable. This would imply that specifications that ignore the absorption-GDP
effect are likely to produce income elasticities that are highly unstable.

Consistent with the predictions from the theoretical model discussed above,
the import price elasticities are generally higher in absolute values than the
exchange rate elasticities. Kenya is the one exception: the hypothesis of equal
price and exchange rate elasticities cannot be rejected at the 1 percent signifi-
cance level. In addition the hypothesis of identical exchange rate and interna-
tional price elasticities is rejected in four countries (Nigeria, Tanzania, Zaire,
and Zambia) at the 5 percent level of significance, whereas in Kenya it was
rejected at the 10 percent level. The null hypothesis could not be rejected at
any reasonable level of significance only for Côte d'Ivoire. This is probably
because Côte d'Ivoire appears to have relied less on import restrictions than
have most of the other countries (Halevi 1988). The complete conventional
specification, which ignores absorption and the independent effects of the ex-
change rate and world prices (that is, which imposes $b_2 = 0$ and $b_4 = 0$),
cannot be refuted at the 10 percent level of significance only for Madagascar.
For all other countries it appears that significant gains are attained by including
absorption as an explanatory variable or by allowing for different price and
exchange rate elasticities.

Because absorption is determined in part by GDP, exchange rates, and import
prices, ideally the model should be closed with an absorption equation that
should be jointly estimated with the import demand equations using simulta-
nous equation methods. This would permit the calculation of the total effect
of exchange rates, prices, and GDP, including their direct effects as well as the
indirect effects via absorption changes. If an increase in the exchange rate
reduces the absorption-GDP ratio, this would strengthen the effect of devalua-
tion on imports. The results in table 1 show that government policies, particu-
larly those affecting absorption and exchange rates, can have a powerful effect
on imports.

**Accounting for the Structure of Absorption**

The import equations next were reestimated using disaggregated expendi-
tures to examine the influence of the structure rather than only the level of
total absorption. Expenditures were disaggregated into private and government
consumption and investment, and the income and absorption-GDP ratio were
excluded.

The specification estimated is:

$\begin{align*}
m_t &= c_0 + c_p E_p + c_g E_g + c_I + c_2 e_t + c_3 p_t^* + c_4 m_{t-1}
\end{align*}$

where $E_p$ is real private consumption, $E_g$ is real government consumption, $I$ is
real investment, and all are deflated by the domestic currency GDP deflator. All
other variables are as previously defined, and as in equation 8, all variables are in log form. We excluded real GDP from equation 9 after several runs showed that its coefficients were quite unstable, probably because of the high degree of collinearity between GDP and some of the absorption variables. This analysis covers only 1966–83 because of a lack of more recent data on disaggregated expenditures.

Table 2 shows that the long-term import demand elasticities have the expected signs, with the exception of private consumption in Côte d'Ivoire and Nigeria, and the exchange rate in Tanzania. Only in Côte d'Ivoire, however, is the unexpected sign significantly different from zero. Unfortunately, we see a marked increase in the number of coefficients that are not significant at the 5 percent level, rising from 36 percent in table 1 to 63 percent here.

The relationship of the different categories of expenditures with imports varies widely across countries. Government expenditure is the most import-intensive of the three categories in Côte d'Ivoire, Madagascar, and Zaire, whereas private consumption is the least import-intensive in four of the seven. For these countries, this would imply that decreasing government consumption and increasing private consumption by the same amount could result in a net decrease of imports.

The quantitative importance of the exchange rate is somehow lower when total absorption is disaggregated into its components. Thus the net effect of a package of trade reform with exchange rate adjustment on the level of imports is uncertain. If tariffs are substituted for import restrictions and the tariffs are reduced, import levels need not increase. A lowering of import restrictions and

<table>
<thead>
<tr>
<th>Country</th>
<th>Real private consumption, $E_p$</th>
<th>Real government consumption, $E_g$</th>
<th>Real investment, $I$</th>
<th>Exchange rate, $e_r$</th>
<th>Dollar import prices, $p_i$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Côte d'Ivoire</td>
<td>-0.55 0.64</td>
<td>0.22</td>
<td>-0.83</td>
<td>-0.54</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.11) (8.49)</td>
<td>(3.04)</td>
<td>(-14.65)</td>
<td>(-3.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>0.18 0.02</td>
<td>0.52</td>
<td>-1.03</td>
<td>-0.81</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.13) (0.03)</td>
<td>(2.76)</td>
<td>(-1.86)</td>
<td>(-1.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madagascar</td>
<td>0.75 0.96</td>
<td>0.10</td>
<td>-1.44</td>
<td>-1.33</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.15) (1.90)</td>
<td>(0.41)</td>
<td>(-2.06)</td>
<td>(-3.62)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>-0.77 0.19</td>
<td>0.92</td>
<td>-0.63</td>
<td>-0.25</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-0.84) (0.71)</td>
<td>(6.58)</td>
<td>(-1.06)</td>
<td>(-0.29)</td>
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</tr>
<tr>
<td>Tanzania</td>
<td>0.90 0.61</td>
<td>0.88</td>
<td>0.38</td>
<td>-0.54</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.38) (2.92)</td>
<td>(4.33)</td>
<td>(0.69)</td>
<td>(-0.99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zaire</td>
<td>0.38 0.57</td>
<td>0.49</td>
<td>-0.16</td>
<td>-0.68</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.81) (2.72)</td>
<td>(2.62)</td>
<td>(-0.53)</td>
<td>(-2.34)</td>
<td></td>
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</tr>
<tr>
<td>Zambia</td>
<td>0.35 -0.03</td>
<td>0.53</td>
<td>-0.92</td>
<td>-0.98</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.66) (-0.08)</td>
<td>(2.80)</td>
<td>(-1.04)</td>
<td>(-1.69)</td>
<td></td>
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</tr>
</tbody>
</table>

Note: t-statistics are in parentheses. All estimates are ordinary least squares. Source: World Bank data (see appendix).
tariffs will increase imports. But that increase may be offset by a depreciation of the real exchange rate, induced by macroeconomic policies. Trade reform often involves export expansion, but any significant increase in nontraditional exports may be expected to increase demand for imported inputs. The import-intensity of export production, however, is not independently assessed here.

**Foreign Exchange Variables**

In Sub-Saharan Africa, import quotas are often imposed in response to the increasing scarcity of foreign exchange. To assess the role of foreign exchange availability in the determination of imports, we estimate equation 9 allowing $\theta$, the value of import quotas, to change over time. Because data for $\theta$ are not available, we use data on foreign exchange availability as a proxy for $\theta$.

In analyzing the effect of foreign exchange constraints on imports, it is necessary to use both stock and flow variables: foreign reserves or net debt, plus exports, capital inflows, or changes in foreign exchange reserves. If one uses only a subset of flow variables, the estimates are likely to be unstable because their effect will be dependent on underlying stock variables. If all flow foreign exchange variables are used, however, then one is estimating something very close to an identity—imports are equal to the foreign exchange used for imports. The implication is that not all flow variables can be used, and that stock variables should be used to account for stock adjustment processes. We thus use exports as a share of debt to incorporate both flow and stock variables.

If domestic and foreign-currency-denominated wealth are perfect substitutes, domestic currency could be freely used to pay for debt or imports, and consideration of foreign exchange constraints would be unnecessary. Many developing countries have some possibilities of substitution; Latin American debt swap operations are an example. But most African countries cannot readily substitute domestic for foreign assets, and therefore we treat domestic and foreign exchange wealth as differentiated assets.

Under this assumption one can solve the following problem: maximize welfare as an increasing and concave function of imported goods subject to an intertemporal budget constraint. Real income and domestic prices are also included in the objective function on the assumption that they increase the effectiveness of imports in promoting welfare. The constraint restricts the present value of future trade deficits to be equal to the current stock of foreign exchange assets, defined as the level of foreign exchange reserves less the stock of net international debt. Solution of this problem gives the import level as a function of net foreign exchange assets, current and expected future exports, the terms of trade, real income or total real expenditures, and the real domestic price of imports.

Table 3 presents long-term import elasticities estimated from this model, including the same variables as in equation 9, plus the ratio of exports to debt. The greater the value of that ratio, the greater the foreign exchange available and the smaller the pressure to further restrict imports. As this would suggest,
all the coefficients associated with this ratio are positive, although those for Nigeria and Zaire are not significant. The very low coefficient for Nigeria may be explained by Nigeria's large potential oil export earning, which would mean that Nigeria is not likely to have suffered serious foreign exchange restrictions during this period. The lack of significance of the coefficient for Zaire cannot so easily be explained.

Because data on national debt are only available since 1970, the coefficients reported in tables 1 and 3 are not strictly comparable. Nonetheless, a review of the 1966–69 period for these countries would not suggest any important changes in the macroeconomic relationships that we are analyzing. This is supported by the statistical significance of the estimates here; only thirteen of the thirty-five are not significant at the 5 percent level, which is almost the same share as in table 1. The inclusion of the foreign exchange availability does not appear to reduce the significance of the coefficients associated with GDP and the absorption-GDP level, even in countries in which the export-debt coefficient is significant.

III. Conclusion

We have examined here the effects of several primary macroeconomic factors on imports. Within them, two key characteristics commonly altered by structural adjustment programs are real absorption and the exchange rate. In addi-

Table 3. Estimated Long-run Import Elasticities Considering Foreign Exchange Constraints, 1970–86

<table>
<thead>
<tr>
<th>Country</th>
<th>Real GDP, Y</th>
<th>Absorption/ GDP, A/Y</th>
<th>Exchange rate, e</th>
<th>Dollar import price, p</th>
<th>Export-debt ratio</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Côte d'Ivoire</td>
<td>0.88</td>
<td>0.85</td>
<td>-0.72</td>
<td>-0.43</td>
<td>0.22</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>(3.53)</td>
<td>(3.35)</td>
<td>(-10.81)</td>
<td>(-2.71)</td>
<td>(2.82)</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>0.88</td>
<td>2.53</td>
<td>-0.69</td>
<td>-0.62</td>
<td>0.21</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>(4.78)</td>
<td>(10.21)</td>
<td>(-6.03)</td>
<td>(-7.85)</td>
<td>(5.75)</td>
<td></td>
</tr>
<tr>
<td>Madagascar</td>
<td>1.78</td>
<td>2.37</td>
<td>-0.51</td>
<td>-0.56</td>
<td>0.09</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>(2.03)</td>
<td>(2.58)</td>
<td>(-1.67)</td>
<td>(-2.85)</td>
<td>(2.24)</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>3.06</td>
<td>3.19</td>
<td>-0.86</td>
<td>-1.02</td>
<td>0.01</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>(14.51)</td>
<td>(6.89)</td>
<td>(-11.08)</td>
<td>(-3.23)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>1.58</td>
<td>3.09</td>
<td>-0.38</td>
<td>-0.58</td>
<td>0.23</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>(1.63)</td>
<td>(3.40)</td>
<td>(-1.46)</td>
<td>(-2.45)</td>
<td>(2.64)</td>
<td></td>
</tr>
<tr>
<td>Zaire</td>
<td>1.92</td>
<td>1.09</td>
<td>-0.10</td>
<td>-0.71</td>
<td>0.06</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>(1.52)</td>
<td>(0.97)</td>
<td>(-0.55)</td>
<td>(-5.29)</td>
<td>(0.94)</td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>-3.00</td>
<td>2.30</td>
<td>0.54</td>
<td>0.46</td>
<td>0.56</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>(-1.48)</td>
<td>(1.14)</td>
<td>(1.12)</td>
<td>(0.39)</td>
<td>(2.25)</td>
<td></td>
</tr>
<tr>
<td>Median*</td>
<td>1.23*</td>
<td>2.45</td>
<td>-0.51</td>
<td>-0.58</td>
<td>0.22</td>
<td></td>
</tr>
</tbody>
</table>

Note: t-statistics are in parentheses. All estimates are ordinary least squares except those for Madagascar, which used a Cochrane-Orcutt procedure to correct for autocorrelation.
a. Excludes estimates with "wrong" signs.
b. Excludes Nigeria because of the extremely high elasticity obtained.
Source: World Bank data (see appendix).
tion to assessing the relationship of the level of absorption and imports, the relationships when the composition of absorption varies were also estimated. Exchange rate adjustments were also included, first independently, and then using a proxy for foreign exchange availability to explicitly account for import restrictions that would limit the extent to which imports could directly respond to changes in the exchange rate.

We estimated the determinants of imports for seven Sub-Saharan African countries over the 1966–86 period. Our findings correspond with those of previous works regarding the positive effect of income on imports. Policies often adopted in structural adjustment programs also are important, however. First, on average, a 1 percent reduction in the absorption-GDP ratio is associated with a 2 percent decline in imports. The composition of absorption also turns out to be relevant. Although the import-intensity of the three components varies widely across the seven countries, a reduction in the share of government consumption can be seen to be significantly related to a decrease in imports in some countries.

Second, although the exchange rate, as would be expected, is an important determinant of imports, it is less so than is the dollar import price. The reason is the presence of import quotas set in dollar terms that limit the total dollar value of a subset of imports. Thus the quantity of imports for the restricted goods can only rise if the dollar price falls. On average, a 1 percent depreciation of the exchange rate is associated with a 0.5 percent decline in imports, holding the absorption-GDP ratio constant.

Third, we have seen evidence that foreign exchange availability is positively associated with the total import quota values set by some African countries. We thus used the ratio of exports to debt as an indicator of foreign exchange availability, and found it positively and significantly associated with imports. The demand-related variables (real GDP and absorption-GDP) remain significant when the foreign exchange availability variable is included. This suggests that aggregate imports are jointly determined by both foreign exchange and demand factors.

These findings suggest that adjustment programs that include exchange rate depreciation and aggregate demand reduction are likely to reduce imports. Although import liberalization may raise import-GDP ratios, simultaneous reduction in absorption and depreciation of the exchange rate may lower imports during the adjustment process. In Sub-Saharan Africa, as for most developing countries, adjustment programs must account for these interactions in addition to consideration of demand and foreign exchange constraints if the effects on imports are to be understood and anticipated.

APPENDIX: DATA DEFINITIONS AND SOURCES

Real merchandise imports: Nominal dollar merchandise imports deflated by a country-specific dollar import price index (1980 = 1). Merchandise imports
are taken from the World Bank ANDREX tapes (International Economics Department—IECSE), line "CP, IMP, TOTAL." This series follows very closely merchandise imports (Standard International Trade Classification—SITC—categories 0–9) as reported by the United Nations Conference on Trade and Development (UNCTAD). However, as the latter series covers up to 1983 only, we used the IECSE series instead.

**Dollar import price:** The country-specific dollar import price indexes are from the ANDREX tapes, line "PT, IMP, TOTAL." These price indexes are weighted averages of subindexes for five categories: manufactures, food, non-food agriculture, metals and minerals, and fuels, defined according to one-, two-, and three-digit SITC codes (see Moran and Park 1986).

**Real GDP:** Nominal home-currency GDP deflated by the implicit home-currency GDP deflator (1980 = 1). Both series are from the World Bank Economic and Social Data (BESD) tapes.

**Real absorption to GDP:** Nominal home-currency absorption relative to nominal home-currency GDP deflated by home-currency GDP deflator (1980s). Absorption is the sum of private consumption, public consumption, and investment, and it is taken from BESD.

**Real exchange rate:** A nominal exchange rate index (1980 = 1) deflated by the implicit GDP deflator (1980 = 1). The nominal exchange rate is a bilateral rate that indicates the number of domestic currency units traded per U.S. dollar. It is taken from the BESD and is the same as the period-average exchange rate in IMF (various years) line “rf.”

**Ratio of exports to net debt:** Nominal dollar exports of goods and services relative to nominal dollar net debt deflated by a country-specific dollar import price index (1980 = 1). Exports are taken from ANDREX, line “CR, EXP, GS.” Net debt is defined as the stock of debt exclusive of foreign exchange reserves. The stock of debt is taken from BESD, and it refers to long-term public and publicly guaranteed disbursed outstanding debt. Foreign exchange reserves, including gold holdings, are taken from the data tapes for International Financial Statistics (IMF various years) line 1.D.

**Real exports of goods and services:** Nominal dollar exports of goods and services.

**Investment share in GDP:** Nominal home-currency investment relative to nominal home-currency GDP. Investment incorporates fixed investment as well as changes in stocks. Both investment and GDP are from BESD.

REFERENCES


