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EXTERNAL DEBT AND CREDITWORTHINESS: THEORY WITH EVIDENCE*

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The existence of international lending raises the issue of creditworthiness of sovereign debtors. From a lender perspective, it is important to have some prior warnings about potential debt repudiation. We analyze how the fiscal evolution of a country might contain information about its creditworthiness. In a two good, small open economy theoretical framework, we find that budget deficits and current account developments hold critical information regarding structural imbalances and creditworthiness. The model is also able to account for a number of features which often characterize countries with chronic debt problems including the phenomenon of capital flight and the usefulness of debt relief for stabilizing explosive debt situations. Estimation of a model of debt arrears with cross country data provides general support to the theoretical structure. A major finding of the paper is that it is the efficiency of investment and not the level of investment that is important for creditworthiness purposes. In general, we find that exports, imports, income inequality, inflation and the efficiency of investment are able to explain about three-fourths of the cross-country variation in debt servicing performance. We find that the results are robust to both different specifications as well as alternative measures of country risk such as credit ratings assigned by international creditors. (JEL F3, F4)

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1. Introduction

The recent Brazilian debt agreement is often heralded by creditors as a milestone in putting the debt crisis of the last ten years behind. But the debt problem is far from over for the developing countries. While it is true that on the whole, the net debt creating flows to these countries have dropped from about $70 billion p.a. during the years preceding the Mexico debt crisis (August 1982) to about $35 billion p.a. since then, the developing countries have accumulated over $300 billion in net debt over this period. Further, if history is any indication, the relatively quiet period in international lending is likely to give way to another cycle of booms and bursts in lending. The enthusiasm of creditors to opportunities in Eastern Europe and the former Soviet Union is a case at hand.

The question of debt sustainability therefore remains critical as ever, as does the analytical framework to analyze the conditions of default on sovereign debt. In this paper, we show that the gap between theory and practice as far as creditworthiness analysis is concerned, remains very wide. In particular, the dynamic relationship between the budget deficit and external debt, often considered the cornerstone of applied country risk policy, has not been well investigated. We use a fairly simple two-good, open economy model to analyze the dynamics of debt accumulation and the nature of its interaction with a number of macro variables, particularly the fiscal evolution of the country. We show that budget deficits and current account developments hold critical information for the continued creditworthiness of a country. The model highlights the critical role that fiscal adjustments play in managing debt crises. Within our model structure, we are also able to demonstrate the role that debt relief might play in managing explosive debt situations. In the process, we generate predictions for the sustainability of debt service.

Drawing from these theoretical findings, we estimate an econometric model of debt arrears, using data on 57 countries over the 1979–1989 period. The results are supportive of the theoretical model in that all the relevant variables of the model turn out to be significant for predicting debt servicing difficulty. The results raise several interesting points. First, it is not enough to focus on exports as an indicator of creditworthiness. Imports, which are often neglected in empirical studies, should also be considered as they represent a claim on foreign exchange earnings and affect the willingness of debtors to repay. Second, the effect of fiscal deficits on debt servicing problems is undeniable. However, it is more important to look at the fundamental causes of high deficits rather than the deficits themselves. Among those fundamental causes, we find income distribution and the productive use of debt to be very important.

A major finding of the paper is that it is important to distinguish between the quantity and the efficient use of investment, and that it is the latter that seems to matter the most. The result bridges an important gap between the theoretical literature in this area which stresses the importance of productive investment for sustainable debt creation and the empirical literature which focusses on the quantity of investment and thus ignores the prevalence of inefficient investment and the creation of »white elephants» in the public sector in a number of LDC's. This result also underscores the informational content of micro level data for macroeconomic developments. We are not aware of any work in this area which has highlighted the difference between the quantity and quality of investment in analyzing debt problems.

Third, we find that the rate of inflation positively correlates with the probability of facing a debt servicing problem. The result strengthens the importance of a good economic climate and careful macroeconomic management for the creditworthiness of a country. We should note that the literature has not focussed much attention on inflation as a determinant of debt servicing and creditworthiness. We also find that not only are the results robust to different specifications but they are also robust to alternative measures of country risk such as credit ratings assigned by international creditors.

Traditionally, there have been three approaches to the problem of country risk analysis. The first is purely empirical. Under this approach, variables which are likely to have some

predictive power for default on country debt are brought together either in a checklist approach (see, for example, Calverly, 1990, Haner and Ewing, 1985, Kreyenbuehl, 1988, or in a quantitative framework such as discriminant, logit or probit analyses, see Calliari et al., 1990, Cline, 1984, Feder and Just, 1977, Frank and Cline, 1971, Berg and Sachs, 1988). The problem with these models is the lack of any theoretical underpinning.

The second approach is purely theoretical. It recognizes the distinctiveness of sovereign debt and investigates the enforceability of sovereign debt contracts (see Eaton, Gersovitz and Stiglitz, 1986, Fernandez and Kaaret, 1987, Bulow and Rogoff, 1989). This work is inherently game theoretic and not very amenable to empirical verification. Furthermore, this literature does not quite address the issue of devising suitable early warning mechanisms for predicting prospective default.

The third approach is also theoretical but the focus of attention is on the determinants of optimal debt accumulation. This literature is primarily embedded in the long run growth framework. The rationale is that in a growing economy, that part of domestic income not used for debt service payments could be used for domestic consumption and investment. Thus emphasis is placed on the relationship between the productive capital stock and per capita output growth. The key issue is the sustainability of debt policies with attention being focussed on the use of external finance to supplement domestic savings for investment financing. The work of Avramovic (1964) and Kharas (1984) is along this line.

Country risk analysts in practice have taken an agnostic view and have followed the first approach since it allows them to have a comprehensive view of factors affecting a country's creditworthiness. However, there are severe limitations to this approach. First and foremost, there is no theoretical justification to include one set of variables over others. This remains perhaps the most fundamental criticism of this approach. Second, the traditional approach neglects several important variables that are often deemed crucial to creditworthiness in practice. For instance, while it is widely acknowledged that fiscal policy holds the key to an understanding of the fundamental causes of external debt, almost all of the studies conducted thus far (including the checklist type[1]), to the best of our knowledge, have ignored this area.

Another area is capital flight. It is often observed that capital flight provides an early warning sign to debt servicing difficulties. The experience of some Latin American countries is particularly instructive in this respect. Sachs (1989) reports that in Mexico, during the late 1970's and early 1980's, the Mexican government accumulated foreign debt of approximately $75 billion while the private sector accumulated foreign asset holdings of about $40 billion. Similarly, Auernheimer (1990) reports that between 1978 and 1986, the declared foreign debt of Argentina went up by about $45 billion while the foreign asset holdings of the private sector went up by about $31 billion. This capital flight not only led to greater instability but also to lower growth potential due to reduced investment at home. The lower growth potential implied lesser debt servicing capability which only exacerbated the problem. This aspect is also not usually addressed in empirical studies[2].

The rest of the paper is organized as follows: the model is presented in Section 2, followed by the econometric evidence in Section 3. Section 4 concludes the paper.

2. *The Model*

We essentially draw on the model developed by Drazen-Helpman (1987)[3]. Consider a small open economy with two consumption goods: one traded and the other non-traded. Let the output of the traded good be denoted by x_1 and the output of the non-traded good by x_2. Let P_1 be the foreign currency price of the traded good

[1] *The only exception is Haner and Ewing (1985).*

[2] *Alesina and Tabellini (1989) and Auernheimer (1990) discuss this issue in the context of a theoretical framework.*

[3] *We should note that while Drazen and Helpman used the model to analyze the interactions between the government budget, inflation and exchange rate developments, we use the model to analyze issues of external debt sustainability.*

and P_2 be the domestic currency price of the non-traded good. Let E be the nominal exchange rate, i.e., the price of the foreign currency in terms of the domestic currency. For convenience we normalize the foreign currency price of the tradable to one. Thus the domestic currency price of the tradable is E. Let $\varepsilon = E/P_2$ be the real exchange rate. Let $P = P(E,P_2)$ be the domestic currency price index of the two goods. We assume that P is increasing and linearly homogenous in each of its arguments.

A representative individual maximizes utility derived from consumption of the two goods and real money holdings subject to a budget constraint. We assume that the individual utility function is separable across consumption of the two goods and real balances. Thus the representative individual's utility function is represented by

$$U[c_1(t),c_2(t)] + v[m(t)]$$

where $c_i(t)$ = consumption of the ith commodity, $m(t) = M(t)/P(t)$ and M(t) = nominal money balances. Thus m(t) is the real balance holdings of the individual. We assume that consumption of both goods and production of the tradable good are functions of the real exchange rate and that

$$c_1'(\varepsilon) < 0 \text{ , } c_2'(\varepsilon) > 0 \text{ , and } x_1'(\varepsilon) > 0;$$

Further the representative individual has a fixed endowment, x_2, of the non-tradable good. Note that x_1 is the production of the tradable commodity domestically.

Residents can hold two assets: (a) domestic money; and (b) securities, denoted by b, which are denominated in terms of the traded good. Given the normalisation of the foreign currency price of the tradable to unity, this is equivalent to the securities being denominated in terms of the foreign currency. The securities earn a real rate of return, r, in terms of the traded good. The individual's subjective discount rate is denoted by ρ.

For reasons of analytical convenience, we rule out discrete money – security swaps by the individual. Such discrete portfolio changes have important implications for the sustainability of fixed exchange rates and the timing of speculative runs on foreign exchange reserves. That is however not the focus of this paper. Interested readers are referred to Drazen-Helpman (1987). Using traded goods as the numeraire, the lifetime budget constraint facing the individual is thus given by

$$(1) \quad b_0 \geq \int_{t=0}^{\infty} e^{-rt}\left[c_1(t) + \frac{P_2(t)c_2(t)}{E(t)} + \tau(t) + \frac{z(t)}{E(t)P(t)} - x_1(t) - \frac{P_2(t)x_2(t)}{E(t)}\right]dt$$

where τ is the lump sum tax in terms of the tradable and z is the flow addition to nominal money holdings. b_0 is the individuals stock of initial security holdings. The nominal money balance constraint facing the individual is

$$(2) \quad M(t) = M(0) + \int_{s=0}^{t} z(s)\,ds \text{ for all } t$$

where M(0) is the initial stock of money balances. Let seignorage revenue in terms of domestic currency be σ where

$$(3) \quad \sigma = \frac{\dot{M}}{P} = \frac{\dot{M}}{M}\frac{M}{P} = \mu m$$

Hence seigniorage revenue in terms of the tradable good is given by $\mu m/E$. Thus, using equation (2), we have

$$(4) \quad \frac{z}{EP} = \frac{\mu m}{E}$$

The individual's total asset holdings, in terms of tradables, are $a = b + m/E$.

The government in this economy prints money, imposes taxes and holds debt, d, denominated in terms of traded goods and hence under our assumptions, in terms of foreign currency. We assume that government expenditure is on both tradables and non-tradables. The intertemporal budget constraint facing the government is thus given by

$$(5) \quad d_0 \leq \int_{t=0}^{\infty} e^{-rt}\left[\tau(t) + \frac{z(t)}{E(t)P(t)} - g_1 - \frac{P_2(t)g_2(t)}{E(t)}\right]dt$$

Note that d_0 is initial net government debt, where net government debt is defined as outstanding debt less reserve holdings. We can also define net country debt, n, as

$$(6) \quad n = d - b$$

The individual's optimization problem is

maximise

$$(7) \quad \int_{t=0}^{\infty} e^{-\rho t} [U(c_1(t), c_2(t)) + v(m(t))]\, dt$$

subject to equations (1) and (2). The first order conditions of the problem are[4]

$$(8) \quad U_1(c_1, c_2) = \lambda$$

$$(9) \quad U_2(c_1, c_2) = \lambda \frac{P_2}{E}$$

$$(10) \quad \frac{V_m}{\lambda} = \frac{r + \pi + \frac{\dot{E}}{E}}{E}$$

where λ is the current value costate variable associated with a.

Equations (8) and (9) together imply

$$(11) \quad \frac{U_1(c_1, c_2)}{U_2(c_1, c_2)} = \frac{E}{P_2} = \varepsilon$$

Equation (11) is the condition that the marginal rate of substitution between the tradable and the non-tradable should equal the relative price, which in this case is the real exchange rate. Equation (10) defines the demand for real balances by the representative individual. We assume that r = r(n) with r'> 0, i.e., the rate of interest faced by the economy is an increasing function of the net country debt. The formulation is attractive as it captures the phenomenon of increasing capital flight with greater domestic instability and burgeoning foreign indebtedness. This happens to be a fairly common phenomenon in Latin American countries facing huge amounts of foreign debt.

Using the market clearing condition, ($x_2 = c_2 + g_2$), the first order conditions and the budget constraints facing the private agents and the government we have the differential equations which characterize this economy. They are

$$(12) \quad \dot{c}_1 = \frac{U_1(c_1, x_2 - g_2)}{U_{11}(c_1, x_2 - g_2)} [\rho - r(n)]$$

$$(13) \quad \dot{n} = rn + c_1 + g_1 - x_1 [\varepsilon(c_1, g_2)]$$

$$(14) \quad \dot{b} = rb + x_1 + \frac{P_2}{E} x_2 - c_1 - \frac{P_2}{E} c_2 - \tau - \frac{\mu m}{E}$$

$$(15) \quad \dot{d} = rd + g_1 + \frac{P_2}{E} - \tau - \frac{\mu m}{E}$$

$$(16) \quad \dot{m} = \left[\mu + r + \frac{\dot{E}}{E} - v_m \frac{E}{\lambda}\right] m$$

In order to analyze the interaction of the monetary side of the system with net foreign indebtedness we now focus on the system defined by equations (13) and (16). The system is characterized by two roots which are both positive. Hence the steady state point is unstable, i.e. it is a »source». Figure 1 depicts the laws of motion governing the system. Any level of debt higher than n_* leads to net foreign debt exploding over time. Note that this is true of all points lying to the right of the $\dot{n} = 0$ locus. Explosive debt implies unsustainability and thus debt repudiation by the country concerned.

From the $\dot{n} = 0$ equation we can solve for the critical level of net foreign debt, n_*, and the associated debt servicing burden which is consistent with sustainability, $(rn)^*$. Setting equation (14) equal to zero we have

$$(17) \quad rn = x_1 [\varepsilon(c_1, g_2)] - c_1 - g_1$$

Using equation (18) we can solve for the critical level of debt service, $(rn)^*$, as a function of x_1, c_1 and g_1. As primary predictions, we have

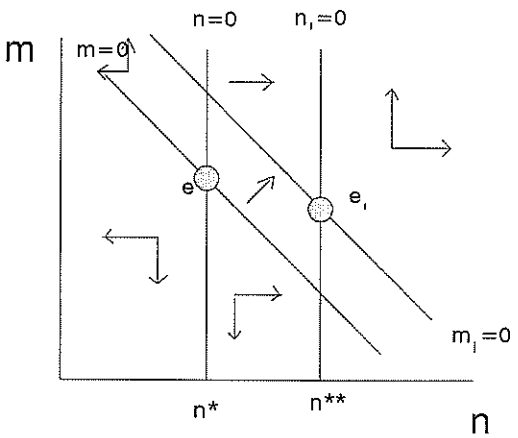

Figure 1.

[4] *For a detailed and comprehensive theoretical analysis of the model see Dinh and Lahiri (1992). Here we are restricting ourselves to a »bare-bones» version.*

$\delta(rn)^* / \delta x^1 > 0$, $\delta(rn)^* / \delta c_1 < 0$, and $\delta(rn)^* / \delta g_1 < 0$. Noting that $r' > 0$, we also have $\delta n_* / \delta x_1 > 0$, $\delta n_* / \delta c_1 < 0$, and $\delta n_* / \delta g_1 < 0$.

In other words, an increase in the domestic production of the tradable good or a decrease in the private or government consumption of the tradable good would lead to an increase in the level of net foreign indebtedness consistent with sustainability and steady state. Thus, in a multi-commodity world, an increase in exports, ceteris paribus, would reduce the probability of a debt servicing problem while an increase in imports would increase the probability.

The model can be used to analyze the conditions under which debt relief or a debt »time out» may help stabilize an explosive debt situation[5]. The effect of debt relief is to reduce the debt repayment commitment or equivalently to provide additional concessionary resources at the disposal of the debtor. Assume that the debt relief is given to the debtor by reducing the rate of interest. In terms of Figure 1, this causes the $\dot{n} = 0$ locus to shift to the right and shift the $\dot{m} = 0$ locus upwards. The new steady state point would be to the right of point e and hence would be consistent with a higher level of net country debt. Thus if a country started out to the right of point e and were faced with destabilising debt accumulation, the right amount of debt relief or debt »time out» could enable the country to stabilize. The successful stabilization in Indonesia (1966–71), Turkey (1979–81) and Bolivia (1986–87) were based upon this strategy of debt relief.

It has long been argued that large budget deficits lead to increasing inflation and domestic instability. This, in turn, leads to increasing capital flight from the home country. Drazen and Helpman (1990) showed that the phenomenon of increasing inflation could be explained by incorporating expectations of future stabilization. In particular, they argued that inflation dynamics could exhibit varied patterns depending on what agents expected the government to do in order to stabilize. The implications of the above for country risk analysis is well brought out by analyzing the system in terms of real money balances and government debt.

Our system is thus given by equations (15) and (16), i.e., in terms of the $\dot{m}$ and $\dot{d}$ equations. The system is characterized by two positive roots and is hence unstable. Figure 2 depicts the laws of motion governing the system. It is important to note that all points to the right and below the $\dot{d} = 0$ locus are characterized by increasing government debt over time.

To understand the dynamics of the system it is instructive to study a simple policy experiment. Starting from the steady state point in Figure 2 (point e), suppose government spending on tradables suddenly goes up to make government debt expand over time. Given the government solvency requirement, this cannot continue indefinitely and hence residents expect a stabilization in the future. Suppose agents expect the government to start printing money at a faster rate in period T in order to plug the deficit and freeze the government debt at that point. Under complete certainty about both the timing and instrument of stabilization, increasing μ, assuming that the elasticity of real mon-

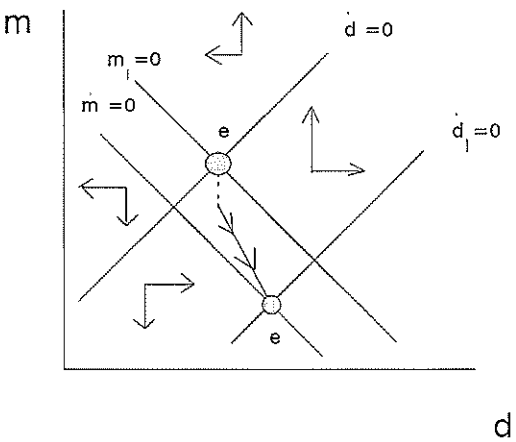

Figure 2.

[5] *Note that we are analyzing debt dynamics explicitly from an »ability-to-pay» view. From a »willingness-to-pay» approach Bulow and Rogoff (1989) conclude that debt reduction schemes are worthless for debtors. However even from this approach, Chang (1991) shows that it is possible to come to the oppsite conclusion from Bulow and Rogoff. Thus the literature seems to be divided on the usefulness of debt relief. Also, for a historical perspective on the usefulness of debt relief for stabilizing explosive debt situations, see Lindert and Morton (1989).*

ey balances with respect to μ is less than unity, would increase μm. This would shift the $\dot{d} = 0$ locus outwards to the right and the $\dot{m} = 0$ locus inwards to the left. Given that agents expect e_1 (in Figure 2) to be the long run steady state point, real money balances would jump down today so as to get on the dynamic path leading to e_1.

For given nominal balances this implies a jump up in the inflation rate today and then a monotonically increasing rate of inflation over time till period T when the stabilization is actually effected. Everything else being given, declining m implies $\dot{b} > 0$, i.e., private capital starts flowing abroad due to the anticipation of an increase in the inflation tax in period T. Note also that starting from steady state, equation (15) implies that with declining m, seignorage revenue declines due to the contracting money base. Thus government debt starts expanding over time. However this expansion of government debt due to declining seignorage revenue is exactly offset by the increase in private foreign asset holdings. The expansion of government debt due to increased expenditure on tradables is however not offset by private foreign asset holdings. Hence government debt expands at a faster rate than private asset holdings abroad which leads to expanding net country indebtedness over time. Given our previous analysis, this would be unsustainable in the absence of a policy change (like plugging the deficit in period T). It is important to observe that the entire stabilization in period T cannot come through printing money. If that happens private asset holdings would start declining without check and lead to a violation of the private budget constraint and the solvency of the country itself. In this theoretical experiment, the only way of restoring steady state is for the government to cut back its expenditure on the tradable commodity. In other words, the government would have to restore equilibrium in the current account to prevent the country from becoming insolvent over time.

The above implies that the increase in net country indebtedness occurs due to the widening domestic budget deficit. This naturally suggests that huge budget deficits should be symptomatic of expanding country indebtedness and hence of potential instability and debt repudiation. For all points along the $\dot{d} = 0$ locus we have

$$(18) \quad rd = \tau + \frac{\mu m}{E} - g_1 - \frac{P_2}{E} g_2$$

From equation (19) we can solve for the critical level of government debt, d_*, and the associated level of debt service, $(rd)^*$, which is sustainable, as a function of τ, μ, g_1, and g_2. From equation (29) it is easily seen that $\delta(rd)^*/\delta\tau > 0$, $\delta(rd)^*/\delta\mu > 0$, $\delta(rd)^*/\delta g_1 < 0$, and $\delta(rd)^*/\delta g_2 < 0$. Noting that $n = d - b$ and that r is a function of n, we also have $\delta d_*/\delta\tau > 0$, $\delta d_*/\delta\mu > 0$, $\delta d_*/\delta g_1 < 0$, and $\delta d_*/\delta g_2 < 0$. Thus the sustainable level of government debt decreases with an increasing deficit. Equivalently, it increases with declining government expenditures or increasing government revenues.

3. Econometric Evidence

Using the theoretical predictions derived above as priors, we estimated a logit model of debt servicing difficulty. Our data set consisted of panel data from 57 countries for the period 1979 to 1989 obtained from the World Bank ANDREX[6] database. These countries were selected on the basis of data availability, their active relationship with the World Bank (so that detailed country information is available), and geographical representation. Of these countries, 12 are located in Africa, 21 in Latin America and the Caribbean, 11 in Asia, 6 in the Middle East and North Africa, and 7 in Eastern Europe and Central Asia (Table A). The primary data sources for the ANDREX database were the World Debt Tables (World Bank), International Financial Statistics Yearbook (IMF), Government Financial Statistics Yearbook (IMF), information from the Institute of International Finance and the World Bank's Debt and International Finance Division. All possible attempts were made to ensure data consistency. However, given the wide variety of sources some problems might have remained.

[6] *ANDREX is the acronym for Analysis, Derivation, and Reporting in Express database maintained by IEC.*

For the dependent variable we constructed a dichotomous (0,1) variable. The variable took on the value »one» if the country ran arrears on interest payments due and »zero» otherwise. This variable was constructed on the basis of interest arrears figures reported by the World Bank. This kind of a dichotomous variable was constructed for total interest arrears, private interest arrears, bilateral interest arrears and multilateral interest arrears. The baseline model that we estimated used total interest arrears as the dependent variable. We also experimented with the other measures of interest arrears and found that the results remained qualitatively unchanged. In order to alleviate the problem of simultaneity, we lag the independent variables by one year.

A note on the use of interest arrears as our dependent variable is in order given some history in the literature of using commercial rescheduling as the dependent variable. For one, interest arrears is the logical dependent variable from our theoretical model given that both equations (17) and (18) have interest payments as the left hand side variable (rn and rd). Secondly, the attempt of the paper is to develop an early warning mechanism of prospective debt-servicing problems. The first sign of such a problem is inevitably the accumulation of interest arrears. Further, commercial rescheduling only takes place after the country fails to correct the interest arrears problem. Thus, between the time a country slips into interest arrears and the time that its commercial debt is rescheduled, the independent variables that we propose to look at would have undergone systematic shocks or alterations in order to correct the interest arrears problem. Hence, by the time a country undergoes commercial rescheduling the independent variables may not be reflective of their true structural nature. Thus results derived from analysis which uses the incidence of commercial rescheduling as the dependent variable might report spurious results. Thirdly, it is often the case that despite the fact that the debt problems of a country are widely acknowledged, it doesn't show up through a commercial rescheduling as that is usually the outcome of protracted negotiations. Many of these developing countries also do not have access to commercial banks[7]. Hence looking at interest arrears seems to be more attractive on this count as well.

We should also note that many of the above features of interest arrears are also satisfied by secondary market prices. However, secondary markets in sovereign debt operate only for commercial debt. Our sample has quite a few countries which do not have access to commercial lending and hence, we would not have secondary market prices for their debt. Thus, given our sample, interest arrears seem to be the best measure of debt problems. However, as part of robustness checks on our results we also estimated the model with credit ratings as a proxy for creditworthiness and found that most of the results remained unchange.

The first model we tested was the one which was directly derived from our theoretical results. Thus we expected the probability of a debt servicing problem to be an increasing function of imports and a decreasing function of exports and the fiscal balance. The normalising variable we chose in order to control for size was GDP. The fiscal balance measure used is the Central Government consolidated balance (line 14) from the IMF's GFS, as formally defined according to the IMF Manual on Government Financial Statistics (1986). Unless otherwise noted, all other series have been taken from the World Bank ANDREX database.

The results conformed to our hypothesis (see Table 1, model 1.1). All the variables entered with the correct sign and were significant. The result on fiscal balance was especially heartening because though in applied country operations it is usually given a lot of importance, in cross-country comparisons, its effect is hard to document. In this and in all the other models that were estimated, we considered a calculated probability of more than 0.5 as a prediction of debt servicing problems. The percentage of correct predictions made by this model was 58.15.

In as much as good economic management lowers the probability of running into debt-serv-

[7] *Thus, the World Debt Tables 1992–1993 reported that between 1982 and 1991, 19 countries (out of 114) had rising payment arrears but no restructuring agreement.*

Table 1. Basic results[1] [2]

Model Number	Constant	Exports/ GDP	Imports/ GDP	Budget Balance	Inflation	ARIS	Income Distribution	Agriculture/ GDP	Percent Correct
1.1 N = 521	-0.14 (-0.67)	-5.01 (-3.14)	3.51 (2.32)	-6.16 (-3.19)					58.1
1.2 N = 518	-0.49 (-2.16)	-5.08 (-3.15)	4.09 (2.63)	-5.29 (-2.60)	1.43 (3.37)				62.1
1.3 N = 388	-0.47 (-1.61)	-5.18 (-2.60)	2.98 (1.50)	-3.33 (-1.37)			0.06 (3.69)		66.2
1.4 N = 497	-0.11 (-0.34)	-5.23 (-3.09)	3.89 (2.48)	-6.39 (-3.27)				-0.53 (-0.55)	57.7
1.5 N = 445	-1.77 (-4.73)	-6.92 (-3.88)	5.98 (3.43)	-3.09 (-1.44)		5.86 (5.52)			67.6
1.6 N = 331	-1.83 (-4.09)	-8.36 (-3.48)	6.57 (2.71)	-0.04 (-0.01)		4.46 (3.65)	0.06 (3.38)		73.1
1.7 N = 349	-2.10 (-4.78)	-8.66 (-3.93)	7.36 (3.30)		0.75 (2.04)	4.70 (3.97)	0.06 (3.00)		74.4

[1] *In both table 1 and 2 values in parenthesis are t-statistics.*
[2] *N = number of observations*

icing problem, proxies for economic management should also have significant prediction power for debt-servicing problems. One such variable is inflation. In the theoretical model presented above, we noted that capital flight would be related to domestic instability and rising inflation. Given the difficulty in collecting data on capital flight, and given the strong evidence linking this flight to domestic inflation, we included inflation as a proxy for capital flight. Note that in addition to causing capital flight, high and variable inflation would also tend to lower investment and growth due to uncertainties. Given that lower investment and increased capital flight lead to lower earning potential and growth, higher inflation should lead to a greater propensity of running into debt-servicing problems.[8]

In order to test for this effect we added inflation as an explanatory variable to model 1.1. All the variables once again entered with the correct sign and were highly significant. Further the model performed better overall as it was able to predict 62.16% of the cases correctly (see Table 1, model 1.2). The result highlights the importance of good economic management. Interestingly, the informational content of inflation for debt developments has not been much documented in the empirical literature in this area.

The result on fiscal deficits, however, requires greater analysis and scrutiny on two counts. Firstly, given the diverse measurement methods for fiscal data adopted by different countries, one should always be careful in drawing inferences from results obtained using cross country fiscal data. This is true despite the best attempts of the IMF to standardize the cross country data that it reports in its Government Financial Statistics Yearbook. For a comprehensive fiscal analysis, one would require detailed country level studies.

Secondly, given the simplified nature of our theoretical construct, we did not address the political economy issues underlying government behaviour. In a persuasive paper, Berg and Sachs (1988) argue that government debt creation and increasing fiscal deficits are the logical outcome of high social and economic/income heterogeneity. The two proxies that they used to measure this heterogeneity were income distribution (ratio of the income share of the top 20% of households relative to the income share of the bottom 20%) and the share of agriculture

[8] *For an application of the above idea to cross country growth issues see Stanley Fischer, NBER Macroeconomics annual, 1991*

in GNP. Their reasoning behind the income inequality measure was that the more skewed the income distribution was, the greater would be the incentive to purchase political support from potential political opponents without raising taxes. Thus fiscal deficits would tend to expand. Further, direct militancy and pressure for income redistribution policies would tend to be high in such countries.

For the share of agriculture in GNP, Berg and Sachs argued that political support tends to be more stable from rural areas. Urban areas very often tend to be the centers of organised opposition to the government. These forces increase the pressure for higher government spending and lower urban taxes as a price for political stability.

The implication of the above is that once we control for either of these two variables, fiscal balances should lose their significance. In order to test for this, we added both these variables by turn to the explanatory variables in model 1.1. For the income distribution measure we used the figures reported by the World Bank which is the ratio of the income share of the top 20% to the income share of the bottom 20%. The original sources for this data are household surveys with the unit of measurement being the household. We are once again aware that this variable is likely to be measured with error. However, in cross country comparisons we hope that the measurement errors would tend to cancel out[9]. The effect of including income distribution was as hypothesised by Berg and Sachs – fiscal balances lost their significance even though they still entered with the right sign (see Table 1, model 1.3). The effect of including the share of agriculture in GDP was, however, not as predicted. Not only did fiscal balances not lose their explanatory power in terms of both the sign of the coefficient and its significance, but the Agriculture to GDP ratio entered with the wrong sign and was not significant (see Table 1, model 1.4). Thus (based on our data set) the evidence on the Berg and Sachs idea seems to be mixed.

The preceding, however, ignores the use to which debt-creating capital flow is put. It assumes that government debt creation is primarily for non-productive purposes. In actuality, some amount of debt creation is definitely intended for productive purposes – investment projects being a case in point. Further, public works programs are very often directed at roadworks, irrigation, waterworks etc. which are inherently productive in nature. On the other hand, investment projects and public works programs undertaken through debt creation tend to become a net drain on social resources if they are implemented inefficiently since it implies that the debt so incurred has to be serviced without the project being able to finance itself through production and productivity gains. The end result is that fiscal deficits tend to widen and debt servicing problems increase. This is the issue that the classic work of Avramovic (1964) addresses.

The preceding argument leads to the hypothesis that the greater the efficiency with which a country undertakes and implements its projects, the less likely it would be to face debt servicing problems. In order to check this hypothesis, one requires micro-level data on individual projects or a suitable proxy for it. The World Bank, with its portfolio of over 1800 projects in 113 countries in the world, is an important source for this micro information. The proxy we use is a variable called ARIS (due to the name of the Bank report in which it appears)[10]. This variable is computed and collected by the World Ban The variable covers all projects funded by the World Bank. From the time that work on the project begins to the time that the project becomes operational, the World Bank sends it representatives to the project site on an annual basis to file a progress report. Each project performance is rated on a scale of 0 to 5. 5 implies that progress on the project implementation is very bad, while 0 implies that it is very good.

Based on individual project reports, the World Bank then generates an overall project efficiency rating for the country on a scale of 0 to 1. Once again 0 signifies excellent implementation while 1 implies the opposite. This

[9] *We should note that including income distribution shrinks the sample to 42 countries since the measure isn't available for 15 countries in our sample.*

[10] *Annual Report on Implementation and Supervision.*

variable is computed for all countries which undertake projects with World Bank funding and is available from 1980 onwards[11]. We are cognisant of the fact that this variable is likely to be measured with error due to both subjective inferences and biases. However, we hope that due to both macro aggregation and cross-country variation, it will not be important for our cross-country results.

As a first step to testing whether project implementation efficiency is important for predicting debt servicing problems and whether fiscal deficits proxy for this efficiency, we added ARIS as an explanatory variable to model 1.1. The result confirmed our hypothesis. ARIS entered with both a positive coefficient and a high level of significance. Further fiscal balances lost their significance even though they still entered with the correct sign (Table 1, model 1.5).

As a second step we added both income distribution and ARIS as explanatory variables to those of Model 1.1. Income distribution and ARIS both entered with positive coefficients and high significance levels. The effect on fiscal balances however was drastic. Its coefficient became close to zero and it lost whatever little significance it had previously. Exports and imports, however, retained their significance (Table 1, model 1.6). This result suggests that income distribution and project implementation efficiency together account for most of the explanatory power of fiscal balances. This is primarily due to the fact that these two variables account for both uses of debt – productive and non-productive.

Finally, as a third step, we estimated our most preferred model. In this model, we included as explanatory variables imports/GDP, exports/GDP, inflation, income distribution and ARIS. All the variables entered with the right sign and high significance. This model also gave us the best prediction results as it was able to predict 74.48% of the 349 observations on the dependent variable correctly (Table 1, model 1.7).

The preceding results, despite confirming our hypothesis, do not preclude the possibility that the included explanatory variables may be proxying for some other variables. A first possibility is that countries which exhibit high income inequality and low efficiency scores are also the ones which have a low per capita income level. It could thus be argued that the income inequality and/or the ARIS measure might be proxying for a low per capita income level. If this hypothesis is true then the introduction of per capita GNP should make income distribution and/or ARIS insignificant in predicting debt servicing problems. However, contrary to this hypothesis, per capita GNP, when added to model 1.7 was not significant though it entered with the right sign (Table 2, model 2.1).

Another variable which is often mentioned in the literature is the share of investment in GDP. The primary hypothesis underlying this variable is that the greater the share of investment in GDP, the greater would be the growth potential of the economy. The more the potential to grow that a country has, the less would be the prospect of this country facing debt servicing problems. In as much as greater investment reflects greater income earning potential and as much as exports reflect some amount of this earning potential, the export-GDP ratio in our most preferred model might be proxying for the investment share in GDP. Thus the introduction of investment as an explanatory variable should lower the significance of exports. However, we do not find this argument particularly convincing.

A more convincing argument about which variable might be proxying for investment in our model follows a learning-by-doing idea. If the quality of project implementation improves with an increase in the number of projects undertaken, then ARIS should proxy for the quantity of investment. If this hypothesis is correct then the introduction of the quantity of investment to our most preferred model should make the quality of investment (ARIS) unimportant in explaining debt servicing problems. However, when we introduced the investment-GDP ratio as an explanatory variable, not only did the original explanatory variables retain their signs and significance but, surprisingly, investment/GDP turned out to be insignificant, though it entered with the correct sign (Table 2, model 2.2). Thus, quality of investment seems to be

[11] *Thus, all models using both income distribution and ARIS as explanatory variables use data on 42 countries over the period 1980–1989.*

Table 2. Results of robustness tests

Model Number	Constant	Exports/ GDP	Imports/ GDP	Inflation	ARIS	Income Distribution	GNP p.c.	Inv/ GDP	LAC	SAC	SSA	% correct
2.1 N=349	-1.89 (-4.23)	-7.90 (-3.49)	6.80 (2.99)	0.83 (2.19)	4.63 (3.99)	0.05 (3.01)	-0.30 (-1.54)					75.3
2.2 N=349	-2.05 (-4.65)	-8.87 (-3.91)	7.60 (3.31)	0.73 (2.03)	4.63 (3.91)	0.05 (3.00)		-8.11 (-0.75)				73.0
2.3 N=349	-0.68 (-1.30)	-6.50 (-2.81)	4.80 (2.01)	0.45 (1.47)	2.65 (2.18)	0.03 (1.38)			0.12 (0.32)	-2.07 (-4.73)	1.26 (2.81)	77.6
2.4 N=233	-2.31 (-4.20)	-12.49 (-3.65)	11.14 (3.13)	0.53 (1.47)	5.23 (3.48)	0.08 (3.02)						76.4
2.5 N=41	0.73 (2.16)	10.65 (6.38)	-10.91 (-6.35)	-0.05 (-1.22)	-3.59 (-3.33)	0.004 (0.31)						R^2=.64
2.6 N=41	0.49 (1.42)	10.55 (6.14)	-11.18 (-6.11)	-0.04 (-0.99)	-2.27 (-2.03)	0.01 (1.00)			-0.49 (-1.76)	0.45 (1.65)	-0.43 (-1.55)	R^2=.72

more important for debt servicing problems than the quantity of investment.

The result is intuitive but striking given the background in the empirical literature. The theoretical literature stresses the importance of investment spending for sustainable debt creation through an »efficiency of debt use» argument. The empirical literature has inevitably used the quantity of investment for estimation purposes, assuming that all investment is efficient. An example of this is Kharas (1984). This ignores the propensity for inefficient investment in a number of LDC's. Our result bridges the gap between theory and empirics and, to the best of our knowledge, has not been documented before.

Another test of robustness that might be important in the presence of panel data is to test for country specific effects. In our estimation so far we have constrained the incidental parameters to be invariant across countries and time. Given the large variation across the countries in our sample in terms of socio-cultural, institutional and political characteristics it is important to test for the significance of our specification when these country specific effects are controlled for. However our initial attempts ran into estimation problems as the coefficients failed to converge.

Given the consistent problems in debt servicing that the Latin American countries have had, and the consistent good performance of a large number of South and Southeast Asian countries, it stands to reason that there could be some region specific factors which affect the performance of these countries. As a second best to estimating with country specific effects, we reestimated model 1.7 by adding regional dummy variables. The hypothesis underlying this approach is that the incidental parameters are likely to be the same for countries belonging to the same region but would differ across regions.

To test for region specific effects we split up our sample into four groups – Latin America (LAC), Asia (SAC), sub-Saharan Africa (SSA) and the rest. The results of the estimation were striking on more than count (Table 2, model 2.3). First, both the Asian and the sub Saharan Africa dummies were significant with effects specific to Asia reducing the probability of debt servicing problems while effects specific to sub Saharan Africa increasing the probability. More strikingly, the Latin American dummy variable turned out to be insignificant. Given the history of chronic debt servicing problems among Latin American countries we expected to find evidence of region specific effects contributing to some of these problems. However once we control for our original independent variables of model 1.7, Latin America specific effects do not add any explanatory power to our model. Using the log likelihood ratio test we also tested the hypothesis of no regional effects. With 3

degrees of freedom, the log likelihood test statistic (49.39) was greater than the critical Chi-Square at all levels of significance. Thus, we were able to reject the hypothesis. Further, this model (model 2.3) yielded the largest percentage of correct predictions (77.65%).

The effect of regional dummies on our original independent variables of model 1.7 was mixed. Exports/GDP, Imports/GDP and ARIS remained significant and their coefficients entered with the correct signs. However, income distribution and inflation became insignificant though they still entered with the correct signs. Interestingly, we found that all the explanatory variables retain their significance and signs if China, India, Pakistan and Sri Lanka are dropped from the Asian dummy (see Dinh and Lahiri, 1992). A proper explanation of this result requires more country specific work on the Asian sub-continent. The broad conclusion from these results is that it is important to account for region specific effects in cross country inferences. Further, even after controlling for regional effects, there seems to be enough evidence in the data documenting the explanatory power of Exports/GDP,Imports/GDP and ARIS. We take this to be supportive of our theoretical model of debt servicing problems.

Due to the variation in our data over both countries and time, some or all of our results might also be proxying for time specific effects. In order to check for this, we introduced time dummies to model 1.7. The significance and signs of the original explanatory variable remained unchanged. All the year-dummies post 1982 were insignificant. However, the time-dummies upto 1982 were significant but, interestingly, negative. In other words, once we control for exports, imports, Aris, income distribution and inflation, effects specific to the years upto 1982 actually reduced the probability of a debt servicing problem in all the countries of our sample.[12]

Given the large outbreak of debt servicing problems in the early 1980's and the results of estimations including time effects, there could have been a structural break around that time. Given that our data set runs from 1979 to 1989, a structural break in the middle of the sample period might lead to spurious results. To alleviate this problem we reestimated model 1.7 with a truncated sample period running from 1983 to 1989. The essential results of model 1.7 remained unchanged with one exception. Inflation lost its significance in this truncated regression (Table 2, model 2.4). Thus post-1982 inflation may have lost the predictive power that it previously had for debt servicing problems. A possible reason for this result could be that a large proportion of debt servicing problems in the early 1980's was due to the oil price shock of 1979. However since then we have not had a similar shock to world prices and hence debt servicing problems since then have been primarily due to other factors. Note that in the post-1982 sample all the other explanatory variables of model 1.7 continue to be significant and have the right signs.

Since there is not much history in the literature of using interest arrears for measuring country risk, a valid concern is that the results are an artifact of the particular measure of country risk used here. Due to arguments given above, we ruled out a couple of candidate measures – commercial rescheduling and secondary market prices. Another possible measure is the credit ratings assigned by international banks to debtor countries. This rating is published twice a year by the Institional Investor. Further, this rating is available from 1979 onwards on over a hundred countries. For our sample, it is available for all countries except Fiji.[13] Note that this rating is on a scale of 0 to 100 with a higher rating signifying greater creditworthiness. Also this rating is based on a biannual survey of one hundred international investment portfolio managers. The ratings of individual managers are then weighted by the bank's lending exposure and the sophistication of its country analysis system.

Model 2.5 in Table 2 reports results of the cross sectional, least squares regression of av-

[12] *The results of estimations including time dummies are available from the authors on request.*

[13] *In this connection, see Lee (1993) for evidence that credit ratings provide a reasonable measure of country creditworthiness. This measure has also been used by Melvin and Schlagenhauf (1986) as a measure of country risk and by Spiegel (1992) as a measure of political risk.*

erage credit ratings for the period 1980–89 on the corresponding averages of our preferred explanatory variables.[14] While exports, imports and ARIS are significant and have the correct signs, income distribution enters with the wrong sign and is insignificant. Also inflation loses significance even though it has the correct sign.[15] The model explains about 64% of the cross country variation in credit ratings. Model 2.6 reestimates model 2.5 by including the continental dummies. The qualitative features of the previous model remain unchanged. However, region specific effects from Latin America and sub Saharan Africa seem to reduce ratings while the specific effects from Southeast Asia increase them. The model is able to account for approximately 72% of the cross country variation in credit ratings. The incorrect sign on income distribution is puzzling and probably needs more work. But overall, we interpret the results as being supportive of our model.[16]

Thus our theoretical model seems to find a fair amount of support from the data. Exports/GDP and Imports/GDP were significant for almost all the specifications we tried. Without controlling for other variables, we found that Fiscal Balances/GDP were significant for predicting debt servicing problems. The estimation of expanded models which controlled for variables that, we argued, would lead to higher fiscal deficits, led to Fiscal Balances/GDP losing their significance. Given that we did not explicitly model government behaviour in our theoretical model, the result validates our model. Fiscal deficits are the consequence of government behaviour. Estimation with ARIS and income distribution accounted for the cause of fiscal deficits and hence fiscal deficits lost their significance when the causal variables were introduced. Further, the results are robust to a fairly large number of alternative specifications.

4. Conclusions

We feel that our results raise a few interesting issues. First, it is not enough to focus explicitly on exports. Imports represent a claim on foreign exchange earnings. Most of the lietrature on the subject seldom uses information on imports. When imports are used, it is usually the Imports-Reserves ratio that is included. This seems to be a flawed approach since low reserves are a consequence of imbalances and the resultant debt problems rather than being a cause of the problems. A high Imports/GDP ratio might imply that socio-political compulsions make import compression infeasible. Even if imports are primarily for investment purposes, the country would be unwilling to compress imports for fear of jeopardising the growth process. Thus, in times of lower foreign exchange earnings, countries might willingly choose not to service their debt.

The results also point to the importance of looking at exports and imports separately since both carry independent information. Thus, looking at the Balance of Trade would not give the full picture. In most of the models that we estimated, the export coefficient systematically exceeded the import coefficient. Thus a unit increase in both exports and imports would leave the balance of trade unchanged but lower the probability of a debt servicing problem. This could be due to two reasons. First, the time series properties of exports and imports are likely to be different. Hence, a unit increase in both would have asymmetric effects on the likelihood of a debt servicing problem. Second, increasing exports might lead to improving creditor perceptions of creditworthiness of a country. This might increase the capital inflow into a country and hence lower the probability of a problem. However, the hypothesis holds only if there are asymmetric effects on creditor perceptions due equal changes in exports and imports.

Second, while the effect of fiscal deficits on debt servicing problems is undeniable, it is

[14] *Since the ratings are assigned on a scale of 0 to 100, for estimation purposes we used the logistic transform of the rating rather than the rating itself.*

[15] *We also estimated the model with pooled cross-section and time series data by including time dummies and region dummies. The results remained qualitatively unchanged and are available from the authors on request.*

[16] *Unlike interest arrears, a problem with the ratings measure is that it is extremely sensitive to non-economic developments like political upheavals, coups, assasinations, wars, etc. Thus, the variable is likely to move around without any change in economic fundamentals.*

more important to look at the cause of high deficits rather than the deficits themselves. In looking at the causes of deficits it is also important to account for the specific end use of debt. We found that as a first step it is important to distinguish between productive and non-productive uses of debt. But as a second step, it is also important to distinguish between the quantity of productive use and the quality of productive use. We found surprisingly strong evidence that it is the quality of productive investment which is more important than the quantity of investment. We feel that this is a distinction that country risk analysts should take into account. This result also underscored the informational content of micro level data for debt servicing problems which is independent of macro aggregates. We are not aware of any work in this literature which has tried to use micro data to analyse debt problems.

Third, we found that rate of inflation contained important information for creditworthiness purposes. This, we think is an important result given the lack of attention it has received from country risk analysts even though inflation control happens to be a target of most stabilization programs undertaken under the aegis of the IMF. We believe that a major strength of this study is that it is based on a strict theoretical underpinning. We do not believe that the variables included in this study hold the full explanation to debt servicing problems. However, we have restricted our empirical study to these variables in order to conform, as closely as possible, to our theoretical model.

It is also worth noting that one could conceivably visualize three possible states of the world – no debt problems (no interest arrears), slight debt problems (interest arrears), and severe debt problems (debt rescheduling). In this paper, we have focussed on the first two states of the world. The third state, in our opinion, is the outcome of not just structural features but also strategic and political determinants. Hence, a structural approach does not seem to be the right method to model the third state, or more precisely, the transition from the second state to the third state. Our focus has primarily been on the transition from the first state to the second state of the world.

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