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THE PURE THEORY OF COUNTRY RISK

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ABSTRACT

This paper attempts to survey, and to put into perspective, recent literature that has analyzed the nature of credit relations between developed and developing countries. This analysis has made use of recent advances in the economics of information and strategic interaction. Traditional concepts of solvency and liquidity are of little help in understanding problems of sovereign debt. Creditors do not have the means to seize the assets of a borrower in default. Hence the borrower's net worth is not relevant in determining the amount of a loan that can be recovered. A borrower who is expected eventually to repay his debts should be able to borrow to meet any current debt-service obligations. A problem that is essential to a theory of international lending is that of enforcement. The difficulty is one of ensuring that the two sides of a loan contract adhere to it, in particular that the borrower repays the lender and the lenders can commit themselves to penalize the borrower if he does not.

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## I. Introduction

In the early 1980's, several LDC's with very large debts to foreign banks did not meet the payments schedules to which they had originally agreed. Various participants in, and observers of, these markets began to speak of a crisis, one which they feared might shake the banking system of the developed countries. So far there has been no dramatic event to resolve the status of these loans. The absence of overt clues to what will happen to those involved with these debts generates a widespread interest in a conceptual framework useful in interpreting the current situation.

In this paper, we seek to articulate very general principles for looking at the most essential problems posed by international lending, ones that will be common to the relationships of most sovereign debtors and their creditors. This set of concepts is a necessary, although admittedly not a sufficient, tool kit for understanding current events and prescribing public policy.

Our concern, then, is with the pure theory of sovereign lending or country risk. We discuss the roles of borrowers, of lenders and of the various public authorities who mediate between the two groups, or regulate the lenders, or insure deposits in the banks. We make use of the literature on LDC indebtedness, which is related to recent advances in the general theory of credit markets. This work, in turn, incorporates recent advances in the general theory of the economics of information and the theory of games.

Loans are a particular contractual arrangement between suppliers of capital and the users of capital. The borrower promises to pay the lender certain amounts at certain times. A paramount concern in

designing the contract is that the borrower may not be able to or may not wish to make payments under certain circumstances. The possibility that the lender will not recover his money is reflected not only in a high interest rate, but in the covenants of the loan contract. The purpose of these covenants is to protect the lender by precluding the borrower from engaging in certain activities, and ensuring that he engages in others. The loan contract also stipulates conditions under which the lender can intervene, e.g., in the event of a default on another loan.

Credit markets, like labor markets, are characterized by implicit as well as explicit contracts. For example, it is frequently the case that a lender makes a short-term loan for a long-term investment. There is an understanding that the loan will be renewed, except under unusual circumstances. The advantage of the short-term contract is that the lender can insist on additional restrictions on the borrower to renew the loan. To stipulate all of these restrictions on a conditional basis beforehand, at the time of the original loan, would have been virtually impossible. What prevents the lender from taking unfair advantage of the borrower are, as usual, reputation and competition from other lenders.

Consequently, the distinction between equity and debt, that the borrower is required to repay the principal plus interest on the latter and not on the former, becomes somewhat blurred. Though indeed the borrower is required to service a debt, there is no way that, in general, the borrower can be forced to do so under all contingencies. Debt and equity are both contingent claims, although they clearly differ in the nature of the contingencies involved. What factors are observable, and therefore can be used to condition contractual obligations, is an important determinant of the relationship between debtors and creditors.

### I.1 Defining Default

We have not, so far, said what we mean by default. In a two-period model of the economy, default may easily be defined: Whenever the borrower gives resources to the lender that are less than the fixed amount that he is committed to pay the lender, then there is a default.

In multi-period models, however, the concept is somewhat more elusive. A default occurs whenever the lender formally declares that the borrower has violated a certain condition of the loan.<sup>1</sup> A loan may be declared in default when a borrower refuses (or is unable) to pay another loan. The lender does not have to declare a loan in default, however; the contract only provides him the right to do so.

Thus, in most situations, a default is a result of a set of decisions, not the mechanical realization of some outcome. The proximate cause is generally the result of the borrower's decision not to make all or part of a loan payment that is due. But that decision, in turn, is frequently the result of the lender's decision not to extend further credit.

When the relationship between debtor and creditor can, in principle, last beyond the period in question, a violation of the repayment schedule, with or without a default, is neither necessary nor sufficient for the lender to realize less than the (present-discounted) value of the loan. A failure to make current payments does not necessarily imply that future payments will not be made, and conversely. This is one reason why observers of, and participants in, the market cannot expect any very overt sign of the status of these loans.

There is therefore an important difference between two-period and finite horizon, but multi-period, models. Furthermore, as we shall show,

finite-horizon and infinite-horizon models can have qualitatively quite different properties when lenders can only ensure repayment through exclusion from future borrowing.

Much of the recent literature has failed to recognize these aspects of default. Thus, some writers attempt to relate default to insolvency, which arises in the case of unsecured loans when the borrower's debt exceeds his net worth (presumably inclusive of the debt). This is neither necessary nor sufficient for the declaration of a default. The declaration of a default usually has a large cost associated with it; an ongoing firm is almost always worth more than the value of its assets sold in a bankruptcy sale.<sup>2</sup> And in international banking, declarations of default may trigger certain actions of bank regulators that are costly to lenders, in the first instance, and possibly to debtors as a consequence. What is at stake is more than the distribution of claims between debtors and creditors. More importantly, in a formal sense, insolvency is not really an issue in lending to foreign governments: The debt of a country in almost all instances is less than the value of the assets owned by nationals and the government of the country. There may be limits on the extent to which governments can appropriate the assets, but these limits themselves are, in general, not hard and fast constraints, but involve trade-offs.<sup>3</sup>

While some writers have linked default to insolvency, others have linked it to illiquidity. A borrower with a positive net worth who cannot convert the required portion of his net worth into a means of payment is said to be illiquid. The question is: why would no supplier of capital be willing to supply credit, if it were unambiguously clear what the net worth of the asset were? Frequently, it is the withdrawal

of credit that leads to the borrower's illiquidity; but it is precisely this withdrawal of credit that the theory should explain.

## I.2 Domestic Versus International Lending

The ambiguity in the notion of default is relevant to both domestic and international lending. But there are also very important differences between the two, with consequences for the applicability of various concepts. We review briefly three problems traditionally addressed in theories of credit markets: enforcement, moral hazard and adverse selection.

One problem in all lending is enforcement, the difficulty in ensuring that both sides of a contract adhere to its terms. Here, the particular concern is the difficulty of ensuring that the borrower pays the lender. The major difference between domestic and international debt is that the former are legal obligations, enforceable in courts. Another difference is that, domestically, debtors who cannot meet their obligations have the option of filing for bankruptcy. Repayment of international debt, however, is largely voluntary; the penalties to be imposed on a country that does not honor a contract are, at best, indirect. On the other hand, there is no systematic procedure corresponding to bankruptcy, by which a country that has undertaken an excessive amount of debt can discharge its obligations and proceed on its way.

For similar reasons, collateral, which can be important domestically, plays little role in international lending.<sup>4</sup> If the collateral is retained in the borrowing country, there is no mechanism by which the creditor can seize it. If the collateral is moved outside the country where the creditor can seize it, the borrower will usually lose

fully the use of it, so that the value of the loan is reduced by the value of the collateral.<sup>5</sup> A fully and effectively collateralized loan would then be of no value to the borrower. As we shall see, the inability to provide collateral may significantly exacerbate the problems facing credit market participants.

When making loans to borrowers within the developed countries, lenders need to pay relatively little attention to enforcement problems, but instead must worry about problems of moral hazard. These arise because it is difficult for the lender to monitor actions of the borrower to ensure that they do not affect adversely the prospects for debt service. For instance, a firm may have an investment opportunity with low expected return, but with the possibility of a high return under some circumstances. In the good states, the firm pays its creditors and reaps large net benefits; otherwise, the firm goes bankrupt, and the creditor loses. Such a project may be quite attractive to the firm, although quite undesirable from the creditor's viewpoint.

In international loans, such problems are much less prominent in the relationship between country borrowers and their creditors. As we have argued, the resources of the debtor are likely to be adequate to repay the loans regardless. In a sense, it is the very importance of the enforcement problem that, as we shall explain, keeps creditors from ever lending so much that moral hazard problems involving choice among risky investments become central. On the other hand, moral hazard problems may arise if (1) borrowers can affect their susceptibility to penalties that enforce payment; or (2) they can affect the likelihood that creditors will impose penalties (if creditors cannot precommit fully); or (3) the total amount that they have borrowed cannot be observed by individual

lenders. In each of these situations, borrowers' actions affect the probability of payment.

Moral hazard issues also arise in the relationship between banks and the governmental insurers of bank deposits. This insurance obviates the need for depositors to monitor adequately bank portfolios. There is a consequent incentive for banks to lend in a risky fashion, hoping for big profits but able to transfer large losses to their insurers. The traditional role for bank regulators is to prevent these actions by rules on portfolio composition, but these have been loosely designed, and have not prevented the lending of multiples of bank capital to LDC's.

A third set of problems facing lenders are ones of adverse selection. Here the difficulty is one of ascertaining the characteristics of a borrower, both transitory and permanent, relevant to designing a repayment schedule and judging whether a borrower will adhere to it. Without this ability, the lender is vulnerable to attracting only those borrowers who know that their repayment prospects are poor or who claim that they cannot pay when they can. In many cases, however, outside lenders are as fully informed as domestic politicians about the country's economic situation, and so adverse selection may be less important internationally than domestically.

In our view, then, the problems of moral hazard and adverse selection deserve attention, but really central to our understanding of credit relations between developed and developing countries is identifying the incentives for borrowers to repay, and for suppliers of capital to continue supplying capital. As we shall show, actions of the borrower (or lender) may affect these incentives. To the extent that borrowers can take actions that increase the likelihood that they will

repay their loans, they will be better off. By doing so, they can increase the willingness of lenders to lend. Similarly, to the extent that lenders take actions that increase the likelihood that they will continue to renew the loans, borrowers may be more willing to borrow and repay.

## II. The Willingness-to-Pay of Borrowers

In the introduction, we sketched our basic view, that in most situations, what happens to a loan is a result of a series of decisions, not the mechanical realization of some outcome. Thus, the analysis of international credit markets must focus on how borrowers and lenders make their decisions. Surprisingly, a few simple notions can help to delimit the possible relationships between debtors and creditors. For instance, the fact that loans are voluntary rules out situations in which all future net transfers as of any date are always from the lender to the borrower. Later on, we show that in an important class of models, net transfers also cannot always be from the borrower to the lender.

In this section, we focus on the behavior of borrowers, and in the next section, we turn to the lenders. In a fundamental sense, the dichotomy is artificial: A borrower's willingness to pay depends critically on his beliefs about (1) the lender's resolve to penalize a recalcitrant borrower, and (2) the lender's willingness to lend in the future. For now, we assume that the potential penalties we discuss will always be imposed.

### II.1. The General Structure of Models With Penalties

We begin with an extremely simple two-period model. A loan of amount  $L$  is made in the first period with an obligation to repay  $r(L)$  in the second period. The model ends after the second period, so that there are no further considerations that affect the participants.

If the borrower does not discharge this obligation, he suffers a penalty,  $\bar{P}$  expressed in the same units as  $r(L)$ . The borrower's welfare is a function  $U[L, x]$  which increases with the amount borrowed,  $L$ , and decreases in the obligation imposed by the loan,  $x$ , where

$$(1) \quad x = \begin{cases} r(L) & \text{if he repays} \\ \bar{P} & \text{if he defaults.} \end{cases}$$

The borrower who defaults receives total utility of

$$(2) \quad U_d = U[L, \bar{P}]$$

in the second period. If he does service the debt as agreed, his utility is

$$(3) \quad U_p = U[L, r(L)].$$

The borrower chooses to pay if

$$(4) \quad U_p \geq U_d.$$

This comparison of alternatives is at the heart of a willingness-to-pay approach.

Under the assumptions that lenders are competitive and face an opportunity cost of funds of  $i$ , the repayment lenders require is

$$(5) \quad r(L) = (1+i)L.$$

Substituting (1), (2), (3), and (5) into (4) implies that repayment occurs for

$$(6) \quad L \leq \bar{P}/(1+i).$$

As long as lenders understand the borrower's situation some central conclusions follow:

- (1) Borrowers may be credit constrained. If the borrower wishes to borrow a little more than  $\bar{P}/(1+i)$  at rate  $i$ , he cannot. On the other hand, the borrower need not wish to borrow as much as he can.
- (2) There is never any inconsistency between a loan contract that says the loan must be repaid with interest at rate  $i$  and what happens.
- (3) Penalties are never imposed.
- (4) If the borrower wants to borrow more, he benefits from an increase in the penalty  $\bar{P}$ .
- (5) If there is no penalty, one observes no lending rather than a rash of loan-contract violations. At its simplest, willingness-to-pay is a theory of rationing, not one of lender losses.

We use the simple model and its conclusions as a mechanism to organize other formulations of the willingness-to-pay approach.

For instance, one modification that undermines the fourth conclusion on the welfare effects of enhanced penalties, while maintaining the

others, can occur if the borrower is large, or if we consider simultaneous increases in the penalties applied to a large number of borrowers. An increase in  $\bar{P}$  may then raise the world interest rate, to the borrowers' detriment. In the extreme, if funds available for this kind of lending are fixed, an increase in  $\bar{P}$  raises  $i$  without raising  $L$ .

## II.2 Models with Uncertainty

Next, we begin to introduce uncertainty into the model, otherwise returning to all the assumptions of eqs. (1) - (5). For simplicity, assume that the penalty depends on the state of nature,  $s$ ,

$$(1a) \quad P = P(s).$$

Utility of the borrower if he defaults is

$$(2a) \quad U_d = U[L, P, s],$$

and if he does not

$$(3a) \quad U_p = U[L, r(L), s],$$

where the argument  $s$  indicates that utility may depend on  $s$  in other ways than through  $P$ . Note, however, that  $r(L)$ , the amount of payment, does not depend on  $s$ .

The debtor pays off his obligations in all states  $s$  in  $S$  for which

$$(4a) \quad U_p \geq U_d$$

and otherwise not, for  $s$  in  $S'$ . The borrower's expected utility is

$$\int_S U_p f(s) ds + \int_{S'} U_d f(s) ds ,$$

where  $f(s)$  is the probability of state  $s$ . If lenders are competitive, risk-neutral and face a constant cost of funds  $i$  then

$$(5a) \quad \pi r(L) = (1+i)L$$

where the probability of repayment is

$$(7a) \quad \pi = \int_S f(s) ds.$$

The existence of uncertainty means that payment may not be made, and the penalty may be imposed. An increase in the penalty need not increase a borrower's expected utility. While it will normally increase the amount lent, to the borrower's benefit, in those states when the country does not pay it may be worse off.<sup>6</sup>

On the other hand, uncertainty need not imply  $\pi < 1$  if the repayment schedule can also be made contingent on the state of nature. In this case, the state contingent repayment,  $r(L,s)$ , is chosen so that  $U_p \geq U_d$  for all  $s$ . This is the approach taken by Grossman and Van Huyck (1985). The explicit legal contract, however, conventionally specifies a single interest rate (or a single spread above the market rate). Lenders do not have the scope to revise the contractual interest rate upward, unless the borrower violates the contract. The contractually specified payment must therefore be the maximum of payments in all possible states,

$r^+(L) = \max_s r(L,s)$ . Any state  $s$  with  $r(L,s) < r^+$  could then be called a situation of excusable default, in the Grossman-Van Huyck terminology. Penalties are only imposed if the country pays less than  $r(L,s)$ , not less than  $r^+$ . This is one interpretation of the current reschedulings. It presupposes that the state  $s$  can be observed by both parties after the fact, and that disputes over what has happened do not arise. The issue therefore remains of what situations can be used to condition contracts.

A further set of complications arise if the actions by the borrower can affect the burden of the penalty. Actions that lenders perceive as increasing the burden may improve the terms of loans. To do so such actions must be observable by the lender and costly to reverse. Actions that are unobservable but still raise the burden of the penalty give rise to a whole range of moral hazard issues (Stiglitz and Weiss, 1981 and 1983).

### II.3. The Nature of Penalties

The simple models just discussed do not show how the penalty originates; its size is exogenously given and does not depend on the characteristics of debtors or creditors. In fact, however, we believe that the penalties available to creditors are rather indirect, and that identifying their ultimate implications for debtors is one of the basic issues in the pure theory of country risk. Only by modeling the penalty realistically can one tell which countries are most susceptible to them.

Eaton and Gersovitz (1981b) discuss some of the legislation that potentially provides for penalties imposed by the U.S. government, while Kaletsky (1985) provides a comprehensive review of the relevant legal,

institutional and political issues. What concerns us here are two types of exclusions that creditors can potentially impose on debtors: (1) an embargo of future borrowing, and (2) various forms of interference with the debtors' international transactions and transfers.

Eaton and Gersovitz (1981a) consider what it means to a borrower to be excluded from future loans. Some very simple situations in which such a penalty has no force can be mentioned. First, such a penalty only makes sense in a model with an infinite horizon. If there were a last period, no loans would be repaid in that period since there would be no future exclusion to worry about. Lenders knowing this would never make a loan coming due in this period. But, this in turn would render a threat of exclusion meaningless from the viewpoint of the penultimate period, so no loan coming due in this period would be possible. And so on, by backward induction, the penalty would be unable to support any lending. Second, even in an infinite-horizon world, such a penalty would be ineffective if the model ever predicts that a point will be reached after which the flow will always be from debtor to creditor, via arguments similar to those just made.

It is only when the future always holds some possibility of transfers in both directions that this penalty becomes operative. It is for this reason that Eaton and Gersovitz focus on a model in which the income of the borrower alternates between low and high values, either in a deterministic or stochastic way. If borrowers are risk averse, the demand for loans derives from a desire for consumption smoothing. The cost of the denial of credit is that the country must resort to other methods for consumption smoothing (e.g., building up stockpiles), or it must accept a greater fluctuation in its consumption pattern.

If lenders are risk neutral and borrowers risk averse, the lenders can smooth borrowers' consumption at no cost to themselves. In effect, the penalty is the loss of consumers' surplus on being excluded from the market; it is inframarginal from the borrower's viewpoint. The penalty (and hence the supply of credit) is higher the greater the cost to the borrower of exclusion, which in turn is higher: (1) the greater the borrower's elasticity of marginal utility; (2) the more variable its income; (3) the lower the cost of smoothing via the international capital market, i.e. the lower the world interest rate; and (4) the more limited are domestically available options for smoothing consumption. A country with limited risk aversion may still want to make great use of the possibilities for consumption smoothing afforded by international lending if its income is highly variable. The cost of losing this option may not be large, however, so that the current demand for the facility is not necessarily related to the penalty occasioned by the loss.

Uncertainty, or at least income variation, seems crucial for the penalty of exclusion to have force. By contrast, the argument is sometimes made informally that countries that need funds for development are likely to suffer if denied loans. It is true that they may benefit greatly from being able to borrow, but this is not the same as saying that the penalty of exclusion can assure the lender that he will be repaid. Borrowing for capital accumulation or productive investment implies that a point will be reached beyond which the debtor will begin making transfers to his creditor. Once the marginal product of capital equals the interest rate, there will be no further gain to moving capital to the debtor. At this point, the debtor will lose nothing by being denied access to credit markets, and will refuse to service his debts.

And, by backward induction as before, it will never be possible to lend with prospects of payment.

Owners of capital can entrust it to others who have the opportunity for profitable investment, and obtain payment by threatening exclusion from future access to capital, but in situations that do not seem relevant to financial lenders. Allen (1983) discusses how landowners may be able to ensure that they are paid even if those who use their land could, in principle, abscond without paying their rents. In his model, the land must be left behind, and those who do not pay landlords cannot get land to farm in the future. As a result, they may have diminished income opportunities in the future, in which case the penalty has deterrent value.

Eaton and Gersovitz (1983) discuss a model of direct foreign investment. In this case, capital depreciates and cannot be replaced without the help of foreign investors. If they are expropriated, foreign investors refuse to cooperate, and exclude the country from the market for physical capital in the future. Here again, financial lenders do not seem able to impose such a penalty package.

International lending appears to play an important role in financing international trade. Borrowing does not simply finance the current account deficit, but is associated with the level of international purchases. In principle, a country could trade on the basis of barter, but to do so is likely to be costly. Kraft (1984) reports that Mexican officials perceived the disruption of trade as the primary cost of default. Iran, when faced with a temporary credit embargo, found trade difficult, even though the country was a net creditor.

When countries can anticipate problems in effecting transactions, however, they can act to shield themselves. Waiting to impose penalties may diminish their efficacy. Countries may accumulate foreign reserves to finance post-default trade, rather than use income to pay debts. Trading partners that gain from trade with debtors may help to facilitate transactions; it is hard to know what potential institutions will try to substitute for banks, thereby undermining the sanctions available to banks.

Gersovitz (1983) develops a model in which the penalty associated with default depends positively on the importance to a debtor of its opportunity to trade. An implication is that a borrower's commitment to increase investment raises the credit ceiling if it increases the value of the option to trade. In the factor endowment model this is not always the case. If the investment is in import-competing industries, then the country may be better able to withstand a credit embargo. If the investment is in export industries, requiring at the same time large imports of certain key materials, then the country may be in a much worse position to withstand a credit embargo.

In a series of papers Sachs (1984) and Cooper and Sachs (1985), Sachs and Cohen (1985) assume that the penalty is proportional to income. This assumption is useful in illustrating certain basic aspects of creditor-debtor relationships, as is the model of subsection II.1, but the penalty is clearly not a plausible one in the same way as an exclusion from future borrowing or trade transactions. As a consequence, some of their conclusions seem questionable, such as their emphasis on the benefits obtained by a credit-constrained borrower who can precommit to investment rather than consumption; see Gersovitz (1985).

### III. The Resolve of Lenders

So far, we have assumed that lenders always penalize debtors who do not adhere to loan agreements. But will lenders do so? There is no obvious way that lenders can commit themselves at the time the loan is made to punish a country that refuses to pay. Depending on the situation, it may be costly to penalize recalcitrant debtors. Moreover, punishment may not affect the prospect of a resumption of debt service. If it is not in the interest of lenders to punish, then the threat of punishment will not be credible to borrowers. An equilibrium with positive lending will be infeasible.

In some cases the penalties may be fairly automatic. For instance, if a country that refuses to pay banks tries to transact with the help of these same banks, it may find that its transactions balances are offset by the banks against its outstanding obligations. The country will then have to seek alternative means of effecting transactions, presumably at higher cost, to avoid this threat. In fact, a promise by the banks not to seize the country's balance may itself not be credible. This mechanism is part of the justification behind the trade-cost model in Gersovitz (1983).

There is more doubt, however, about the resolve of lenders to exclude debtors from future loans. Below, we discuss two models. In one, lenders do cut off credit from those who are in default (as part of a reputational equilibrium), but in the other they do not, and the loan market ceases to function.

### III.1. Penalties in Reputation-Based Models

Contracts that are unenforceable through the legal system may still be enforced by some kind of reputational mechanism. The threat of losing one's reputation (credit rating) is what induces so-called good behavior (repayment of the loan). There are two classes of reputational models. In one there are markets in which there are inherently good and bad borrowers. Lenders make an inference concerning individuals according to their past behavior. Thus it is the fear of being classified as a bad borrower that induces good behavior. But even if there is only one type of borrower, reputational mechanisms may be effective. To construct a reputational equilibrium one must show that, if a borrower does not service a loan, it will not pay the lender (or any other lender) to extend credit to him. Thus reputational models entail the simultaneous analysis of borrower and lender behavior.

In Eaton and Gersovitz (1981a), lenders are competitive, and each occupies a small share of the market, earning zero profit on any loan. It therefore costs the lender nothing to refrain from future lending. Moreover, in their model, the borrowers and lenders interact over a potentially infinite horizon. [In a finite horizon, a loss of reputation means nothing in the last period, and therefore cannot justify any last-period lending. By backward induction, reputation is meaningless, as in the chain-store paradox discussed by Selten (1978).<sup>7</sup>]

If there is no finite upper bound on the number of times players expect to play a game, however, and their identity is remembered by their opponents, then the players' reputation as cooperative players can succeed in enforcing some degree of cooperation. A player who fails to

cooperate at any single play will not find cooperative partners for subsequent plays. If players' discount rates are zero then full cooperation is ensured, while infinite discount rates leads to no cooperation. With a finite but positive discount rate, some co-operation emerges, and in Eaton and Gersovitz (1981a) this is embodied in the credit ceiling that sets the maximum loan that lenders will extend to countries that have paid in the past.

For the threat of withdrawal of credit to be a credible sanction, it must not only be in the interests of the current creditors to withdraw credit, but it also must be in the interests of potential creditors not to extend credit. The relatively small number of international banks may be able to sustain the cooperative outcome (in which they all punish defaulters) within a non-cooperative context. Since they deal with each other repeatedly, those who fail to cooperate will themselves be punished. Moreover, the country's current bankers are likely to be more informed concerning the country than other potential lenders. Hence, the refusal of the current lenders to continue extending credit may lead others to refuse as well; see Greenwald, Stiglitz, and Weiss (1984). Indeed, the current lender usually has more to gain from the continuation of credit than do others, for it stands to recover earlier loans as well.

Finally, seniority clauses in international loan contracts could be enforced by earlier lenders against subsequent lenders in the courts of developed countries, thereby dissuading other potential lenders. Such clauses are attractive because they do not require a suit or enforcement of a judgement against the sovereign debtor. Stiglitz and Weiss (1983) show that if there are seniority provisions in outstanding loans, then if the current lender refused to lend, others will as well.

Because individuals are finite lived, they may lack incentives to impose penalties, so lending among individuals may not be sustainable. Infinitely-lived institutions, such as banks, can emerge, however, that can credibly threaten to punish debtors in order to maintain their reputation as lenders. Maintaining the value of their equity investments in a bank provides the incentive to the owners of the bank to punish default. The failure to do so would cause the value of a bank's equity to fall to zero.

For this mechanism to work, the value of bank equity must exceed the cost of imposing the penalty. If it is costly to punish, a bank must earn a profit strictly in excess of zero. The interest rate on loans consequently exceeds that on deposits. Even though in equilibrium the penalty is never imposed, the cost of implementing the penalty causes the equilibrium allocation to differ from what would emerge if loan repayment were automatic, see Eaton (1985).

### III.2 Information and the Lender's Problem

Lenders need information to make sure that they can prevent the debtor from getting into situations in which debt is not serviced. In subsection II.2, we discussed a model in which debtors did not pay in some states of nature, but debtors and lenders had the same information about the likelihood of these states of nature. Borrowers may, however, have more information than lenders about their own attributes that determine their susceptibility to penalties, and even about the total amount of debt they have undertaken which, with the penalty, determines the set of states when the borrower does not pay as he contracted.

Kletzer (1984) analyzes some of the problems that arise under these circumstances in a model similar to that of Eaton and Gersovitz (1981a). He focuses on knowledge about the amount lent, a crucial determinant of borrower behavior. (See also Arnott and Stiglitz, (1983) for the basic structure of such moral hazard problems).

If lenders can observe the total quantity lent, competition will assure a loan-interest-rate combination that maximizes borrower utility subject to the zero-profit condition. The equilibrium is consequently determined by a tangency of a borrower's indifference curve to the supply curve. The borrower will be constrained in that, given the interest rate, he would prefer to borrow more.

On the other hand, the total amount lent may be unobserved by lenders. If an equilibrium with positive debt exists under these circumstances, it will be characterized by both a higher debt and a higher interest rate than if debt is observable. The borrower is better off when debt is observable, however; the lower rate of interest more than compensates for the rationing of credit. Kletzer interprets lending through syndicates and the importance of short-term debt as institutional arrangements in international financial markets that facilitate lenders' monitoring and control of the borrower's total debt.

As we noted in section II, borrowers may be able to take actions that affect penalties, and thereby undermine their willingness to pay. To the extent that these actions are observable, and lenders can deter them by credibly threatening sanctions, no moral hazard problems arise. But when the action is unobservable, moral hazard problems are a concern (Stiglitz and Weiss, 1981 and 1983). Furthermore, if different borrowers have different unobservable susceptibilities to penalties, creditors will

have an incentive to design contracts that improve the quality of their borrowers, or that sort borrowers. As a result market equilibria may be characterized by credit rationing and/or a nonlinear relationship between interest payments and loan size; see Jaffee and Russell (1976) and Stiglitz and Weiss (1981 and 1983). For instance, in the context of international loans, whether debtors are prepared to adopt an IMF program or not may serve to distinguish between countries that do and do not intend to service their debts.

### III.3 The Breakdown of Lending

So far, we have looked at models in which lenders may manage to deal with problems of asymmetric information and credibility, at least sufficiently to justify some lending. Hellwig (1977) provides a model that stresses the inability of lenders to cope with enforcement problems, and their consequent inability to lend.

In this model, the breakdown of lending results from the lender's inability to precommit himself to a ceiling on indebtedness. The borrower is an agent with zero current income. At some unknown future date the borrower's income is expected to jump to a permanently higher level. If by that time the borrower has not defaulted then any debt up to some maximum is repaid. In the meantime, the borrower finances his consumption from loans. The lender extends a line of credit which the borrower draws down as he consumes. If the line is depleted before income rises, the loan goes into default unless more credit is forthcoming. If default occurs, the borrower's utility from that moment onward is specified exogenously as a decreasing function of indebtedness.

A particular consumption profile corresponds to each amount of total credit that the borrower believes available. The lender wants the borrower to draw on credit slowly, minimizing the probability of default before income rises. If the lender could precommit to providing a particular amount of credit then a loan to the borrower can provide a non-negative expected yield. The problem is that if the borrower exhausts the initial line of credit before his income rises, the lender has an incentive to provide more. Cutting the borrower off ensures default; extending credit maintains a hope of repayment. Part of the return on additional funds committed to the borrower is the possibility of salvaging some of what has already been lent. The lender will consequently make loans that would not yield a profitable expected return on their own. It pays him at that point to throw good money after bad.<sup>8</sup>

The borrower perceives that when he exhausts the initial loan the lender will provide more. He consequently draws down the initial loan more quickly. This raises the probability of his incurring the maximum amount of debt that will be repaid before income rises, at which point credit is cut off.

By initially extending credit, then, the lender places himself in a situation in which the commitment of additional funds may be profitable even though the expected return on all funds committed is negative. To avoid this imbroglio he desists from lending in the first place. He suffers from his inability to control the borrower's consumption once the loan has been made, and from his inability to control his own future lending behavior. While some features of Hellwig's model may seem special, the point raised is more general as shown by Stiglitz and Weiss (1981).

#### III.4. Panics by Lenders

The previous section explained why enforcement and commitment problems may constrain lending in some circumstances, even though additional lending may be mutually beneficial in the absence of these problems. We now examine situations in which banks that have been lending suddenly cut off credit. There is some similarity between such credit runs and the traditional problem of bank runs.

While bank runs have long been a source of concern, only recently have researchers developed simple models to analyze them; see Diamond and Dybvig (1983) and Nakamura (1985). Diamond and Dybvig analyze runs using game theory. All lenders are better off if none withdraws his funds. But if some depositors run, the others are better off if they simultaneously withdraw their funds, or, indeed, anticipate the others' action and withdraw first. There exist perfect equilibria in which all try to withdraw and others in which none do.

Nakamura observes that the expected rate of return on deposits is a function of the number of depositors withdrawing their funds; while at the same time, the number of depositors withdrawing their funds is a function of the expected rate of return. There may be multiple solutions to this pair of equations, in one of which many depositors withdraw funds (a run), and in the other of which few do. The existence of multiple equilibria raises questions about which equilibrium prevails, and why and how the economy moves among them.

Depositors are, of course, the bank's creditors; the phenomenon of runs can arise whenever a borrower has many creditors and there are short-term liabilities. Each creditor wishes to protect himself; in

doing so, he may actually increase the likelihood that others will be unable to recoup what they have lent. This is a potentially important externality.

The occurrence of runs depends critically on the form of the debt instrument. For instance, in the Diamond-Dybvig model, the bank must allow any customer to withdraw his entire deposit at the posted yield on a first-come-first-served basis. Other contract arrangements avoid this problem; for instance, if there is a well-defined seniority structure, runs will not occur. Runs do not occur against mutual funds, since the asset value is continuously redefined. To the extent that the runs problem is important, one needs to explain why a contractual form that leads to runs is employed.

Sachs (1984) and Krugman (1985) present models similar to Diamond and Dybvig with respect to syndicated bank loans to developing countries, only with the borrowing country assuming the role of the banks and the lending banks that of the individual depositors. In period one the borrower owes debt to a large number of bank lenders, an amount that exceeds current income.

The central problem in explaining credit runs is why it does not pay other banks to step in when one lender withdraws credit. Sachs resolves this difficulty by assuming that each bank faces a rising marginal cost of loans, an assumption that can be justified by bank exposure regulations or by managerial risk aversion. Because individual banks face an increasing marginal cost of lending, it may not pay any single bank to extend a loan to avoid a default in the first period. It is in the collective interest of all creditors to extend further credit in concert, guaranteeing themselves the necessary return. The reason for

this in Sachs' model is that a failure to renew any loan in the first period brings about a situation in which no loan is repaid in either period. More generally, this will be true if the return on one loan increases with the amount lent by others. This hypothesis can be contrasted with that of Kletzer (and moral hazard analysis, in general) where the return on one loan decreases with the amount lent by others.

The assumption of an increasing marginal cost to each bank of lending may be questioned. The senior debtor knows that if he refuses to renew credit others will do so as well; see also Stiglitz and Weiss (1981). Even if the cost of capital increases with exposure, once some amount has been extended, a bank may be willing to commit further funds to prevent the loss of the original commitment even if, standing alone, the yield would be inadequate. Consequently, it is a bank with an initially large exposure that will find the value of extending further credit the greatest.

The criticisms levied earlier at the Diamond-Dybvig model apply here as well. In particular, to the extent that this is a serious problem, it should have been anticipated. To the extent that it was anticipated, the problem could have been forestalled, e.g. by each bank lending for two periods, and only on the condition that other banks lent for a similar period. There is, moreover, one important difference between bank behavior and the behavior of depositors. Because banks are engaged in economic relations with each other repeatedly over an extended period of time, there may exist a cooperative equilibrium that sustains the efficient outcome (no-runs).

As Gersovitz (1985) has pointed out, there is a basic difference between a situation in which the debtor would like to obtain a new net

flow of funds and one in which he merely wants to postpone debt service. It is the latter situation that most debtors have confronted who have recently engaged in reschedulings. They are making net payments to their creditors, but less than would be required by the original loan contracts in the absence of new loans. In this case, the debtor can deal with reluctant creditors by declaring a unilateral, partial moratorium on debt service. If all creditors have the same upward-sloping cost of funds, the debtor will minimize their losses by making proportional (although partial) payments. By contrast, the upward-sloping cost of funds and the associated externality means that it may not be possible for the debtor first to pay all creditors and then to ask them for further funds. It is this difference between a pro-rated moratorium or rescheduling and a refinancing after payment that the Sachs and Krugman models explain. On this interpretation current problems are more ones of form than substance, assuming, of course, that there is no fundamental reason, such as willingness-to-pay, why debt service will not be resumed.

It would be quite another thing if debtors needed positive flows. For instance, a debtor may have an investment project already underway that will become valueless without a further infusion of funds to allow its completion. In this case, the debtor could not unilaterally initiate a solution and the prospects for success under the Sachs and Krugman assumptions would be very much reduced. The problem would then be closer to that originally postulated by Diamond and Dybvig who assume that two-period investments are inherently more productive.

#### IV. A Re-Examination of the Solvency Issue

Earlier, we remarked that it seems implausible that lending to developing countries is constrained by their ability to pay, or solvency. Debt levels do not seem so high, and, we argue, for a good reason: Long before a country's ability-to-pay would become relevant, its willingness-to-pay constrains its access to credit.

An earlier literature did analyze the sovereign debt problems from a solvency viewpoint, however, and in this section we briefly re-examine this literature using the framework we have just presented. Although primary reliance on ability-to-pay models is dangerous, some important insights can be gained from this approach. Indeed, as noted, some of the models of lenders' resolve we reviewed use solvency concepts in determining when payment occurs.

A useful way of understanding the problems that arise in evaluating the ability of the borrower to repay a loan is to look at the basic balance of trade identities. If  $D$  is total debt,  $\Delta D$  repayment of debt,  $r$  the interest rate, and  $B$  the trade balance then in any period

$$(8) \quad \Delta D - rD = B.$$

If  $S$  is private savings,  $I$  domestic investment,  $T$  tax revenue and  $G$  government spending, another identity is that

$$(9) \quad \Delta D = (S - I) + (T - G).$$

Thus debt service is related both to the trade surplus and to private and government savings. If domestic product  $Y$  is independent of  $T$ , an unconstrained government could in theory set  $T = Y$ , and  $G = I = 0$ , in which

case  $S=0$  and  $\Delta D+rD=Y$ . Though eqs. (8) and (9) are nothing more than identities, they provide a framework for understanding possible sources of problems in a country's meeting its foreign debt obligations.

An early paper by Domar (1950) made the point that a lender country could perpetually run a current account surplus only if the growth rate of loanable funds permanently exceeded the interest rate. Avramovic (1964) applies an analysis somewhat like Domar's to a borrowing country. There are fixed savings, tax and import parameters. In this context a borrower eventually cannot repay his debt unless his growth rate permanently exceeds the interest rate.

Such models suffer from two problems. First, the variables that they take as exogenous, such as the growth rate, are endogenous. Second, if they were exogenous, a variety of conundrums would arise. If the borrower's growth rate remains permanently above the interest rate, there would be the problem of matching loanable funds to the implied loan demand. On the other hand, how is repayment to occur if and when the growth falls below the interest rate?

Since sovereign loans are owed by the governments of countries, repayment is not constrained by the net worth of the country, but by that component of net worth that the government can (or is willing to) appropriate. For a government that can impose lump-sum taxation at no administrative cost, national wealth and maximal government revenue do coincide. Taxes typically impose excess burdens and are costly to raise, however, so that the maximal amount that the government can extract from an economy falls short of the net worth of the economy. Nonetheless, it seems implausible that governments are anywhere near making the maximum feasible debt service.

Kharas (1984) and Sachs (1984) model solvency in terms of a constraint on government revenue. The first is a variant of the Domar (1944) and Avramovic (1964) models with an exogenous, fixed proportional tax rate, as well as an exogenous saving rate. Sachs (1983) considers a two-period optimizing framework in which a government faces a revenue constraint only in the repayment period. He emphasizes that such a government should borrow less than the amount that equates the world interest rate to the domestic marginal product of capital. The reason is that the binding resource constraint implies a higher marginal cost of government revenue in the repayment period than in the borrowing period.

The argument that a binding government budget constraint reduces optimal borrowing does not, however, generalize much beyond this example. If the government were constrained in total resources from domestic sources in the initial, rather than the repayment, period then the marginal cost of funds in that period would exceed that in the repayment period. Efficiency would demand borrowing more than the amount that, if invested, would equate the domestic marginal product of capital to the world interest rate. The argument also assumes that the revenue from investments financed by the loan does not accrue to the government, but must be taxed from the private sector. Otherwise the standard condition for optimality would apply.

More generally, there is not a rigid constraint on raising taxes in any period. Efficient borrowing-cum-tax policy will take into account three factors: (1) the marginal (social) cost of raising revenue increases with the amount raised in any period; (2) additional investment at one date may affect the marginal cost of raising funds at a later date; and (3) borrowing costs may increase as a country borrows more

within any period. Plausible models may be constructed that imply a country should borrow more than the amount that would, if invested, equate the domestic marginal product of capital to the world interest rate.

A second reason why national net worth may overstate resources available for repayment to lenders abroad is the difficulty in transferring national assets to foreigners. Simonsen (1985) provides an extreme version of this view which postulates an autonomous trade balance. A country's net worth, from a lender's perspective, is consequently the discounted present value of its trade account. For a solvent borrower this amount exceeds the value of debt. The value of resources within the country is irrelevant since there is no way to transfer them to foreigners except through the trade account. A less extreme version of this view models the trade account as a function of a set of variables that are partially responsive to policy. Repayment then requires that the government pursue policies that yield the necessary trade account surplus. This view precludes the possibility of repayment by a direct sale of domestic assets to foreigners without their contemporaneous export.

One argument why the trade balance constrains a debtor's ability to repay is the traditional transfer problem, an issue raised by Diaz-Alejandro (1984). Repayment could worsen the terms of trade of a debtor, consequently reducing his capacity to service debt. But the transfer of purchasing power (as represented by the repayment of loans) from a small debtor to a larger creditor probably will not have a significantly adverse effect on the terms of trade.<sup>9</sup>

These solvency models emphasize how borrowers can come up against a net-worth constraint and become unable to pay. A more complete picture is given by other models that incorporate the behavior of lenders, who only lend if there is a reasonable probability that this situation can be prevented. In these models credit crises never arise since no bank lends more than the borrower can repay. If repayment capacity is stochastic the bank will in general lend so much that in some contingencies repayment is impossible, at least without rescheduling (recall section II.2).

Jaffee and Modigliani (1969) present a model of a borrower with limited resources next period to repay a loan. They make the point that if the resources available to repay a loan are limited, then there is clearly an upper bound on the amount that a lender will be willing to lend.

The models of solvency that we have discussed up to this point have treated the value of the borrower's resources available for repayment as an exogenous variable, and have assumed that borrowers and lenders share the same subjective probability distribution about that value. In fact, borrowers are more likely to have better information about their worth in the repayment period than lenders, and borrowers' actions affect what that distribution will be. Consequently lenders face problems of adverse selection and moral hazard.

The terms of the contract affect both the mix of applicants and the actions undertaken by those who get loans. Thus, increasing the rate of interest may actually lower the bank's expected return, both because the best risks (from the lender's perspective) decide not to apply and because the higher interest charges induce borrowers to undertake greater

risks. The consequence of this is that banks may find it profitable to charge an interest rate below the market clearing level. This results in credit rationing; see Keeton (1979) and Stiglitz and Weiss (1981)

Stiglitz and Weiss (1983) also show how a bank involved repeatedly in lending to a particular borrower can use the terms of subsequent loans to modify the selection of borrowers or decisions of borrowers to its own advantage. They assume that the bank can credibly commit itself to the terms of subsequent loans when the initial loan is extended. In particular they show that a bank may exclude a borrower in default from subsequent loans to discourage (ex ante) risky investments.<sup>10</sup> They also have analyzed the role of collateral, showing that its absence exacerbates problems, although credit rationing may still exist with collateral. Thus credit rationing may be more important in country loans, where collateral is not feasible, than in domestic loans.

The Modigliani-Jaffee and Stiglitz-Weiss papers show how credit rationing can arise when the borrower's insolvency threatens a loan. An implication of the Stiglitz and Weiss papers is that solvency itself cannot be defined independently of the actions of borrowers and lenders. Even though, ex post, the lender receives all the borrower's assets if a default occurs, the borrower can affect the probability of being able to pay. Ex ante the lender's return is affected by the borrower's actions. Even when the solvency constraint is binding ex post, the borrower's willingness-to-pay is important in this ex ante sense.

#### V. Operationalizing and Testing the Theories

Economists have investigated a fairly large number of theoretical notions in their discussion of international lending. While many of the

models complement each other, we have remarked upon important conceptual differences among them. In this section and the next, we are motivated by a set of very general questions about the empirical relevance of these models: How can these theories help to interpret recent developments in international lending? How can they be used to identify future topics of importance and to make predictions? How can experience in the markets be used to distinguish which theories are relevant? What are the priorities for further theoretical research? In short, what are the connections between the theories, empirical research and what is happening in these markets?

Specific empirical questions facing the researcher range from knowing the facts to understanding the actual behavior of borrowers and lenders. Some examples are: How much has been lent and what determines the amount lenders wish to lend, borrowers wish to borrow, and the actual amount of debt outstanding? What are the terms of the loans, and what determines them? What types of ruptures occur between lenders and borrowers, and why? Do lenders maintain unity in confrontations with debtors, and under what circumstances? What are the terms of the reschedulings? of IMF agreements?

Some of these questions are informational, and knowledge of particular facts can answer them. No econometric analysis is needed. Others involve evidence on the motivations of borrowers and lenders, and involve inferences about behavior. In principle, econometric analysis is appropriate; in practice, there are limitations to the application of econometric methods. One obstacle to econometric work arises because the informational questions are logically prior to econometric analysis, and

when they cannot be answered in a satisfactory manner, there may be little point to pressing on with econometric analysis.

One basic problem confronting all econometric studies of sovereign debt is that the unit of analysis is unavoidably the country. Consequently, it is very difficult to identify exogeneous variables that vary by the unit of analysis. The interpretation of many results in the literature is clouded by the inclusion in the estimated relationships of many endogenous variables as explanatory variables. The terms of trade, however, is one important source of external shocks that may be roughly exogenous for many developing countries, which tend to be relatively small in world markets. Similarly, it may be possible to introduce climatological variables to measure an important set of domestic shocks when agriculture is an important source of income, exports and government revenues.

Existing studies fall into two groups corresponding to an earlier and a later stage in the relationship between borrowers and lenders. One group focuses on an environment of voluntary lending, and seeks to identify the determinants of the quantity of debt, and the terms at which it is contracted. The second type of study focuses on when debt problems arise. So far there are no studies that address the prospects for a resumption of voluntary lending to countries that have experienced problems.

Estimating the determinants of debt outstanding is quite difficult. Even in the absence of problem cases, it is necessary to allow for the possibility that observed debt is the minimum of the credit ceiling and desired debt. This implies two regimes. An appropriate econometric technique produces not only coefficient values but also a probabilistic

separation of the sample into the two regimes. The existence of problem debtors whose debt exceeds the level desired by creditors means that three or more regimes are required in empirical work if both cases of voluntary and involuntary lending are to be treated in a unified analysis.

At present, only the two-regime model has been estimated (Eaton and Gersovitz 1980, 1981a). In these studies the observations on individual countries were from 1970 and 1974, so that there was no need to account for problem debtors. By the same token, however, these results apply to only a very early period in the evolution of lending to developing countries. Bank lending was much less important before 1973-74. The results of these studies indicate that two regimes rather than only one are justified; the credit-constrained regime was relatively more prevalent.<sup>11</sup> In 1974 relatively more countries were credit-constrained. Some of the oil exporters that were included in the sample for both years moved against this trend, however, as one would expect. The analysis of Eaton and Gersovitz (1980), which considers determinants of foreign reserve holdings as well as international indebtedness, suggests that debt was a substitute for reserves.

In the analysis of debt levels and debt problems, an important distinction is between the long-run characteristics of countries (for instance, the standard deviation of the terms of trade about trend) and transitory shocks that they may experience (the actual deviation of the terms of trade from trend in any one year). For instance, Eaton and Gersovitz (1981a) present a model in which an increase in the permanent variability of a debtor's income can increase the debt ceiling it faces, although a failure to repay, if it occurs at all, will occur in a period

of relatively low income. Existing studies use some constructed measures for long-run country characteristics such as the variability of exports. They do not, however, incorporate variables capturing transitory factors into the estimation. Under reasonable distributional assumptions, the omission of these variables (and their implicit inclusion in the error term) need not bias the estimated coefficients. Of course, their omission does mean that these models do not reflect the role of shocks in determining indebtedness.

Gersovitz (1985) presents graphical evidence that debt has tended to increase most markedly when the terms of trade would seem to have been temporarily high. Thus, debt does not seem to have helped countries to smooth their absorption, despite the theoretical presumption that debtors would want this pattern, and that creditors should want to accommodate them to the extent that debt is below the borrower's credit ceiling. It may be that when shock variables are included in the formal econometric work, this casual impression will be reversed. If it is not, however, it may be possible to determine whether this pattern reflects behavior of lenders, borrowers, or both groups.

Finally, there is scope for improving these models by using data available since the earlier studies and variables that could be constructed from unpublished data sources. The Eaton-Gersovitz studies use the World Bank's World Debt Tables series on debt to private creditors. It is important to add short-term debt guaranteed by the debtor country to the World Bank figures to produce a dependent variable that is more comprehensive. Cline (1984, pp. 291-2) discusses one way this can be done. It would also be useful to integrate debt owed by the private sector that is not guaranteed by the debtor's government. This leads to

questions of model specification as well as of data because such debt is subject to sovereign risk in rather special ways, as well as subject to conventional risks of corporate failure. At the same time, a significant part of debt owed to private creditors is guaranteed by the governments of these creditors, and these debts must be treated more like debt to public creditors.

Bank loans to sovereign borrowers typically specify an interest rate that is the sum of two components, a reference rate from an OECD financial market, usually the London Inter Bank Offer Rate, and a spread. The reference rate component is adjusted at fixed intervals to its current market value, so that the loans are at floating rates. The spread is set for the duration of the loan, and is the component specific to the loan.

There are several econometric investigations of these spreads. McDonald (1982) provides references and some description of individual studies. These studies focus on an interpretation of the spread as a risk premium, and attempt to infer the lenders' perception of loss from the size of the spread. The type of loan problem leading to the spread is not, however, explicitly specified, nor could it be, given the methodology and information. Insofar as a probability of loss is inferred, it seems to correspond to a probability ( $\pi$ ) of total loss of present value, via the condition  $(1-\pi)(1+r+s)=(1+r)$  where  $r$  is the safe, base rate and  $s$  is the spread.

In fact, however, the spreads may reflect other factors. There may be higher costs of originating loans in certain countries. Tax treatment of interest income earned by foreigners in the borrowing countries may have implications for spreads. For instance, in Mexico, the Mexican withholding tax may be paid by the borrower but still generates U.S. tax

credits for the lender. Other components of the loan contract, such as the front-end fees, affect the total return to the lender.

In general, these studies use an eclectic list of explanatory variables that are not derived from a clearly stated model of sovereign lending and borrowing. Because they share this characteristic with models of debt problems, we postpone a discussion of individual variables.

One problem that is specific to these models, however, is the inclusion of other conditions of the loan agreement as explanatory variables, and these are most probably endogenous. The motivation for their inclusion is that these factors are known to be related to interest rates even in markets without a risk of repayment. For instance, there is a term structure relationship between rate and maturity on U.S. government bonds. On the other hand, such loan characteristics can play a special role in the context of sovereign lending. For instance, we have already noted that loans of short maturity allow for more frequent and effective monitoring of the sovereign debtor, the so-called short leash. On the other hand, very short-term debt is often poorly recorded and it is often feared that debtors who anticipate debt problems and credit constraints may surreptitiously run up their short-term indebtedness, the problem modeled by Kletzer (1984). Thus these econometric studies have included explanatory variables that are themselves endogenously determined by lenders and borrowers with reference to considerations of sovereign risk.

By far the largest number of econometric studies of sovereign lending attempt to explain instances of so-called problem debtors. McDonald (1982) and Saini and Bates (1984) provide extensive surveys of

variables used, estimation methods, coefficient estimates and success in predicting the events studied. Edwards (1984) and McFadden et al (1985) are recent studies in this tradition.

All these investigations try to understand the determinants shifting a country from being a good to a bad borrower. The fundamental difficulty with these models is defining appropriately the dependent variable, the occurrence of a debt problem. The earliest study, Frank and Cline (1971), asked when multilateral reschedulings of debt owed to official creditors occur in Paris-Club type arrangements. This type of question is well posed, and has some obvious policy interest. But it is not the question that seems central to the current debate over sovereign lending; namely, will banks regret having made loans to developing countries? None of the observable events (arrears, reschedulings, or IMF programs) that these econometric studies analyze answer this question. Within the group of countries experiencing each of these events are presumably good credit risks and bad. It is just not possible to say based on an event analysis what the prospects for ultimately realizing the present value of loans are. Even in the case of an explicit repudiation, the rupture between debtors and creditors is never irrevocable. Furthermore, even in very bad situations from the banks' viewpoint, there may be reason for the banks to avoid calling a default and for the country to demur from an explicit repudiation. Such actions may trigger intervention by bank regulators that is unwelcome to creditors, and consequently to debtors. Debt problems are therefore hard to define. We have come full circle to our opening comments about the difficulties of ascertaining loan status inherent in situations in which the relationship between debtors and creditors potentially stretches over an indefinite future.

As an alternative to the study of such events as arrears, reschedulings or IMF problems with their hazy implications for market participants, it is probably better to focus on flows of funds between creditors and debtors. In other words, the critical question is: When will a country with certain characteristics owing a certain amount of debt under certain contractual arrangements pay or receive funds from creditors with certain characteristics? One could then, in principle, make an estimate of the present value that creditors will realize on their original loan, as well as whether countries can expect to receive more funds. This strategy means a return to the estimation of debt supply and demand equations, as in Eaton and Gersovitz (1980, 1981a) but with potentially more regimes. McFadden et al. (1985) introduce a multi-regime model of sovereign debt, but it focuses on arrears and reschedulings, and therefore analyzes events rather than the flow of funds.

Another shortcoming of these econometric models is their incorporation of many variables on a rather ad hoc basis (see Eaton and Gersovitz, 1981b for a further discussion). For instance, some studies have used the ratio of capital inflow to debt service, a variable that is likely to be simultaneous with default. Others use variables like the inflation rate with little obvious theoretical justification. If the notion is that a government short of revenue will resort to the inflation tax as well as run arrears, then the variables are endogenous.

While econometric analysis of international lending faces severe difficulties, there are other types of empirical approaches that have been tried in an attempt to forecast the prospects of debtors and creditors. Kaletsky (1985) reviews the prospects for sanctions of various

types and their costs to debtors. This type of analysis is potentially prescriptive; it provides the type of information that banks and debtors may use in making decisions. By contrast, the econometric analysis assumes that the participants know what they should do, and are doing it.

A second type of exercise used to determine repayment prospects is represented by Cline's (1984) projection of exports, imports and other balance of payments entries. He argues that if the credit entries grow relative to the debit entries excluding debt service, the prospects for debt service are enhanced. This approach neglects that the magnitudes of all these variables are jointly determined. A country may decide that its creditors will neither extend it new funds nor be able to deploy effective sanctions. It can then choose to increase its imports or reserves or decrease its exports relative to the levels projected by reference to past trends and OECD variables.

## VI. Conclusions

The rash of debt reschedulings led to a widespread view that banks had lent too much. Though bankers may now regret having made some of these loans, the relevant question is whether there was some market failure leading to inappropriate lending behavior. We have already noted that the unenforceability of contracts can imply that credit is rationed, and that lending is probably too low relative to what would be optimal if contracts were enforceable, and that borrowers would prefer this latter situation. Now we turn to a related set of questions: (1) Are there factors motivating bankers to lend more than what is likely to be repaid? (2) What is the role of bank regulation in this context? and (3) What is the interpretation of rescheduling?

These questions are inherently very difficult to answer because there is a one-shot aspect about the debt situation. The players do not make repetitive choices in similar situations. There is the comparative behavior of many countries, but they all borrow from more or less the same group of banks. Analysts can refer, therefore, to only a rather limited experience.

#### VI.1 Potential Inefficiencies in International Lending

One potentially important inefficiency results when lenders cannot observe the magnitude of outstanding loans. In this case, the lending of an additional dollar has an externality since it increases the likelihood of default. As Kletzer (1984) shows, this factor can increase the amount lent and the probability of default, as well as the initial interest rate. This type of problem may be more relevant to international lending than domestic lending to individual firms. In sovereign lending, seniority clauses are less important, and a number of lenders make loans to a multitude of government ministries, agencies and public enterprises.

There is another informational externality of potential importance: The fact that one lender is willing to lend funds conveys information about the creditworthiness of the borrower. Similarly, the refusal of a bank to lend funds conveys information to other suppliers of capital. This externality may contribute to the occurrence of runs. In our earlier discussion, we noted that one might view a lending crisis as a run. Each creditor wishes to protect himself; in doing so, he may actually increase the likelihood that others will be unable to recoup what they have lent.

It is not only that the forced liquidation of assets consequent upon an unexpected withdrawal of credit has a deleterious effect on the net worth of the borrower. The withdrawal of credit by some creditors induces a revision in others' estimates of the likelihood of a default, and this by itself can lead to a run.

Lenders must make inferences about the likelihood of a default on the basis of partial information. Some of the risks facing one borrower are similar to those facing another borrower. Withdrawal of credit against one borrower may even cause a re-evaluation of credit extended to other similarly situated borrowers. Thus, there are informational externalities extending across borrowers as well as across lenders. But in general, our conclusion is that if a runs externality were the sole cause of debt problems, it can be handled by a lender-initiated moratorium since new funds net of interest payments do not seem to be required.

Banks are limited liability institutions. Thus, when a bank undertakes a risk, it may be imposing some costs on its creditors which it does not fully take into account, just as firms or countries to which it lent money did not fully take into account the costs that their actions had on the bank.

Many governments of developed countries insure deposits by their citizens in the banks that lend to developing countries. This insurance obviates the need for depositors to supervise bank portfolios, a presumably costly activity for small depositors that provides the rationale for the insurance. In addition, there may be a role for insurance in removing the incentive for bank panics, as discussed by Diamond and Dybvig (1983).

To ensure that this insurance does not lead to moral hazard on the part of banks, various regulations have been adopted to circumscribe their behavior. In the United States, loans to individual borrowers are not to exceed a fraction of bank capital, but all loans to a single country or even to all agencies of a single government were never classified as being to an individual borrower, in this sense. This provision has therefore not prevented the aggregate of loans to entities in individual developing countries from becoming a significant fraction of bank capital.

One important policy that regulators can take is to force banks to increase their net worth. This is particularly important in a situation of involuntary lending (rescheduled loans that otherwise would be in default). Banks are induced to make these loans because they can pay dividends based on interest income that is only paid to them because they extend new loans. Unless these regulators prevent banks from paying these dividends, their loans to developing countries will continuously rise relative to their capital. This process will increase the contingent claim on the insurance schemes, potentially without bound. In fact, U.S. regulators have required two major banks to increase their capital. There is really very little cost to extending this program since it requires no judgment on the ultimate worth of the loans.

A related policy that regulators could adopt is to require full disclosure of loans made to individual countries. Increased reporting requirements have been promulgated by U.S. regulators. This information can help uninsured depositors and shareholders to monitor the portfolio decisions of bank managements and thereby to deter moral hazard.

Insurance agencies can also deter the undesirable risk-taking consequences of insurance by adopting differentiated premia that increase with the riskiness of loans and with their proportion in an individual bank's portfolio. This has not been a general feature of insurance programs, but would deter banks from undertaking correlated loans that yield expected returns net of insurance payments below those on a safe loan, but expected profits to the banks above those on a safe loan. Similarly, the categorization of loans as requiring loss reserves can also be further differentiated.

The moral hazard problems caused by deposit insurance are reinforced by typical (implicit) managerial compensation schemes in which judgments concerning performance are based on relative performance. This too may lead to excessive correlation of risks undertaken across banks. Assume most banks are undertaking higher yielding loans to LDC's. If all loans go into default, then it is unlikely that all (or possibly any) bank managers will be punished; each manager's judgment is confirmed by the actions of the others. On the other hand, if any one refuses to lend, and there is no default, the lower return earned by the bank will count against the manager. Thus, as emphasized elsewhere in the New Theory of the Firm, one must take into account the incentives of the managers; risks faced by the firm and risks faced by the manager are not necessarily the same. It may be possible to deter moral hazard if regulators directly penalize managers, as happened to some extent in the Continental-Illinois case.

## VI.2 Interpreting the Reschedulings

In terms of the models discussed so far, rescheduling has a number of interpretations. One is simply that it is a device to extend the term of the loans in question; rescheduling a short-term loan is simply another means of issuing a long-term loan.

As we have noted, the option for certain types of unspecified interventions that a short-term loan contract allows provides it with certain advantages over long-term contracts. In particular, rescheduling a short-term loan gives creditors more control over the borrower's indebtedness. That is why short term loans may be employed, even when it is (correctly) anticipated that there will be a high probability of a rescheduling.<sup>12</sup>

Still other explanations are that rescheduling is an action by creditors to bring a solvent, willing-to-pay debtor through a liquidity crisis or that it is an attempt by an insolvent or unwilling-to-pay borrower to postpone the inevitable sanctions it will suffer when repayment ultimately is not made. Creditors go along in the latter instance because they hope: (1) that the problem is really one of liquidity; (2) that, by waiting, they may find other, more gullible lenders or a public institution to assume the debt; or (3) that the moment of public realization of the worthlessness of the loan can be postponed until the bank personnel responsible for it have left. Hellwig's (1977) model suggests another rationale, that rescheduling is the lender's throwing of good money after bad to keep alive some prospect of the debtor's repaying.

In most cases, rescheduling reflects a failure to contract completely against all possible contingencies.<sup>13</sup> Ozler (1984) has developed a model analyzing the consequences of this when, after the initial loan, the two parties confront each other as bilateral monopolists (even though initially the loan market is competitive). From the perspective of the initial period two magnitudes are in doubt, the borrower's income in the second period and the penalty of default. The borrower is ultimately solvent, however. The initial loan is extended for one period. Three outcomes are possible. First, the borrower's income and the default penalty both exceed the repayment obligation; the loan is repaid on schedule. Second, the borrower's income falls short of the repayment obligations. A liquidity problem forces the borrower to reschedule at terms more favorable to the lenders than the initial loan, since lenders are now monopolists vis-à-vis the borrower. Third, the penalty of default falls below the borrower's debt service obligation. The borrower uses the threat of nonpayment to negotiate a rescheduling of the loan on terms more favorable to himself.

Two features of the model may have particular relevance to actual lending in international capital markets. First, even though default never actually occurs, borrowers can use the threat of default to extract better loan terms. Kraft's (1984) description of Mexico's debt rescheduling indicates that Mexican negotiators raised the specter of default for exactly this purpose. Second, reschedulings may take place for different reasons, with different implications for borrowers and lenders. Ozler studies the effect of rescheduling announcements on the value of the equity of banks involved. She finds that during the late 1970's reschedulings typically raised equity, suggesting a liquidity

explanation. The opposite is the case for the early 1980's, which she interprets as reflecting a decline in the perceived cost of default to the debtor. This view also seems consistent with the pattern of interest-rate spreads on rescheduled loans, which were first higher and then lower than those on so-called voluntary loans.

### VI.3 Final Remarks

The central role played by the enforcement problem and the absence of collateral make the international loan market fundamentally different from domestic credit markets. In a sense, our analysis leads to a view that it is perhaps more surprising that there has been as much lending to developing countries as that there is not more. It is hard to interpret events to ascertain the future course of payments by debtors to creditors and by creditors to debtors. But we believe that our framework can help to organize thinking about the topics raised by sovereign lending and country risk, and to point up inconsistencies that could otherwise plague analysis in this area.

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ENDNOTES

- 1 We only use default in this restricted sense.
- 2 Consider a firm for which it has suddenly become apparent that there is a large probability that output will be zero. The expected present discounted value of its future income stream is less than the value of its outstanding obligations. The firm is (by standard definitions) insolvent. But a rational lender would not declare the firm in default, if there were no moral hazard problem. For doing so would simply waste away some of the value which the lender might otherwise be able to appropriate.

Consider, by contrast, a similar firm for which a new investment opportunity suddenly becomes available. The new investment is very risky. The expected present discounted value of the firm is very positive. If the firm undertakes the project, however, the expected return of the bank will be substantially decreased. The bank only obtains a return when the firm does not go bankrupt; it does not share in the bonanza which accrues if the risky investment project is successful. The bank would like to stop the project, but its loan contract does not have any provision enabling it to do so. If, however, there is a provision in the loan contract, which enables it to declare the loan in default, it would be in the interests of the lender to do so, even though the firm is not insolvent.

- 3 We emphasize our dissatisfaction with models that simply take critical parameters of the economy as exogenous and, by so doing, create a problem.
- 4 Note that the losses to the borrower often exceed the gains to the lender. This suggests that, at least in some circumstances, the incentive effects of collateral are more important than its guarantee effects.
- 5 There may, of course, be some exceptions such as the opportunity to seize airplanes owned by a national airline in default that tries to use them in international service.
- 6 For instance, Sachs and Cohen (1985) point out that the opportunity not to pay may substitute for insurance, allowing a risk averse borrower to offset bad shocks elsewhere. See also Eaton and Gersovitz (1984) on penalties under uncertainty.
- 7 Kreps and Wilson (1982) suggest how imperfect information of a particular kind can sustain a reputational equilibrium even in a finite-horizon game.
- 8 Note that the current lender's incentives for extending credit are thus greater than the incentives of other potential lenders (recall our earlier discussion and Stiglitz-Weiss, 1983).
- 9 It is worth noting, however, that the initial extension of the loan must have been accompanied by a terms-of-trade gain to the borrower, if repayment implies a loss.
- 10 Their analysis thus provides part of the explanation of why lenders wish to cut bad borrowers off from credit.
- 11 Identification of the regimes is difficult because theory suggests that almost all variables influencing the desired debt should also

influence the credit ceiling, and conversely. Eaton and Gersovitz use restrictions on the signs of coefficients as well as the fact that when the credit ceiling is binding it affects desired reserves. A further possibility is to assign certain countries to different regimes with probability one based on prior knowledge, something that may be attractive now that cases of apparently intractable debtors have emerged.

- 12 Several recent papers have attempted to model this idea formally. See, in particular, Kletzer (1984), and Sachs and Cohen (1985) who provide models in which rescheduling agreements prohibit the borrower from tapping sources of credit other than the initial lenders. The likelihood of the ultimate repayment of the initial loan amount is consequently enhanced. What is not clear in the analysis is why a long-term loan agreement could not attain the same objective by prohibiting the borrower from borrowing from other sources during the term of the loan.
- 13 With complete contracting, repayments would be a function of the state, just as they are with incomplete contracting, but the dependence would be specified ex ante. The following discussion notes some of the differences that arise in the nature of the relationship between debtors and creditors with incomplete contracting.