Savings Rates and Debt Crises

Homi Kharas
and
J. Levinsohn (Consultant)

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Abstract

Conventional wisdom holds that LDC debt problems reflect, in part, the switch of foreign financing towards commercial loans. With no adequate supervision over the use of these funds, international finance may not have improved the capacity to repay external debt. This paper tests two aspects of this proposition. First, have commercial loans been directed more towards consumption and less to investment than official loans? We find no evidence to suggest this has been true. Second, does an increase in the marginal propensity to invest out of foreign loans improve creditworthiness? Again, we find no supporting evidence. We do find, however, that raising the marginal rate of domestic saving out of income does improve creditworthiness. This provides justification for policy conditionality associated with foreign borrowing that goes beyond concern with the uses of individual loans.
I. INTRODUCTION

Conventional wisdom holds that LDC debt rescheduling problems reflect, in part, the failure of borrowers to invest their loans in appropriate productive activities. This worry became particularly acute because of the rapid switch of external financing in the 1970s away from official sources, mostly tied to closely supervised investment projects, towards commercial loans without such ties. Between 1975–78, one half of all eurocredits were destined for "banking and finance" and "general purpose", rather than for real fixed capital formation. The perceived danger was that such loans could be used to finance consumption and, by analogy with a firm that fails to invest borrowed funds, would lead to long-term insolvency. Indeed, most non-oil developing countries had lower average savings rates after 1973. 1/ Several policy statements sounded a warning that "international finance must serve to increase productive investment in debtor countries and to improve their capacity to repay their external debt". 2/

The aim of this paper is to assess the empirical significance of these hypotheses. First, we ask whether high borrowing helps explain the fall in average savings rates. Next, we ask whether there has been any discernible difference in the marginal propensity to consume out of

1/ Middle-income oil-importing developing countries on average had savings rates of 21.5 percent in 1973 and 18.0 percent in 1981.

2/ Excerpt of speech by J. de Larosiere, Managing Director, IMF, delivered before the Economic and Social Council of the UN, Geneva, July 3, 1981.

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project and non-project foreign financing. Although we lack details on
the classification of loans, we can safely assume that the period of the
1960s and early 1970s was characterized by a substantially larger pro-
portion of project lending than the period of the mid- to late-1970s.
This analysis of the relationship between saving and foreign exchange
inflows follows the traditions of substantial literature, e.g., Weisskopf
(1972); Griffin (1970); Papanek (1972). A novel feature here is the
explicit focus on structural change over time.

Second, we address the question of whether the structural
coefficients of the consumption function have been important
determinants of creditworthiness. That is, we attempt to establish the
empirical significance of the hypothesis that more thrifty countries —
those that invest more on the margin, both out of income and out of
foreign resource inflows — are more creditworthy. Although such argu-
ments have been asserted for many years, the empirical literature on the
determinants of creditworthiness has completely ignored differences
across countries and across time periods of important macroeconomic
structural coefficients. 1/ As one of us has argued before (Kharas
(1984)), there are sound theoretical reasons for inclusion of such
coefficients. An empirical confirmation is also important because a
substantial component of the policy conditionality associated with
reschedulings is geared to the improvement of domestic saving rates and

1/ For a review of the assertions and empirical evidence, see McDonald
(1982).

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not to improvement in the traditional indicators of creditworthiness such as higher GDP or export growth.  

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The remainder of this paper is organized as follows. In Section II, we derive efficient estimators for the structural coefficients of interest. This involves estimating consumption functions for each of the twenty-six developing countries in our sample. The marginal propensities to consume out of both income and foreign borrowing are then included as independent variables in a probit analysis of the determinants of reschedulings in Section III. Our findings indicate that marginal saving rates out of income are significant and have played a quantitatively important role in differentiating between country creditworthiness. A higher marginal propensity to invest out of foreign resource inflows seems to have played a minor quantitative and statistically insignificant role in determining creditworthiness. The policy implications of our analysis are expanded upon in the concluding Section IV. Our results provide cross-country empirical support for certain types of policy conditionality in packages designed to restore creditworthiness.

II. CONSUMPTION FUNCTIONS

The relationship between domestic saving and foreign resource inflows has generated considerable controversy. The empirical magnitude

1/ For the most part, policy conditions have resulted in sharply lower investment and growth. The desired improvement in the trade balance has primarily been achieved through reduction in imports.
of the relationship and the policy implications that follow from a negative correlation between domestic saving and resource inflows from abroad are often disputed. For example, Griffin (1970) takes this as prima facie evidence that aid retards development. Others maintain that this is not a proper test of the effectiveness of aid. Even if there is a less than a one-for-one increase in investment with an increase in foreign inflows, welfare would still be raised provided the real return on capital exceeded the real cost of borrowing. If there is a link between domestic saving rates and creditworthiness, however, there may be a need to reassess the impact of foreign inflows and to analyze whether different modalities of foreign financing have different macroeconomic effects.

The first stage of the analysis is to establish the impact of foreign inflows on domestic consumption and to test whether the marginal propensity to consume out of project-related foreign capital inflows is different from that out of non-project inflows. To do this, we estimate aggregate consumption functions for each of the twenty-six countries in our sample. Our procedure differs from the existing literature in two ways. First, we use only time-series, not cross-sectional, analysis. We avoid the bias that may arise due to the simultaneous determination of consumption and income by using instrumental variables. Second, we

1/ See, for example, Griffin (1970), Weisskopf (1982), Papanek (1972) and Heller (1975).
look for possible differences in the effects of alternative types of foreign financing.

The Model

Consider the following simple model:

\[ PC = a_0 + a_1 (Y - T) \]  \hspace{1cm} (1)

\[ BC = b_0 + b_1 T + b_2 FI \]  \hspace{1cm} (2)

\[ T = t_0 + t_1 Y - t_2 FI \]  \hspace{1cm} (3)

\[ TC = PC + BC \]  \hspace{1cm} (4)

where \( PC, BC, TC \) are private, public and total consumption, respectively; \( Y \) is a measure of income, \( T \) is government net revenue and \( FI \) is foreign inflows.

Private consumption is based upon disposable income. Government consumption is a function of net revenues and net foreign inflows into the country. Total net foreign inflows rather than public inflows alone are considered because this reflects total government borrowing from domestic and foreign sources. Government borrowing in many instances forces the private sector to borrow off-shore, or else is ultimately financed by a loss of foreign reserves. In both cases, net foreign inflows to the country increase even if official external borrowing does not. Government net revenue is also a function of income.
and net foreign inflows. The latter reflects the notion that public borrowing is often used to finance transfers to the private sector. Some governments may have weakened their tax collection as borrowing opportunities arose. In addition, borrowing has permitted a delay in adjustment to large relative price changes, reflected in growing public enterprise operating deficits and other forms of subsidies.

Combining equations (1) - (4), we can derive a structural equation for total consumption:

\[ TC = c_0 + c_1 Y + c_2 FI + u \]  \( (5) \)

Equation (5) should not be estimated by ordinary least squares due to the simultaneous equation bias arising from the national accounts identity, \( Y = TC + FI \). Accordingly, we use lagged values of TC, I, and FI along with the contemporaneous value of FI as instruments for Y. In this instance, then, two stage least squares and instrumental variables estimation are identical. We give careful attention to deriving the correct standard errors of estimated parameters — a potential problem when the instrumental variables method is done in two steps.

In estimating equation (5), we treat foreign inflows as an exogenous variable. This reflects two possibilities. First, for many countries, foreign inflows are supply-determined. That is, credit rationing is likely to be pervasive. In the 1960s, this assumption seemed reasonable. Most foreign lending was by official creditors, or took the form of supplier credits or private direct investment. None of
these would be responsive to short-term unanticipated changes in demand. Empirical results in Eaton and Gersovitz (1981) confirm this. During the mid-1970s, however, with the growth of syndicated lending, the existence of credit rationing was less pervasive. While some countries were still undoubtedly rationed (see Kharas and Shishido (1984)), others were not. Even for this latter group, however, we would argue that foreign inflows can be properly treated as exogenous. It is reasonable to suppose that with the lags involved in trade flows, unanticipated changes in demand will not affect contemporaneous trade, but future trade. We assume that the impact effect of higher demand, for example, would be felt in lower stocks held by importers and would result in higher deficits in the next period as stocks were rebuilt.

Data and Results

With these caveats, equation (5) was estimated using instrumental variables for twenty-six developing countries for the period 1961-81. The data were drawn from the World Bank's World Tables. They consist simply of the national income account series for each country. Foreign inflows are derived from national income data on exports and imports of goods and non-factor services, and on net factor income from abroad (\( FI = M - X - NFI \)). All variables were expressed in per capita terms and deflated to limit heteroskedasticity. The consumption variable includes both private and public consumption. Measured income is defined as the sum of gross domestic output at current market prices plus net factor income from abroad. A Cochrane-
Orcutt procedure was used to correct for serial correlation, whenever detected.

We then proceeded to test for any differences in the estimated marginal propensities to consume out of project (PI) and non-project (NPI) foreign inflows. No direct test was feasible, because these are not independently observed variables; only the sum is observable from national accounts data. Details on the sources of foreign inflows, between private and official creditors, for example, are available, but there is no systematic macroeconomic information on the purpose of loans. Official loans, although primarily for projects, have recently been increasingly used for non-project purposes such as export promotion, budgetary support or balance of payments financing. Conversely, many private inflows have financed investment. Thus, the official/private distinction is not a good proxy for project/non-project comparisons. We can, however, make the assumption that non-project lending has increased substantially relative to project lending during the 1970s as compared with the 1960s. This reflects both the growth of commercial eurocredits as a source of finance and the increasing attention given by official creditors to non-project financing. Given this assumption, we would expect differences between the marginal propensities to consume out of these types of foreign inflows to be reflected in a structural change over time in the estimated coefficient on aggregate foreign inflows. On the other hand, if foreign funds are fully fungible, then no such differences would be observed.
To see this formally, consider the following simple model where variables other than foreign inflows have been excluded for expositonal purposes.

\[ TC_t = f_1 \ PI_t + f_2 \ NPI_t + v_t \] (6)

\[ FI_t = PI_t + NPI_t \] (7)

We are interested in whether or not \( f_1 = f_2 \). We only observe FI, however, not PI or NPI. Consider the estimator, \( f \), of the least squares coefficient obtained from a regression of consumption on total foreign inflows (Equation (11)).

\[ C_t = f \ FI_t + w_t \] (8)

\[ \text{E}(f) = f_1 \cdot \frac{C(\text{FI}, \text{PI})}{V(\text{FI})} + f_2 \cdot \frac{C(\text{FI}, \text{NPI})}{V(\text{FI})} \] (9)

where \( C(\text{FI}, \text{PI}) \) is the covariance of foreign inflows with its project component and \( V(\text{FI}) \) is the variance of foreign inflows. Equation (9) shows that the estimated coefficient \( f \) is simply a weighted average of the two underlying coefficients \( f_1 \) and \( f_2 \). Note that if PI and NPI are independent, which does not seem too unreasonable, then the weights are simply the share that each variable contributes to the total...
variance of both. 1/ It is now easy to see that the assumption that non-project inflows were substantially more important during the 1970s (and therefore had a larger variance) implies that the weight of $f_2$ should be higher in this period. Thus, $E(f)$ for 1960-70 should be significantly different from $E(f)$ for 1970-80 if $f_1$ is different from $f_2$. If, on the other hand, $f_1 = f_2$, then the change in the weights has no impact on $f$ (indeed, using the sum of total foreign inflows, FI, is appropriate). We can, therefore, make inferences based on the detection of changes over time in $f$. In fact, $E(f)_{70-80} > E(f)_{60-70}$ implies $f_2 > f_1$. (Of course, another possibility is that the true parameters, $f_1$ and $f_2$, are themselves changing over time in an unknown way. Then we cannot make any inferences about them).

Structural change at alternative dates was examined using a Chow test. When a Chow test indicated a structural shift, the consumption function for that country was run using slope dummies for both the foreign inflows and the income variables. 2/ The dummies take a value of one after a certain date and zero before that date. Hence, we ran the following regression:

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1/ When the other independent variables are included in the model, the basic result that $f$ is a weighted average still holds but the weights are less easily interpreted in an intuitive fashion.

2/ There is some pre-test bias with this approach. We are not, however, interested in estimating in an unbiased way precisely when the structural change occurred, but only if the coefficients are different between any two sub-samples. The bias, therefore, is in favor of detecting structural change.
\[ C_t = a_0 + a_1 Y^*_t + a_2 d Y^*_t + a_3 FL_t + a_4 d FL_t + u_t \]  

The time at which we posit a shift was varied according to judgments based on knowledge of country experience. Where there was serial correlation, each sub-sample was transformed using the rho estimated for the whole sample.  

The results of the estimated consumption functions are shown in Table 1. The coefficients mostly have the right sign and are significant. In twelve countries, consumption is significantly raised by foreign inflows. The regressions are fairly stable over time. One-half of the sample, thirteen countries, showed evidence of structural change. Of these, only one country (Colombia) showed a significant decline in the marginal propensity to consume out of foreign inflows during the later period covering the 1970s, while three (Brazil, Central African Republic and Tunisia) countries showed a significant increase. We conclude, therefore, that for most developing countries there is no strong evidence that the expansion of non-project lending in the 1970s led to a structural change in the propensity to consume out of foreign inflows. There is, however, a strong association between higher borrowing and higher consumption throughout the period for many countries. It seems, therefore, that the fall in average savings rates that was observed during the 1970s can be largely explained as a reflection of

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1/ See Corsi, Pollock and Prakker, "The Chow Test in the Presence of Serially Correlated Errors".

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### Table 1: Estimated Consumption Functions

<table>
<thead>
<tr>
<th>Country</th>
<th>Constant</th>
<th>Y</th>
<th>FI</th>
<th>DY</th>
<th>DPT</th>
<th>D.W.</th>
<th>Shift</th>
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<td>.634</td>
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<td>-.127</td>
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<td>74/75</td>
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<td>(1.35)</td>
<td>(-3.08)</td>
<td>(-.96)</td>
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<td>.742*</td>
<td>.882*</td>
<td>.023</td>
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<td>1.31</td>
<td>75/76</td>
</tr>
<tr>
<td>1962-82</td>
<td>(.960)</td>
<td>(7.77)</td>
<td>(3.13)</td>
<td>(.988)</td>
<td>(-.713)</td>
<td>(after COIC)</td>
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<td>.521*</td>
<td>.233</td>
<td>-</td>
<td>-</td>
<td>1.45</td>
<td>-</td>
</tr>
<tr>
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<td>(4.10)</td>
<td>(11.8)</td>
<td>(1.73)</td>
<td>-</td>
<td>(after COIC)</td>
<td>-</td>
<td></td>
</tr>
<tr>
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<td>(.557)</td>
<td>(2.47)</td>
<td>(3.31)</td>
<td>-</td>
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<td>.989*</td>
<td>-.004</td>
<td>-1.32*</td>
<td>1.02</td>
<td>73/74</td>
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<td>(3.00)</td>
<td>(.207)</td>
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<td>(5.91)</td>
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<tr>
<td>India</td>
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Table 1: Estimated Consumption Functions
(continued)

<table>
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<tr>
<th>Country</th>
<th>Constant</th>
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<th>FI</th>
<th>DY</th>
<th>DFI</th>
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<td>.602*</td>
<td>.334</td>
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<td>1.36*</td>
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<td>(2.95)</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>.020</td>
<td>.711*</td>
<td>-.166</td>
<td>-.057*</td>
<td>1.14*</td>
<td>1.89</td>
<td>72/73</td>
</tr>
<tr>
<td>1964-82</td>
<td>(1.05)</td>
<td>(6.27)</td>
<td>(-.31)</td>
<td>(-2.25)</td>
<td>(2.12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zaire</td>
<td>-.015</td>
<td>1.16*</td>
<td>.241</td>
<td>-.016</td>
<td>-.251</td>
<td>1.26</td>
<td>66/67</td>
</tr>
<tr>
<td>1961-80</td>
<td>(-2.18)</td>
<td>(6.35)</td>
<td>(.686)</td>
<td>(-.541)</td>
<td>(-.678)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>.028</td>
<td>.518*</td>
<td>.354</td>
<td>-.059</td>
<td>-.135</td>
<td>2.27</td>
<td>67/68</td>
</tr>
<tr>
<td>1963-82</td>
<td>(1.58)</td>
<td>(4.70)</td>
<td>(1.65)</td>
<td>(-1.35)</td>
<td>(-.586)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Total consumption is the dependent variable; t-statistics are in parenthesis.

* significant at the 5 percent level.
the expanding volume of foreign inflows rather than of the changing composition of such flows. The marginal savings rates do not seem to change.

III. CREDITWORTHINESS ANALYSIS

Following the analysis in Kharas (1984), we assume that creditworthiness problems arise when random shocks lead to a reduction of actual GNP below some critical level. The critical level of GNP, \( Q^C \), is the level that would avoid long-run collapse in consumption and output if debt service were paid, given a stable relationship between consumption, income and net foreign inflows. \(^1/\)

\[
Q^C = g_0 - g_1 \text{ FI} + g_2 \text{ D} \tag{11}
\]

Where D is debt outstanding.

The higher the level of net foreign inflows, and the lower the stock of debt, the lower is the critical output level. This follows from the fact that high net borrowing and low debt permit higher consumption and investment after debt service obligations have been met.

Creditworthiness problems are not actually observed. We do, however, observe reschedulings. Define a dependent variable, \( y^* \), such that when \( y^* > 0 \), a rescheduling occurs and when \( y^* < 0 \), it does not. We can relate \( y^* \) to the ratio of critical to actual output.

\(^1/\) See Appendix 1 for a derivation of \( Q^C \).
\[ y^* = \frac{\sigma^C}{Q} - C + \zeta \]  

(12)

where \( C \) is a constant. Assuming \( \zeta \) to be normally distributed, (11) and (12) can be combined to get the probability of \( y^* > 0 \) conditional on \( Q, F, I, D \).

\[ y^* = -C + g_0 \cdot (1/Q) - g_1 \cdot (F/I/Q) + g_2 \cdot (D/0) + \zeta \]  

(13)

Equation (13) is estimated in three ways. First, we assume that \( C, g_0, g_1 \) and \( g_2 \) are constant across countries and over time (Run 1). Next, we assume that there are country and time specific effects in \( C \), which are captured by the coefficients of the consumption functions estimated above. Thus, we replace \( C \) by \( C^1 + c_0 + mpcy + mpcfi \) where \( c_0, mpcy \) and \( mpcfi \) are the consumption function constant term and long-run marginal propensities to consume out of income and foreign inflows respectively (Run 2). Finally, we assume that the above parameters enter in a non-linear way (Run 3): \( g_0 \) is replaced by \( g^1_0 \cdot [c_0/(1-c_1)] \) and \( g_1 \) is replaced by \( g^1_1 \cdot [(1-c_2)/(1-c_1)] \).

These transformations are derived from Kharas (1984).

Data and Results

Data on reschedulings were obtained from the World Bank's World Debt Tables, 1984. The dependent variable was assigned a value of one if a rescheduling occurred and zero otherwise. The independent variables, GDP and FI, are those already used in the consumption function regressions. Debt outstanding was taken from the World Debt...
Tables. The variables $c_0$, mpcy and mpcf1 are derived from the regressions above.

Equation (13) was estimated with each country-year pair treated as a separate observation. Thus, there were 521 total observations, of which 44 had reschedulings. Due to the binary nature of the dependent variable, we used a probit procedure. The coefficients are given in Table 2.

<table>
<thead>
<tr>
<th>Run</th>
<th>$C$</th>
<th>$1/Q$</th>
<th>$FT/Q$</th>
<th>$D/Q$</th>
<th>$c_0$</th>
<th>mpcy</th>
<th>mpcd</th>
<th>Log Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1.52</td>
<td>3.86</td>
<td>-1.59</td>
<td>0.382</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-145.7</td>
</tr>
<tr>
<td></td>
<td>(-12.6)</td>
<td>(.367)</td>
<td>(-1.48)</td>
<td>(3.07)</td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.49</td>
<td>7.41</td>
<td>-1.98</td>
<td>0.497</td>
<td>-1.18</td>
<td>1.03</td>
<td>.018</td>
<td>-133.71</td>
</tr>
<tr>
<td></td>
<td>(-6.83)</td>
<td>(.297)</td>
<td>(-1.70)</td>
<td>(3.47)</td>
<td>(-2.61)</td>
<td>(2.33)</td>
<td>(-.074)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1.52</td>
<td>-.032</td>
<td>-.48</td>
<td>.239</td>
<td>-145.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(13.94)</td>
<td>(-.12)</td>
<td>(-2.17)</td>
<td>(2.16)</td>
<td></td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$t$-statistics in brackets

a/ coefficient on transformed variable.

In the bench-mark run, all the variables have the correct sign, but the coefficients on per capita output and net foreign inflows are insignificant. There appears to be no evidence that the richer developing countries are significantly more creditworthy. Nor does it appear that higher foreign borrowings lower the chance of rescheduling. High
debt/output ratios emerge as the most significant determinants of reschedulings. This contrasts with earlier findings that all three variables are significant (Kharas (1984)). The difference is mostly attributable to the updating of the sample. In the period considered here, most of the rescheduling observations are on rich Latin American countries. Adding the information on marginal propensities to consume out of income and out of net foreign inflows (Run 2) improves the fit of the relationship substantially. The coefficient on the marginal propensity to consume out of output has the correct sign and is significant. The marginal propensity to consume out of foreign inflows is insignificant. Countries that consume more on the margin are less creditworthy. The absolute value of the coefficient on the marginal propensity to consume out of income is 57 times the size of the other.

Run (3) results corroborate these findings. While the marginal propensity to consume out of income is combined with the GDP variable, remains insignificant, (the negative sign is due to the influence of $c_0$, the constant term from the consumption function), the coefficient on new foreign inflows, in combination with the income and inflows consumption propensities, becomes significant. These results suggest that concern with countries' savings rates out of income is indeed

1/ The figures in Table 2 should be treated with caution but not skepticism. The inclusion of estimated coefficients as independent variables gives rise to biased estimates. The quantitative impact of this bias, though, is likely to be very small given the high t-statistics on the estimated coefficients. This is a subject of further research by one of the authors.
appropriate for lenders. Policy changes that improve domestic saving rates can be as important as organizing additional inflows, or improving GDP growth, in re-establishing creditworthiness.

IV. CONCLUSION

It has been argued that foreign inflows jeopardize creditworthiness both through the build-up of debt and through their negative impact on domestic saving. Some have suggested that the latter effect was reinforced in the 1970s due to the shift towards untied commercial sources of external funds. We have undertaken an empirical analysis of these hypotheses, covering twenty-six developing countries from 1961-82. We find in almost all cases that foreign borrowing does reduce domestic saving on the margin. However, we find no evidence to suggest that shifts in sources and patterns of foreign financing have altered country behavior. It appears that from a macroeconomic view, foreign funds have been sufficiently fungible with domestic resources such that their impact on domestic investment and consumption has remained unchanged, regardless of whether the loans were tied to specific projects or not.

Also, we find strong empirical support for the proposition that raising marginal saving rates is significant in improving creditworthiness. Additional foreign lending, in and of itself, improves creditworthiness in the short-run. If it can help to achieve structural reform, through raising marginal saving rates, then its impact is substantially reinforced even if average saving rates decline as a result.
of the foreign inflows. These findings support the usefulness of the kind of policy conditionality that has accompanied recent IMF and IBRD program loans to countries with debt servicing difficulties.
REFERENCES


HJK#2Kharas/Levinsohn:DebtCrises:10-2-85:cmb
APPENDIX 1

Consider an economy where technology is Leontief, fixed-coefficients and labor is in surplus in the relevant range. The change in income is determined by the output/capital ratio, $b$, the previous year's level of investment and the change in interest payments on external debt.

\[ Y = bK - rD \]  \hspace{1cm} (1)

Investment, $K$, is given by the sum of domestic saving and foreign inflows.

\[ K = Y - TC + D \]  \hspace{1cm} (2)

\[ = -c_0 + (1 - c_1) Y + (1 - c_2) D \]  \hspace{1cm} (2a)

Foreign inflows are given exogenously by lenders. Assume gross inflows are exogenous and that amortization is a constant fraction of debt outstanding:

\[ D = FI - \theta D \]  \hspace{1cm} (3)

Rewriting:

\[
\begin{bmatrix}
Y \\
D
\end{bmatrix} =
\begin{bmatrix}
b(1-c_1) & -r-b\theta(1-c_2) \\
0 & -\theta
\end{bmatrix}
\begin{bmatrix}
Y \\
D
\end{bmatrix} +
\begin{bmatrix}
b(1-c_2) \\
1
\end{bmatrix}
FI -
\begin{bmatrix}
bc_0 \\
0
\end{bmatrix}
\]  \hspace{1cm} (4)
The general solution to the equation above is characterized by the two eigenpairs:

\[ \lambda_1 = b(1 - c_1), \quad v_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}; \quad \lambda_2 = -\theta, \quad v_2 = \begin{bmatrix} r + b\theta(1 - c_2) \\ b(1 - c_1) + \theta \end{bmatrix} \]

Because the roots are real and of opposite signs, the solution is characterized by a saddle-point equilibrium. All points above the eigenvector \( v_2 \) lead to ever-decreasing debt/income ratios. A critical income level can be defined, for each initial debt stock, such that above this level, domestic savings are sufficient to generate a growth path with falling debt-income in the long-run.

\[ Y^c = \frac{r + b\theta(1 - c_2)}{b(1 - c_1) + \theta} \cdot D - A \cdot F + \frac{c_0}{1 - c_1} \]  \( (5) \)

where \( A \) is a constant that depends on \((1 - c_1)\) and \((1 - c_2)\)