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Some Problems on the Supply Side of International Credit Markets And Countries' External Debt Management

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I. Introduction

Recent theoretical work on international borrowing has taken steps towards greater realism by incorporating factors which explain why international capital markets do not conform nicely to the standard competitive paradigm. Economists have long recognized that because of the difficulties of contract enforcement and moral hazards in the behavior of debtors, individuals and firms are often rationed in their borrowing. In the domestic loan market, some of these difficulties can be overcome through certain legal and economic institutions in a manner not available in international loan markets. Addressing this problem, Eaton and Gersowitz (1980), Sachs (1982, 1983), and Sachs and Cohen (1982) have studied the question of sovereign risk and argue that the risk of default decisively affects the behavior of the loan market. In contrast to the operation of textbook competitive markets where anonymous agents can buy and sell commodities at given prices without quantity constraints, these authors show that default risk gives rise to many observed features in international lending not well explained by the standard framework. In particular, the presence of default risk can explain quantity rationing of loans, an upward-sloping supply schedule of loans and, on the demand side, borrowing country actions to pursue policies designed to enhance creditworthiness.

Whilst paying attention to default risk implies that the behavior of both lenders and borrowers is altered, it is the recognition by rational creditors of the incentives for irregular behavior on the demand side of the market (i.e., for the borrowing country) that effects the supply of loans. In the models referred to, difficulties do not originate from the supply side of the market which is usually treated (implicitly) as if there were only one competitive profit-maximizing source of funds. However, in practice, a striking feature of the period from the oil price increase in 1973-74 to the present has been the importance of the commercial banking system in directing flows of lending. During the last decade, the growth of international banking has outstripped the growth of domestic banking by a wide margin, and the international loan market provided a new and expanding market in which many banks have become involved. It is also clear that commercial bank lending behaviour will play a vital role in efforts to address the current debt servicing difficulties which affect many developing countries.

This paper extends the literature on default risk to consider explicitly issues associated with the supply side of the market. It focuses on the behavior of creditors and asks whether the organization of the supply side provides incentives which are helpful in explaining behavior in the international loan market. Complementing the earlier literature, which argued that actions taken on the demand side of the market by borrowing countries can strongly influence the supply of funds schedule that they face, the general conclusion drawn from several different perspectives is that, in determining the supply schedule of

funds, one cannot ignore the structure of the supply side of the market either.

The organization of the paper is as follows: Section II contains the core of the paper. First, the basic version of the Sachs and Cohen model is briefly described in Section II.1. Section II.2 then uses this framework to analyse the implications of different assumptions about the structure of the supply side. Once one departs from the usual assumption of a single source of funds, it is apparent that there are important interdependencies between banks as the lending decisions of any one bank, by changing the total stock of debt, will affect those of other banks. It also follows that banks face very different incentives to make new loans because of their different existing exposures. The analysis demonstrates that the aggregate loan supply schedule facing a country depends upon the exposure structure as well as the number of its creditor banks just as it depends upon the particular characteristics of that borrowing country as shown by Sachs and Cohen (1982). As well as being helpful in describing behavior, the analysis also suggests an apparent case of market failure.

In Section II.3, we consider the incentives that exist for banks when new loans must be forthcoming if a country is to be able to overcome temporary debt servicing difficulties. The analysis shows that in certain situations in which new loans are not forthcoming to an otherwise solvent economy, external pressures (e.g. those exercised by the IMF in several recent cases) may be necessary to overcome the possibility of a financial panic. An example of how such a liquidity crisis can occur is contained in Sachs (1983). In his model, the possibility rests upon the assumption of risk aversion on the part of banks. In this paper, we show that a panic can occur even with risk-neutral banks once the composition of creditors and, in particular, their existing exposure is taken into account. The analysis also shows how, even in the circumstances in which the Sachs model rules out the possibility of a financial panic, considerable problems can still remain in the successful formulation of a syndicate to extend new loans. As a related point, the discussion addresses the question of why large and small banks alike might balk at a "fair shares" arrangement for new lending.

Section III further extends the analysis by relaxing first the assumption that all creditors are equally informed about the characteristics of the borrowing country. It is shown that differences in the scale of banks' operations might be expected to affect their acquisition of information and that if banks have varying degrees of knowledge this may affect the behavior of the market. A second assumption we relax is that creditors are fully able to relevantly distinguish between borrowing countries. This is an important issue since a notable feature of recent events has been the extent to which debt difficulties for one country may have led to a sharp reduction in loan availability for other countries in the same region, even for those not obviously encountering difficulties. It is shown that such a

"contagion" phenomenon follows naturally from the earlier models on default risk.

Finally, Section IV summarizes the main conclusions and briefly discusses the implications for external debt management in the light of the models presented in this paper.

II. Supply-Side Behaviour With a Competetive Banking System

1. The Sachs-Cohen model

As indicated in the introduction, the starting point for the paper's analysis is the framework developed in Sachs and Cohen (1982) (hereafter S-C) which sets out a basic model of international borrowing with default risk. Following on from the work of Eaton and Gersowitz (1980), S-C show how many of the important issues that arise can be illustrated in a simple two-period model where loans are made to a sovereign borrower in one period that may or may not be paid back in the next period. The key to S-C's modelling of debt repudiation is an explicit assumption regarding the benefits (nonpayment of the real value of outstanding debt) and costs (inability to obtain new loans in world capital markets, loss of overseas assets, decline in capacity to trade) to a debtor country of debt repudiation. The two-period model assumes that if the loan is defaulted upon, creditors can retaliate by imposing a cost to the debtor country assumed to be equal to a fraction λ of national product. The supply side of the market is treated as a "black box" operation with loans being extended so long as they yield the appropriate rate of return -- here the "risk free" or safe rate of interest, ρ, that can be earned on loans made elsewhere. The general maximization problem facing the authorities of the debtor country can then be written:

Maximize expected utility, $EU(C_1, C_2)$, subject to the country's two-period budget constraint $C_1 = Q_1 + D_1 - I_1$

$$C_2 = \max (C_2D, C_2ND)$$

where C_1, Q_1, D_1, and I_1 are first-period consumption, output, borrowing, and investment, respectively;

$C_2D = (1-\lambda)\, Q_2 (I_1, E_2)$ = second-period consumption if a default occurs and $C_2ND = Q_2 (I_1, E_2) - (1+\rho) D_1$ = second-period consumption if no default occurs, where ρ = the safe world rate of interest and $Q_2 (I_1, E_2)$ = second-period output which depends upon first-period

investment and possibly a random shock, E_2, in the second-period. For the time being, we present the simplest case of certainty, ($E_2 = 0$). We relax this assumption and introduce uncertainty in the next section. For illustrative purposes, S-C adopt the particular utility and production functions, $U(C_1, C_2) = C_1 + \frac{C_2}{1+\delta}$, and $Q_2 = Q_1 + (1+\mu) I_1$ respectively where it is assumed that $\rho < \mu < \delta$ and μ is the productivity of investment and δ the time preference rate. Finally, investment opportunities are assumed to be limited in amount $\bar{I}$.

There are three cases to consider. The first is the standard model of borrowing with the (implicit) assumption of no default risk.

Case 1--No default risk

The solution to this problem is:

$I = \bar{I}$

$C_1 = Q_1 + Q_2/(1 + \rho) - \bar{I}$

$C_2 = 0$

$D_1 = C_1 + \bar{I} - Q_1 = Q_2/(1 + \rho)$ and so $D_1(1 + \rho) = Q_2$ and all of second-period output is used to pay back the loan. Why is this the solution? Since $\mu > \rho$, all investment opportunities are exploited, and since $\delta > \rho$, all consumption is shifted forward in time to the first period. This equilibrium is clearly not sustainable if default risk is present, since a second-period default gives $C_2 > 0$ for all $\lambda < 1$.

S-C then go on to incorporate the recognition of default risk. Debtor countries are assumed to default when the benefits to doing so, namely non-payment of interest and principal, $(1 + \rho)D_1$, exceed the costs, λQ_2. Taking account of this we see that there will be a loan supply ceiling beyond which rational creditors will not lend. Two possibilities now arise depending upon whether the credit ceiling is set before or after the country's investment policy is chosen. Since first-period investment affects second-period output, the investment policy chosen clearly affects its ability and willingness to repay the loan. If therefore a country can credibly commit itself to an investment policy in the first period in advance of the credit ceiling being fixed, the choice of investment policy can affect the credit ceiling that it will face. The second and third cases looked at by S-C are therefore:

Case 2--Default risk; no investment precommitment

In this case, creditors lend an amount D_1 unconditionally. The planner chooses consumption levels for the given D_1. What is the maximum creditors will lend? Clearly, $D_1(1+\rho)$ must be less than or equal to λQ_2, otherwise the country has an incentive to default. But Q_2 depends on I_1, which in turn depends upon D_1. Thus:

$$D_1(1+\rho) \leq \lambda Q_2(I_1(D_1)) = \lambda[Q_1 + (1+\mu)I_1(D_1)].$$

For a given D_1, the optimal solution for the borrower is:

$$I_1 = 0$$

$$C_1 = Q_1 + D_1 = Q_1 + \frac{\lambda Q_1}{1+\rho}, \quad \text{since } D_1(1+\rho) \leq \lambda Q_1 \text{ if } I_1 = 0$$

$$C_2 = (1-\lambda)Q_1$$

$$Q_2 = Q_1$$

Why is this the solution? Because if the amount of debt is given, an extra unit of investment simply reduces current consumption. It gives $(1+\mu)$ extra units of consumption next period, but since $\delta > \mu$, this would involve loss of welfare. Therefore, for any given D_1, the optimal investment policy for the country is $I_1 = 0$. Creditors, realizing this, place the debt ceiling at $D_1(1+\rho) = \lambda Q_1$ $(= \lambda Q_2$, since $I_1 = 0)$.

Case 3--Default risk with invesment precommitments

Now debt is given conditional on the level of investment undertaken. The amount of debt available to a country will vary according to the equation $D_1(1+\rho) \leq \lambda Q_2(I_1)$. Thus, the social planner in effect maximizes $U(C_1, C_2) = C_1 + C_2/(1+\delta)$ subject to the additional constraint $D_1(1+\rho) = \lambda[Q_1 + (1+\mu)I_1]$. In this case, by manipulating I_1, the debt ceiling may be raised. Thus, the gain from undertaking a unit of investment is no longer simply $-1 + \frac{(1+\mu)}{1+\delta} < 0$ -- namely, one unit less of current consumption in return for

$1 + \mu$ units of future consumption, each valued at $\frac{1}{1 + \delta}$. Instead, the return to a unit of investment is:

$$-1 + \left(\frac{1 + \mu}{1 + \delta}\right) + \frac{dD_1}{dI_1} - \frac{dD_1}{dI_1}\left(\frac{1 + \rho}{1 + \delta}\right)$$

The third term represents the extra borrowing that can be done and spent on current consumption; the fourth term represents payment of the additional debt plus interest valued in units of current consumption. Clearly, this whole expression could be positive and so we would have $I_1 = \bar{I}$. The point is that by changing investment levels, the debt ceiling can be raised and more consumption shifted forward in time. Moreover, it is straightforward to show that the country's level of investment and social welfare will be higher in the precommitment equilibrium than in the non-precommitment equilibrium. Thus, although rudimentary, the above does indicate how default risk can explain quantity rationing of loans and why borrowing countries have an incentive to pursue policies seen as enhancing their creditworthiness.

Since the above model assumes no uncertainty, an actual default never occurs, although, as we have seen, the threat of default has a profound effect on economic welfare and the nature of macroeconomic equilibrium. Once uncertainty is introduced into the model, debt repudiations will actually occur as random events and S-C show how this can explain an upward sloping loan supply schedule as well as other observed features of international capital markets.

However, the model is silent as to the organization of the supply side of the market. In the next section we therefore incorporate uncertainty into the model and use this framework to examine the problems that may arise when some elements of the institutional structure within which debt is accumulated are taken into account.

2. Externalities and bank exposure

Acknowledging that international borrowing takes place through the commercial banking system in which many banks compete forces upon us the recognition of the interdependency of banks' lending decisions since the riskiness of any single bank's action depends upon the actions of other banks. The risk associated with an individual bank loan to a country depends upon the total stock of debt outstanding to a country, not just currently, but through the life of the loan, which in turn depends upon loans--past, present, and future--made by other banks.

One can see immediately that an important externality results from the fact that the riskiness of any loan depends upon the total stock of debt outstanding. Profit-maximizing banks will calculate the risk they

each face as their loan adds to the total stock of debt, but will not in general take account of the additional risk that they thereby impose upon other banks. This conclusion mirrors that of Bardhan (1967) who argued that on the demand side of the market, private borrowers will fail to take account of the fact that, as a result of their decision to borrow, other agents face higher interest rates when an upward-sloping supply schedule of funds exists. The implication here is that even with full information about the stock of debt, the externalities on the supply side of the market mean that the full social costs of a particular bank's decision to lend are not taken into account as they would be if there were only one source of funds. The interest rate required to make any given loan is therefore lower, and hence the loan supply schedule flatter, than it would otherwise be. Bardhan's conclusion that a tax on borrowing is justified in order to correct the market failure involved would apply equally in the case of a tax on lending.

The above considerations also tell us that the diversity that exists on the supply side of the market will tend to affect the willingness of individual banks to extend credit. Because current decisions to lend affect the riskiness of loans already made by adding to the total stock of debt, it follows that banks with differing exposures to a country will face very different incentives to make new loans. In particular, new entrants to the loan market may be led to make loans which banks with existing exposure would not have made.

The following simple example illustrates the basic problem. Suppose bank A, which has no debt owed to it by a particular country, considers lending a sum D_1 to that country. Also let us immediately introduce uncertainty and assume that there is full agreement that the extra debt incurred as a result of the loan increases the <u>probability</u> of default, π, by $\left(\frac{d\pi}{dD_1}\right) D_1$. Assuming risk-neutral behavior on the part of banks, the expected return on lending to the country must be equal to the "safe" rate of return. Therefore, the interest rate, r, charged on the loan will be given by:

$$(1) \qquad (1 - \pi)(1 + r) = 1 + \rho$$

For each dollar loaned, at interest rate r, there is a probability of $(1 - \pi)$ that it will be repaid. The expected return is, therefore, $(1 - \pi)(1 + r)$, which is equated with the safe rate of interest.

However, the situation for banks with heavy exposure in the country concerned is different, since a loan which increases the probability of default by $\left(\frac{d\pi}{dD_1}\right) D_1$ could mean a substantial expected loss, given the outstanding debt. As a result, new loans might not be forthcoming from such banks. To see this, note that the expected return on a one dollar

loan for bank i which is owed a fraction α^i of the total outstanding debt of the country, D_o, is:

$$(2) \qquad (1-\pi)(1+\hat{r}) - \frac{d\pi}{dD_1}(\alpha^i D_o)$$

i.e., the expected return is now made up of two components: (i) the return on a dollar times the probability of repayment minus (ii) the extent to which an extra dollar loan increases the probability of default multiplied by the existing exposure. Thus, the interest rate $\hat{r}$, which must be charged if the expected return is to equal the safe rate of return is given by:

$$(3) \qquad 1 + \hat{r} = \frac{1+\rho}{1-\pi} + \frac{d\pi}{dD_1} \cdot \frac{1}{1-\pi}(\alpha^i D_o)$$

$\hat{r}$ is increasing in $\alpha^i D_o$ and so, the larger the exposure of a bank to a particular country, the higher the interest rate that must be charged. If, as in S-C, we model the costs of default as a fixed fraction, λ, of output, Q, then it is clear that a rational bank will impose the credit ceiling $D_1(1+r) + D_o \leq \lambda Q_2$, where D_o is the total debt outstanding. By the above argument, we can see that banks with lower exposure will be willing to offer more at a lower interest rate than banks with substantial exposure would desire.

It is important to be clear what the above argument is saying. It does <u>not</u> say that default probabilities will not be reflected in the risk premia charged on loans. From (3), we note that the higher the probability of default, the higher the interest rate that will be charged, and the smaller the amount that will be forthcoming in new loans. This effect operates for all banks regardless of exposure, since the lower $1-\pi$, the higher $\frac{1+\rho}{1-\pi}$ and, therefore, r, the interest rate charged. In turn, a higher r means a lower possible D_1, given D_o and λQ_2 and so less credit is available. Generally, those studies that have analyzed lending behavior in international financial markets have indeed found that lenders tend to take into account the riskiness of borrowers in making their lending decisions [Frank and Cline (1971); Feder and Just (1977), (a,b); Feder and Ross (1982); and Sachs (1981)]. More recent empirical work by Edwards (1983) based explicitly on the Sachs and Cohen framework, where the probability of default depends upon the relationship between the cost of defaulting and the value of the

debt, confirms that banks' lending behavior has tended to consider (some of) the economic characteristics which affect default probability when determing the spreads charged.

The above evidence is quite consistent with the arguments presented here. The argument is that banks that consider increasing their exposure to a country, whether new to the international loan market or with little exposure, will not take full account of the risks faced by others in determining their actions. In the limit, new banks completely ignore the term $\frac{d\pi}{dD_1} \alpha^i D_o$ and, in general, bank i will only take account of the effect in proportion to its own exposure α^i.

To bring these points out in greater detail, we work through a modification of an example of default risk under uncertainty due to S-C. 1/ These authors introduce uncertainty and default risk into the model we have seen in Section II.1 simply by changing the assumption that second-period output is known (once investment is chosen). Output is now assumed to be a random variable and hence at the beginning of the first period neither the borrowing country nor the creditors know what second-period national output, and therefore ability and willingness to repay, will be. To keep things simple it is, however, assumed that the probability distribution of second-period output is known to all creditors. S-C show that this assumption implies that the supply schedule of loans will slope upwards with rising risk premia reflecting the risk of default. Credit rationing remains a feature of the model as in the certainty case.

On the demand side we make exactly the same assumptions as in S-C except for the additional assumption that, at the beginning of the period, there is existing debt which falls due in amount D_o at the beginning of the next period. On the supply side we assume that there are many competing banks, that they are all equally well informed and have full knowledge of the relevant characteristics of the debtor country. We also assume that the banks make their lending decisions taking as given the policies of other banks. This latter assumption is relaxed in Section II.3.

Consider then a two-period model with first-period output, Q_1, known and second-period output $Q_2 = \tilde{Q} + (1+\mu)I_1$, where I_1 is first-period investment and $\tilde{Q}$ is assumed to be uniformly distributed over $[0, Q_1]$. Thus, by undertaking investment in period one, the borrowing country augments future output and hence the costs of default. It is

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1/ See S-C (1982) pp. 24-31.

assumed that the borrowing country will default next period if the benefits to default (given by amount of debt due for repayment) exceed the costs of default captured, as before, by $\lambda \tilde{Q}_2$.

Consider a risk-neutral lender, i, with exposure equal to a fraction α^i of the sum due for repayment next period, D_o. If it makes a loan of size D_1 this period, credit market equilibrium requires that the expected return on lending is equal to the risk-free rate of interest, ρ, and hence the interest rate, r^i, charged by bank i on the loan is given by the equilibrium condition:

$$(3') \qquad (1+r^i)(1-\pi) - \frac{d\pi}{dD_1}(\alpha^i D_o) = 1 + \rho$$

π, the probability of default is the probability that the sum due for repayment next period $(1+r)D_1 + D_o$ (i.e., any principal plus interest loaned this period plus outstanding debt falling due) exceeds λQ_2, i.e., π = probability $[\lambda Q_2 \leq (1+r)D_1 + D_o]$. The assumption of a uniform distribution for $\tilde{Q}$ allows us to solve for π and $\frac{d\pi}{dD_1}$. We can show that 1/

$$(4) \qquad \frac{d\pi}{dD_1} = \frac{1+r}{\lambda Q_1}$$

and the loan supply schedule for bank i is given by:

$$(5) \quad 1+r^i = \frac{\left[1 + (1+\mu)\frac{I_1}{Q_1} - \frac{D_o(1+\alpha^i)}{\lambda Q_1}\right] - \left(\left[1 + (1+\mu)\frac{I_1}{Q_1} - \frac{D_o(1+\alpha^i)}{\lambda Q_1}\right]^2 - \frac{4(1+\rho)D_1}{\lambda Q_1}\right)^{\frac{1}{2}}}{2\left(\frac{D_1}{\lambda Q_1}\right)}$$

This expression is the same as that derived by S-C 2/, except for the terms in $-\frac{(1+\alpha^i)D_o}{\lambda Q_1}$. Graphs of the loan supply schedules are

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1/ See Appendix I.
2/ S-C (1982), see p. 25.

drawn for different cases in Figure 1. What the above expression says is that:

(a) Even for a bank with zero exposure ($\alpha^i = 0$) the outstanding debt term, D_o, is important. Banks lend less at a higher interest rate, the larger is D_o. This is obvious and simply reflects the fact that for any bank, the probability of repayment on a new loan depends upon the stock of outstanding debt. All banks, therefore, take some account of the stock of outstanding debt and hence default probabilities, in assessing risk premia.

(b) In addition, banks' loan supply schedules depend upon the term α^i, the extent of exposure. Formally, the term $\frac{D_o(1+\alpha^i)}{\lambda Q_1}$ shifts the loan schedule in exactly the same way as the term $(1+\mu)\frac{I_1}{Q_1}$ but with opposite sign. Since an increase in $(1 + \mu)\frac{I_1}{Q_1}$ shifts the loan schedule out to the right, so an increase in either D_o or α^i shifts the schedule to the left. Thus, banks with large exposure will require higher interest rates before making new loans and will impose tighter credit rationing. The ceiling on new loans, D_1, will be given by $(1+r^i)D_1+D_o = \lambda\,[Q_1 + (1 + \mu)I_1]$. D_o, Q_1, and I_1 do not vary for any particular country between banks, given our assumption of good information, and so the credit ceiling varies with r^1 which in turn depends, as we have seen, upon α^1.

Although formally the terms $(1+\mu)\frac{I_1}{Q_1}$ and $\frac{D_o(1+\alpha^i)}{\lambda Q_1}$ have the same effect on the loan supply schedule, there is a crucial difference. The term in I_1 is determined by the borrower country with investment levels being chosen by the country concerned in order to effect the loan supply schedule. By contrast, the term $(1+\alpha^i)D_o$ is dependent upon creditor characteristics. This makes explicit the important point that the supply schedule of funds facing a country depends not just on the characteristics of that country but also upon supply-side conditions. In the above case, the supply of funds available to a borrowing country would be very different depending upon whether the existing debt were concentrated in the hands of just a few large banks or very widely dispersed.

(c) Finally, the above makes the positive point that existence of many competitive banks with little or no exposure to countries increases the probability that more and cheaper lending will take place. In addition, we can iterate the normative statement made earlier--namely that overlending, in the sense of being socially inefficient, will take place because of an important externality, as profit-maximizing banks do not take full account of the increase in risk as a result of new loans, $\frac{d\pi}{dD_1}$. Instead, they only take partial account of the increase in risk in proportion to their existing exposure, $\frac{\alpha^i d\pi}{dD_1}$. The extent of overlending therefore also depends upon supply-side conditions.

Examination of the evidence does suggest that during the last decade, newcomers to the loan market were not insubstantial and they did affect loan supply conditions. The publicized Eurocurrency credit market exceeded $70 billion in volume in 1980, compared to $9 billion in 1972. Although the bulk of publicized Eurocurrency lending is undertaken by bank syndicates 1/ rather than individual institutions, World Bank data indicate that between 1973 and 1980, 526 parent institutions which had not participated in any previous year (for which data are available) entered the market. The number of new entrants was relatively constant, averaging 66 per year. In the earlier years, the new entrants were largely European and North American banks and international consortia banks. More recently, Latin American, Middle Eastern, and Asian institutions have entered the market and it was recognized that other banks were always "waiting in the wings." 2/ Thus, in reply to a question in a G-30 survey 3/ regarding the sources of "pressures on spreads," 70 percent of respondents considered "aggressive pricing by lenders seeking to enter new markets" to be very important. Moreover, looking simply at the number of new financial institutions entering the loan market understates the problem. It is not simply a question of new institutions entering a market for the first time, but instead, as we have seen and as the G-30 response indicates, a question of well-established lenders seeking to enter new markets. Major banks that have always participated in the international

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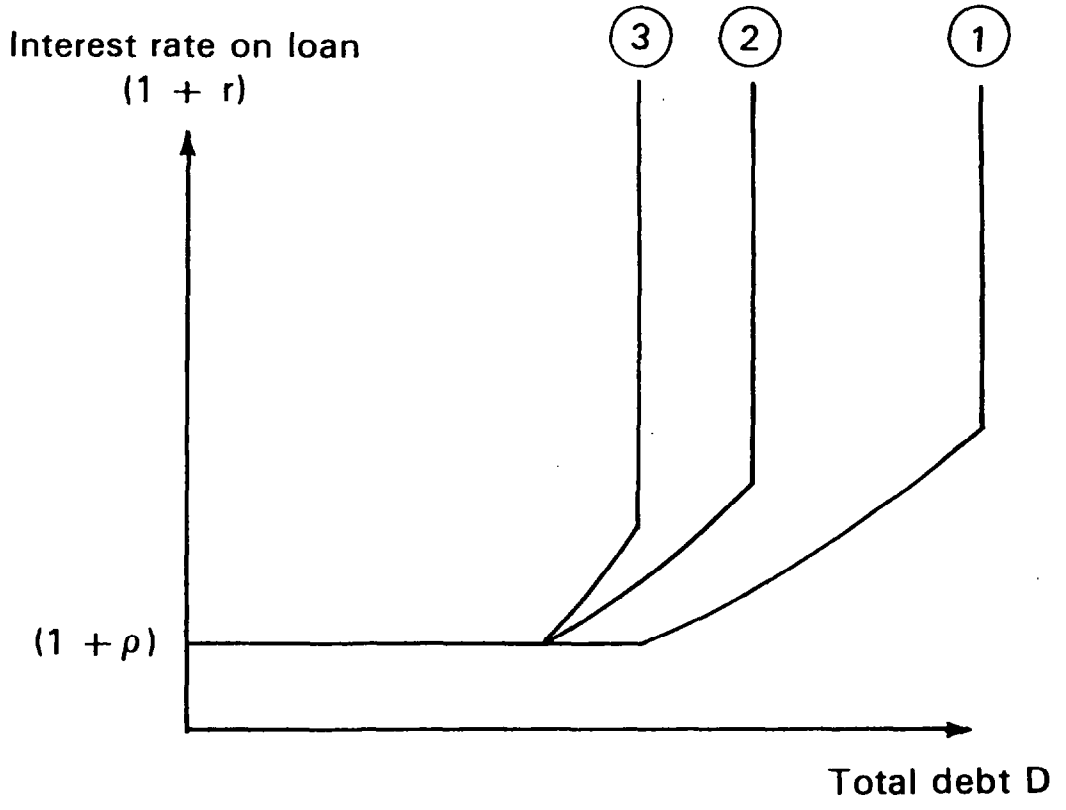
1/ It may be thought that the externality problem would be avoided since most bank lending is now through the system of syndicated bank loans. This solution takes account of risk diversification. However, it does not address the fundamental problem here -- namely the difference in incentives which will be present between new and existing creditors within the syndicate. In addition, the differential incentive could apply to banks outside the syndicate.

2/ The data reported in this paragraph are reported in Page and Rogers (1982).

3/ "How Bankers See the World Financial Market", Group of Thirty (1982).

Figure 1



(1) is the loan supply schedule with no debt outstanding ($D_o = 0$).

(2) is the loan supply schedule for a bank with no exposure ($\alpha i = 0$) to outstanding debt $D_o = \bar{D}_o$.

(3) is the loan supply schedule for a bank with exposure αi of outstanding debt $D_o = \bar{D}_o$.

loan market, but have differing exposures to different countries, are capable of exerting the same pressures.

Finally, and less rigorously, we briefly consider whether problems may occur, not only in the total quantity of new loans supplied, but also in their maturity structure. In other words, why might banks restrict access to long- and medium-term debt "too quickly" thereby forcing the country to have an excessive reliance on short-term debt and, hence, suffer an increase in the risk of not being able to meet its obligations? Consider the incentives for banks to extend loans with different maturities in a situation where it is recognized that there is some risk of rescheduling. For any individual bank, regardless of the actions of other banks, it is rational to lend short-term. If all others lend medium- or long-term, then one bank can reduce its risk by lending short-term. If everybody else lends short-term, then it is clearly in the interest of the bank to do so also. As a result, only short-term debt may be available to the country when collective action on the part of banks would have allowed long- or medium-term debt to be made available with the consequent reduction in overall risk of the country not being able to repay.

3. Rescheduling, involuntary lending, and the possibility of a financial panic

In Section II.2 we examined incentives on the supply side of the international capital market when there is uncertainty and hence default risk. Following S-C, we assumed output to be a random variable and hence that second period output could be so low that a debtor country might have an incentive to default. Banks made their lending decisions taken into account this ex ante risk. Clearly, however, the position may be more unfavourable; an adverse shock (e.g. a sharp reduction in export earnings or increase in interest rateks) may have already occurred and creditors may be in the unwelcome position of having to make additional loans if they are to have the chance of being repaid on those already made. We now therefore explore the incentives that exist on the supply side of the market when a country has suffered adverse circumstances and new loans must be committed if a default is to be avoided.

Consider the framework used by Sachs 1/ in his illustration of a financial panic in order to ask how the question of exposure affects the outcome. Suppose that a country has debt obligations due in the first period equal to $(1+r_1)D_1$, current income Q_1 less than $(1+r_1)D_1$, and stochastic second-period income given by $Q_2 = \bar{Q}$ with probability

1/ Sachs (1983), pp. 35-39.

$1-\pi$ 1/ and $Q_2 = 0$ with probability π. Assume that bank i holds a proportion α^i of the outstanding debt $(1+r_1)D_1$. Consider a loan of size D_2 such that if the loan is not made the country defaults and all of $\alpha^i(1+r_1)D_1$ is lost. If the loan is made, then there is the probability $(1-\pi)$ of repayment of D_2 (if the good outcome for second-period output occurs) and, also, a probability $(1-\pi)$ of repayment of the original debt. 2/ The benefits and costs of such a loan must be equal in equilibrium and so, for a risk-neutral bank, we have:

$$(6) \qquad (1-\pi)(1+r_2)D_2 + (1-\pi)\,\alpha^i(1+r_1)D_i = (i+\rho)D_2 - \alpha^i(1+r_1)D_1 .$$

(6) says that the expected returns to making the loan are the size of the new loan, $(1+r_2)D_2$, times the probability of repayment, plus the original sum that will be repaid, times the probability of repayment. The costs of the loan are the safe rate of return that could be obtained on D_2 less the amount $\alpha^i(1+r_1)D_1$ which, assuming the other banks' lending behaviour is fixed, would be lost with certainty if the new loan is not made. Rearrangement of (6) gives:

$$(7) \qquad 1+r_2 = \frac{1+\rho}{1-\pi} - \left(1 + \frac{1}{1-\pi}\right) - \left(\frac{\alpha^i(1+r_1)D_1}{D_2}\right)$$

Although simple, this expression holds a number of interesting conclusions. First, we can see from (7) that r_2 is decreasing in $\alpha^i(1+r_1)D_1$. In other words, the larger the degree of exposure, the lower is the interest rate required on the loan. Thus, given the assumption of risk-neutrality, 3/ it follows that banks with the largest exposure are willing to loan more at lower interest rates. This seems the opposite of the conclusion reached in equation (3) above where the larger the exposure of a bank to a particular country, the higher the interest rate charged. The reason for the difference is, of course, the

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1/ Sachs uses probability π. We use $1-\pi$ for consistency with earlier notation since π, $1-\pi$ are effectively the probabilities of default and repayment, respectively.

2/ We assume that $\bar{Q}$ is sufficiently large to be able to repay all outstanding debt plus interest and principal on the new loan. As in Sachs, this is not a case of insolvency.

3/ We relax this assumption in a moment.

different circumstances under which the loans are being made. In the equilibrium of equation (3) the risk of default is in the future and so, ceteris paribus, the larger the exposure the more the bank is at risk. In the equilibrium of equation (7), unless a new loan is forthcoming the existing debt will be repudiated. In these circumstances those banks with the heaviest exposure have the most to gain and so will be ready to extend new loans on more favourable terms. The implication in this case is that the more widely is the debt dispersed among the creditors, the greater chance there is of no new loans being forthcoming. Nevertheless, the general conclusion of both cases is the same: the loan supply schedule facing borrowing countries is not simply a function of the borrower country behavior, but is crucially dependent upon the characteristics of the supply side of the market.

Secondly, the above gives a rationale for the "fair shares" agreements of recent syndicated loans to rescheduling countries. If all banks are asked to lend in proportion to their outstanding exposure, then

$$D_2^i = K\,\alpha^i(1+r_1)D_1 \text{ where } 0 < K < 1 \text{ and so } \frac{\alpha^i(1+r_1)D_1}{D_2^i} = \frac{1}{K}\,.$$

Substituting into (7) gives:

$$(8) \qquad 1+r_2^i = \frac{1+\rho}{1-\pi} - \frac{[1+(1-\pi)]}{1-\pi}\,\frac{1}{K} = \frac{1+\rho}{1-\pi} - \left(1 + \frac{1}{1-\pi}\right)\frac{1}{K}$$

In other words, so long as all participating banks agree on π, and their behavior is risk-neutral, they will agree on the interest rate at which to make their "fair shares" loan. By extension, therefore, this also points to the factors which put such syndicates under strain:

(i) Risk assessment. If banks differ in their perceptions as to the probability of repayment, π, then tensions will arise.

(ii) Expectations. So far we have made the assumption that banks take the actions of other banks as given. Thus we have assumed that the original debt, $(1 + r_1)D_1$ (or a particular bank's share $\alpha^i(1 + r_1)D_1$) would be lost if the new loan were not forthcoming. This, however, may not be the case for any one bank if all others are willing, or expected to be willing, to lend the requisite amount. In this case, a bank does not have the additional benefits of recovering its old loan by making a new one and would want to earn an expected rate of return equal to the safe rate of interest on the new loan. To the extent that banks, asked to participate in a syndicate, believe their original loan will be made safe by the participation of others, they will be reluctant to enter. 1/

1/ We return to this question on pp. 29-30.

(iii) Risk Aversion. Suppose that banks are not all risk-neutral but instead differ in their degree of risk-aversion. Let us continue with the above example and consider two banks identical in all respects except that one is risk-neutral and the other risk-averse. We admit risk-averse behavior by assuming, as in Sachs (1983), that risk-averse banks (with zero exposure) no longer require an expected return just equal to the safe world rate of interest, ρ, but require a premium in excess of the safe rate of interest, $f(\frac{L_i}{B_i})$, according to the amount of bank lending to a country, L_i, expressed as a fraction of bank capital, B_i. Thus, banks demand an expected return close to ρ when the country loans constitute a small fraction of bank capital but demand a higher expected return as the loans constitute a growing fraction of bank capital. Substituting this assumption into (7), gives the following equilibrium conditions:

$$(9) \qquad 1 + r_2^{ra} = \frac{1 + \rho + f\left(\frac{D_2^{ra} + \bar{L}}{B^{ra}}\right)}{1 - \pi} - \frac{(1 + (1-\pi))\alpha(1+r_1)D_1}{(1-\pi)D_2^{ra}}$$

$$\text{and } (10) \qquad 1 + r_2^{rn} = \frac{1 + \rho}{1 - \pi} - \frac{(1 + (1-\pi))\ \alpha\ (1+r_1)\ D_1}{(1-\pi)D_2^{rn}}$$

where $\bar{L}$ is existing bank lending to a country and the superscripts ra, rn stand for risk-averse and risk-neutral, respectively. From (9) and (10) we can see that in order for r_2^{ra} to be equal to r_2^{rn} we must have $D_2^{ra} < D_2^{rn}$ and, therefore, $\frac{\alpha(1+r_1)D_1}{D_2^{ra}} > \frac{\alpha(1+r_1)D_1}{D_2^{rn}}$

In conclusion, a risk-averse compared to a risk-neutral (or by extension, less risk averse) bank will, for any given interest rate, want a less than "fair shares" agreement.

(iv) Bank Exposure. So far bank "exposure" to a debtor country has been defined in terms of the absolute dollar size of its loans and the "fair shares" arrangement asked banks with the largest share of the original debt to make the largest additional loans. However, an alternative definition of "exposure" is the dollar size of a bank's debt in relation to its capital. We can see that if banks are concerned about their exposure in this latter sense--as they are in the above example with risk aversion--then, even if banks do not differ in their

degree of risk-aversion, a "fair shares" agreement may cause tensions if it leaves banks with different lending positions expressed as a proportion of bank capital. An arrangement which asks banks to extend new loans in proportion to their exposure expressed as a fraction of total loans to a country carries no guarantee that banks will be equally exposed in terms of the loans expressed as a fraction of bank capital.

Let us now look more closely at the circumstances in which a financial panic can occur. In Sachs (1983) 1/ a panic can arise because of risk averse behavior on the part of banks. The reasoning is as follows: risk aversion implies that larger risk premiums are required for larger loans to any country. This in turn raises the possibility that it is not in the interests of any one bank alone to make a loan of sufficient size to prevent a default, because the interest rate required on the loan makes it impossible for the country to meet its obligations (alternatively, it gives the country an incentive to default). Thus, multiple equilibria can exist where beliefs are self-confirming. In the favorable case, all banks continue to lend because each believes others will continue to lend and, therefore, the size of the loan they must contribute is small. In the panic, all banks stop lending because it is believed that others will or have stopped lending and an otherwise healthy country is forced into default.

We now drop the assumption of risk aversion and examine whether financial panics might nevertheless occur as a result of the different incentives that exist for banks depending upon their outstanding exposure. We assume therefore that banks are risk neutral. From (7), we note that r_2 is increasing in D_2. In other words, the larger the loan any bank is asked to make in a salvage operation, then, ceteris paribus, the higher the interest rate it will want to charge. But this immediately means that it is possible that a number of banks could be willing to lend the sum necessary to prevent a default ($(\bar{D}_2)$ say, shared out under a "fair shares" agreement) because the interest rate that could thereby be charged would not give an incentive to default. However, it may not be in the interests of any one bank, if all others stop lending, to make a new loan of size $\bar{D}_2$. To take a concrete example, let us compare a "fair shares" arrangement where all banks have equal exposure (in absolute dollar terms) and are thus all asked to extend the same amount $D_2 = \bar{D}_2/n$, where "n" is the number of banks, with the case where just one bank is required to make the whole loan

1/ pp. 37-39.

$\bar{D}_2$. For any one bank under the "fair shares" arrangement, the interest rate required on the loan is given by 1/:

$$(11) \qquad 1 + r_2 = \frac{(1+\rho)}{(1-\pi)} - [1 + (\frac{1}{1-\pi})][\frac{\alpha(1+r_1)(D_1 n)}{\bar{D}_2}]$$

The interest rate required for any one bank to be willing to make the loan $\bar{D}_2$ is given by 2/:

$$(12) \qquad (1 + \hat{r}_2) = \frac{1+\rho}{1-\pi} - [1 + \frac{1}{1-\pi}][\frac{\alpha(1+r_1)D_1}{\bar{D}_2}]$$

therefore, $\hat{r}_2 > r_2$ and the required interest plus principal under the "fair shares" agreement, $\sum_n D_2(1+r_2) = \bar{D}_2(1 + r_2)$ is lower than in the case where one bank must make the loan, $\bar{D}_2(1 + \hat{r}_2)$. This then raises the possibility that it is rational for no one bank to extend a new loan, but that all banks could find it worthwhile to do so. A panic can occur as all banks stop lending because of a belief that all other banks will break ranks and not commit new loans. An IMF Occasional Paper describes some aspects of recent events in very similar terms. "Banks also are worried about the likely reaction of other banks to further requests for new lending, as a "breaking of ranks" will endanger the quality of their own assets and/or require even larger increases in their own exposure.... Uncertainties about the behavior of other banks add a new layer of risk for the banks' assessment of lending to countries that are not themselves affected by debt servicing problems, but that would be vulnerable to any sharp curtailment of bank lending flows." 3/

We have shown therefore that the possibility of a financial panic exists even with risk neutral behaviour once we recognise that different incentives exist for banks with outstanding exposure. This conclusion has policy implications for the management of the maturity structure of a country's debt. Note that a panic requires the country to be coming to the market for fairly large loans. For any given costs of default, λQ , say, a panic in this example requires that

$$\bar{D}_2(1 + \hat{r}_2) + (1 + r_1)D_1 > \lambda\bar{Q} > \bar{D}_2(1 + r_2) + (1 + r_1)D_1 .$$

1/ substituting $D_2 = \bar{D}_2/n$ into (7)
2/ substituting $D_2 = \bar{D}_2$ into (7)
3/ "International Capital Markets, Developments and Prospects," Occasional Paper No. 23, July 1983, p. 12.

In other words, the costs, $\lambda\bar{Q}$, of not repaying the original loan plus the interest and principal on the new loan exceed the benefits in one situation (interst rate r_2), but not in the other (interest rate $\hat{r}_2$). Clearly there exists a D_2^{MIN} for which if $D_2 \leq D_2^{MIN}$, a panic is impossible, while if $D_2 > D_2^{MIN}$, a panic can occur. Thus, short maturity borrowing, by increasing the frequency with which a country has to make calls upon the loan market for large sums, increases the probability of liquidity crises and so increases risk for both lenders and borrowers.

Let us now explore our example further--in particular, the question of banks' perception of other banks' behavior. In Sachs' example of a financial panic, expectations can be self-fulfilling; if each bank believes that no other bank will lend, it may not pay each individual bank to make the new loan, and so indeed, no banks lend. Conversely, a favorable equilibrium exists where if each bank believes others will lend, this indeed will occur. Thus, although the possibility of multiple equilibria exist, if only the appropriate expectations could be induced--say by having a credible syndicate--all banks would willingly participate in the new loan arrangement.

Once we take account of creditor heterogeneity, however, the outcome is not so clear-cut. It is true, as we have seen, that the possibility of a liquidity crisis exists if all banks believe they alone may be required to make the new loan. However, will the favorable equilibrium necessarily occur if all banks believe other banks will lend? From the equilibrium condition (7) we know that:

$$(7) \qquad 1 + r = \frac{1+\rho}{1-\pi} - \left[1 + \frac{1}{1-\pi}\right]\left[\frac{\alpha^i(1+r_1)D_1}{D_2}\right]$$

One can see that the expected return on one dollar of the new loan, $(1 + r)(1 - \pi)$, is less than the safe rate of interest.

$$(7') \qquad (1 + r)(1 - \pi) = (1 + \rho) - (2 - \pi)\left[\frac{\alpha^i(1 + r_1)D_1}{D_2}\right] < 1 + \rho$$

The reason banks are willing to extend the new loan, the expected returns on which earn less than the safe rate of interest, is because by doing so, they can possibly retrieve endangered previous loans. Banks then are willing to lend at a lower interest rate than otherwise only because they have previously made loans which have subsequently turned "bad." If banks could pull out of the situation but still have their stake made safe, they could earn the higher safe rate of return on a new loan elsewhere. But the circumstances under which an individual bank will feel that this is a possibility are precisely those where each

believes that all other banks will lend. Thus, we get the result that in exactly those conditions which avoid the possibility of a financial panic in Sachs, there is a motive for individual banks to free ride on the behavior of others. A new loan agreement could face difficulties and even fail because paradoxically each bank believes it will succeed. In such a situation, the role of a syndicated loan arrangement in giving consistency to expectations will be insufficient to guarantee its success. Without some further inducement or even external pressure the favorable equilibrium in which a financial panic is avoided will not occur even where all banks believe other banks will lend.

The above argument applies straight-forwardly to banks that perceive themselves as sufficiently small that their individual action will have no influence on the probability of default. In aggregate terms, of course, small banks do hold a significant proportion of outstanding debt and recognizing that other small banks face similar incentives may lead them to realize that a decision not to lend will significantly affect default probabilities. Small banks still, nevertheless, hold significant bargaining powers, since the loss to the larger banks of not filling the gap left by the failure of the smaller banks to lend, even in aggregate, will be greater than to the smaller banks. Recognition of such bargaining power is another factor which leads to tensions with commercial bank rescheduling packages.

III. Two Extensions

Although in the last section we allowed some uncertainty regarding the current actions of competitors in the loan market, there have been two basic assumptions about the information available to banks on the characteristics of the borrower countries. First, all banks are equally informed and secondly, banks have been able to relevantly distinguish between borrowing countries. We now relax these assumptions and examine the additional difficulties that arise.

1. Differential information

In order to assess the behavior of a loan market where banks differ in the extent to which they are informed about borrowing countries, one must first ask the question: How much information will be acquired? In the neo-classical framework, rational maximizing agents will devote resources to obtaining extra information until the expected marginal benefits equal the expected marginal costs. This simple statement tells us immediately that agents will vary in the extent to which they are informed, so long as the benefits and costs differ. Further, information is a public good since, once available, it can be consumed over and over again. Thus, the expected value of information to an agent depends upon the number of times that information can be used. The potential pay-offs to a given expenditure on cost-saving research and development for a multinational corporation, where the results of the research can be used in-plant in each country and to the local firm,

are clearly very different. In exactly the same way, the expected benefits from research on country risk analysis to two different banks with $1 billion and $100 billion to lend, respectively, are clearly much greater for the larger bank. Larger banks will, therefore, tend to be better informed, which is one reason why we observed those banks being first into the international loan market. In such circumstances, smaller banks can free-ride on the larger banks by observing their actions. Thus, the lending behavior by the larger banks may well be seen as conveying information about the creditworthiness of different countries, and imitative behavior on the part of the smaller banks will be the outcome. Some evidence in support of this comes from responses to a G-30 questionnaire study on international banking where although nearly 90 percent of all respondents said they think it inappropriate for banks to rely on country-risk assessments by other banks instead of their own, more than a third of the smaller banks questioned took the opposite view. 1/ The lending behavior of the larger banks may, therefore, be followed by the smaller banks; to the extent that this phenomenum occurs, larger swings in lending will result.

In fact, in the years preceding the current events, even the larger banks seem to have been inadequately informed, and although they would have known of their own exposure in different countries, they were less sure of the extent of other banks' involvement. Guttentag and Herring (1981) state in a footnote that "anecdotal evidence suggests that on several occasions, both creditors and debtor governments have been surprised by the magnitude of a country's external debt and that renegotiations have been subjected to substantial delays while information was amassed." Williams, et. al., also write that "one effect of recent events was that, as part of the reschedulings for major countries, banks became much more aware of other banks' lending strategies and exposures to various sovereign borrowers." 2/

2. Contagion effects in supply behavior

We now show that even if the market consists of a single, competitive, profit maximizing source of funds, volatility in the form of a sudden cut-off of funds to healthy economies can result from rational behavior on the supply side of a market if it is not possible for lenders to distinguish fully between different borrowing countries. A sharp cut-off of new loans to well-defined regions triggered by a crisis in a single country has occurred in both Eastern Europe and Latin America. The Mexican debt crisis of August 1982, on top of the Argentinian difficulties with debt servicing associated with the Conflict in the Southern Atlantic, was followed by problems of credit availability and resulting debt rescheduling spreading to Brazil,

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1/ "How Bankers See the World Financial Market."

2/ "International Capital Markets, Developments and Prospects," Occasional Paper No. 23, July 1983, p. 12.

Chile, Peru, and Venezuela by mid-1983. 1/ Cline (1983) states that "the only significant exception to the regionwide debt servicing disruption was Colombia, a country that had carefully avoided incurring heavy debt and placed the receipts of the late 1970s coffee bonanza into reserves instead of using them as leverage for further borrowing...the sharp psychological shift aggravated debt problems and at least in some cases (especially Peru), probably precipitated debt servicing disruptions that otherwise could have been avoided." 2/ It is likely that part of the explanation of this lies with concern over the reactions of other banks to a shock. However, we present below a simple example to show that if there is poor information, difficulties can arise for creditworthy countries, even in the absence of such concerns.

Let us return to the S-C certainty model of Section II.1 and adapt it to allow for the fact that there are countries of different creditworthiness between which creditors are unable to distinguish in the absence of further information. A straightforward way of introducing differences in country risk into their framework is to allow for differences in the productivity (μ) of investments that countries undertake. Assume, then, that there are two types of countries--high productivity countries (denoted by superscript H) and low-productivity countries (denoted by superscript L). Assume that δ, the rate of time preference, is the same for both types of countries. Of the three basic cases illustrated in Section II.1, the interesting one to consider is that where the country can take actions (by choosing the level of investment) to try and signal its creditworthiness and so influence creditors to allow more borrowing to take place (i.e. case 3). With differences in productivity, the second-period output of the two types of country is given by:

$$Q_2^H = Q_1 + (1 + \mu^H)I_1; \; Q_2^L = Q_1 + (1 + \mu^L)I_1$$

With full information, the two countries would clearly face different credit ceilings of $D_1^H(1 + \rho) \leq \lambda Q_2^H$, $D_1^L(1 + \rho) \leq \lambda Q_2^L$, respectively, and the analysis would be unchanged. High-productivity countries would choose consumption and investment and, hence, borrowing, knowing that they can influence the amount they can borrow according to the constraint $D_1^H(1 + \rho) = \lambda[Q_1 + (1 + \mu^H)I_1]$. Low productivity countries, on the other hand, being less creditworthy, will face a lower credit ceiling with the supply function of loans determined by

$$D^L_1(1 + \rho) = \lambda[Q_1 + (1+\mu^L)I_1] .$$

1/ In addition, previous debt servicing difficulties (and reschedulings) persisted in Costa Rica, Nicaragua, Bolivia, and Ecuador.

2/ Cline (1983).

In the absence of good information, however, creditors must treat all countries equally, which suggests the debt ceiling faced by both types of countries would be given by:

$$D_1(1 + \rho) < \lambda\bar{Q}_2, \text{ where } \bar{Q}_2 = Q_1 + (1 + \bar{\mu})I_1$$

and $\bar{\mu}$ is the <u>average</u> productivity. As before, countries are assumed to choose consumption and investment levels to maximize well-being. The optimization problem for the two types of country becomes:

$$\text{Max} \quad U(C_1,C_2) = C_1 + \frac{C_2}{1+\delta} \quad \text{subject to}$$

$$C_1 = Q_1 + D_1 - I_1$$

$$Q_2^{H,L} = Q_1 + (1 + \mu^{H,L})I_1$$

$$D_1(1 + \rho) < \lambda[Q_1 + (1 + \bar{\mu})I_1]$$

and investment opportunities are again assumed limited by $\bar{I}$.

As before, it pays borrowing countries to pursue policies which enhance their creditworthiness. By carrying out investment, I_1, the debt ceiling and, hence, current consumption can be raised according to $D_1(1 + \rho) = \lambda[Q_1 + (1+\bar{\mu})I_1]$. Also, as before, the net benefit in current consumption terms is:

$$-1 + \left(\frac{1 + \mu^{H,L}}{1 + \delta}\right) + \frac{dD_1}{dI_1}\left(1 - \frac{1 + \rho}{1 + \delta}\right)$$

Note that the term $\frac{dD_1}{dI_1} = \frac{\lambda(1 + \bar{\mu})}{1 + \rho}$ is, in the absence of creditor knowledge of individual countries, the same for both high- and low-productivity countries. The net benefit (loss) of a unit of investment is clearly higher (lower) for high-productivity countries since $\mu^H > \mu^L$ and so the rewards from the investment are higher. Take the case, nevertheless, where low-productivity countries do have an incentive to invest $\bar{I}$. In other words, $-1 + \frac{1 + \mu^L}{1 + \delta} + \frac{dD_1}{dI_1}\left[1 - \left(\frac{1 + \rho}{1 + \delta}\right)\right] > 0$. If so, since both types of country face the same credit ceiling, both H and L countries borrow $D_1(1 + \rho) = \lambda\bar{Q}_2 = [Q_1 + (1+\bar{\mu})\bar{I}]$ and do

investment $\bar{I}$. However, this equilibrium is not sustainable, since $D_1(1 + \rho) = \lambda\bar{Q}_2$ implies:

$$\lambda Q_2^H = \lambda[Q_1 + (1 + \mu^H)I] > D_1(1 + \rho) > \lambda Q_2^L = \lambda[Q_1 + (1 + \mu^L)I]$$

Faced with such a credit ceiling, low productivity countries would have an incentive to borrow up to the upper limit, finance some additional consumption, and default in the future. Clearly, rational lenders will not impose the credit ceiling $D_1 = \frac{\lambda\bar{Q}_2}{1+\rho}$, but must, if unable to appropriately discriminate between borrowers only allow the lower credit ceiling $D_1(1 + \rho) = \lambda[Q_1 + (1+\mu^L)I_1]$. This example 1/ shows how, unless creditors have sufficient relevant information concerning debtor countries, the presence of less-creditworthy countries (the low-productivity countries) can mean that countries who could safely borrow more are, nevertheless, rationed in the international loan market. One can see then why debt servicing difficulties for what was considered to be a "good risk" country (Mexico, say) can lead to credit rationing for other debt countries.

The above also explains why countries will take pains to distinguish themselves from other countries as more creditworthy in order to be able to enjoy a higher credit ceiling than it would otherwise be rational for creditors to allow.

1/ In fact, the problem is worse than this, since even if

$$-1 + \frac{(1 + \mu^2)}{(1 + \delta)} + dD_1\left[1 - \frac{(1 + \rho)}{(1 + \delta)}\right] < 0$$

$$\overline{dI_1}$$

it may still pay the low-productivity countries to carry out investment, thus mimicking the actions of the high-productivity countries in the knowledge that they will default in the future. The gain from default is:

$$D(1 + \rho) - \lambda Q^L_2 > 0, \text{ since } D_1(1 + \rho) = \lambda\,[Q_1 + (1 + \bar{\mu})\bar{I}]$$

The overall gain from doing investment $\bar{I}$ and being taken as a high-productivity country could, therefore, be positive.

IV. Conclusions

Recent theoretical work on international borrowing has stressed the importance of exploring the incentives that exist on the demand side of the international loan market in order to explain the behavior of that market. Attention has centered on the risk of default which can be shown to lead to quantity rationing of loans, an upward sloping supply schedule of funds, and the pursual of policies by borrowing countries designed to enhance creditworthiness and so the supply schedule they face. The organization of the supply side of the market and the question of how past lending policies affect current behavior have not received equal attention.

This paper has therefore examined the incentives on the supply side of the international loan market which is assumed to be made up of many competing creditors whose past lending, and hence current exposure, differs. Amending an example of international borrowing under uncertainty due to Sachs and Cohen where the authors derive an upward sloping supply schedule of funds--the position of which depends upon the characteristics of the borrowing country--we have shown that the position of the aggregate supply curve depends equally upon the level of exposure of creditors and hence, the organization of the supply side of the market. We have also argued that there is an externality problem which can lead to over-lending in an unregulated market, since the private and social costs of additions to the total stock of debt of a country are different. Although the terms and quantity of credit will partially reflect default risk, insufficient account will be taken by individual banks of the risks faced by banks in aggregate.

An extreme example of variability in supply due to creditor behavior is the possibility of a financial panic. Sachs (1983) has previously shown how a financing panic can occur if there are many competing lenders who exhibit risk aversion. We have shown how, even with risk neutrality, a panic can arise once account is taken of banks' existing exposure. In suggesting a relationship between the probability of financial panics and the concentration of exposure, we therefore stress the importance of the organization of potential creditors as well as the expectations factor which plays a role in Sachs. Indeed, we argued that in just those circumstances where a panic is avoided in Sachs--namely, where all banks believe that all others will lend--considerable problems can remain once we take account of existing and different exposures among banks. Analysis of the incentives for lending during a rescheduling also illustrated circumstances in which a "fair shares" agreement would be appropriate and we described reasons for tensions in syndicates formed to make such loans. A significant factor here, when risk-averse behavior is admitted, is the loan to capital position that creditor banks may have.

Finally, we have suggested that relaxing the assumptions of the extent of information available to creditors can explain volatility and contagion effects in the international loan market.

The arguments of this paper and the earlier literature on default risk have shown how, even with rational agents on both sides of the international loan market, the market cannot always be relied upon to produce the most desirable outcome. There is, therefore, a presumption that suitable intervention in the international borrowing process can improve the efficiency of the outcome and, in recent years, the IMF has found itself increasingly involved on both sides of the market in counteracting market failure in three broad areas: the provision of information; the monitoring and assessment of borrowing country policies which lead to the accumulation of debt; and the marshalling of the actions of creditors in recent reschedulings. On the supply side, in looking at the behavior of rational creditors, we have outlined the rationale for this latter function and also, the importance of good information.

Turning to the demand side of the market, there is equally a necessity for borrowing countries to implement appropriate external debt management policies. In practice, external debt management, which varies considerably by country, spans a wide range of activites comprising: (i) the compilation of data; (ii) the screening of foreign borrowings by private and/or public entities; and (iii) controlling the composition and level of external debt. On the provision of information, we shall say little, except that the IMF can overcome obvious market failure problems by helping in the collection and provision of debt statistics, since the private and social returns to these activities are clearly different. The timely availability of this information is clearly a prerequisite for an effective debt policy.

With regard to public sector debt, it is usually the case that the contracting of external debt by public sector entities is subject to approval on a loan-by-loan basis, either by a ministry, an inter-ministerial committee, or the Central Bank. There is a clear need for such a procedure since, at the least, a viable debt policy requires a rate of return on public sector investments which is equal or in excess of the interest payments required on the loan. In addition, extending the work of Kharas, Sachs (1983) has suggested that further caution with regard to the assessment of investment projects may be required. If, for some reason, governments are constrained in their ability to raise taxes, this can mean less investment and foreign borrowing than otherwise should be done because of the difficulties of raising taxes to service the debt in future periods. His conclusion that this provides "an argument against foreign borrowing, <u>even for productive</u> investment projects, if the domestic fiscal system cannot handle rising debt service ratios" warrants careful attention, given the importance of the public sector in LDC borrowing.

Turning to arguments for measures to control the composition and level of external indebtedness, we have argued briefly that the supply side of the market cannot be relied upon to appropriately contain access to short-term debt. Indeed, the tendency may be to encourage it--the result being a shortening of the maturity structure that increases the

frequency with which debtor countries must approach the market for new large loans, exposing themselves to additional risk. For the same reason, there is a need to keep maturing debt service commitments aligned with the borrowing country's liquid reserve position.

This argument, that by adopting some restraint on its ability to incur short-term debt a country can be made better off as creditors are thereby more willing to lend longer-term and the risk of no new lending being forthcoming is reduced, leads to the question of ceilings on the overall amount of debt accumulated. In domestic capital markets, Sachs (1983) pointed out that the use of bond covenants overcomes some of the incentive problems referred to earlier by pre-committing the borrower to a future line of action. The correspondence between the provisions contained in bond covenants and some of the sources of problems in international capital markets is striking and Sachs goes on to argue that "to an increasing extent, IMF conditionality involves the application of loan covenants to borrowing packages". 1/ The underlying argument that the loan market can be made more efficient with lenders and borrowers made better off, ex ante, by being constrained from pursuing inefficient policies also provides a case for the practice of countries adopting exact ceilings on the amount of debt to be accumulated over time. Successful implementation of self-imposed debt ceilings must, of course, overcome the major difficulty of credibility. Ceilings that are habitually broken become worthless and only by establishing a reputation for observance of the limits will a country gain the rewards from them.

1/ Sachs (1983), p. 45.

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The loan supply schedule is given by the solution to the equation (3') which we can solve explicitly, given the assumption of a particular probability distribution for $\tilde{Q}$. By definition:

$$\pi = pr\,[\lambda\tilde{Q}_2 \leq (1 + r)\,D_1 + D_o = pr\,[\,\frac{\tilde{Q}}{Q_1} \leq \frac{(1+r)D_1}{\lambda Q_1} + \frac{D_o}{\lambda Q_i} - (1 + \mu)\,\frac{I_1}{Q_1}\,]$$

Because $\tilde{Q}$ is uniformly distributed over $[0, Q_1]$, then $\frac{\tilde{Q}}{Q_1}$ is uniformly distributed over [0,1] and so

$$\pi = \frac{(1 + r)D_1}{\lambda Q_1} + \frac{D_o}{\lambda Q_1} - (1 + \mu)\,\frac{I_1}{Q_1}$$

Therefore, $\frac{d\pi}{dD_1} = \frac{1 + r}{\lambda Q_1}$ and the loan supply schedule for bank i is derived by substituting the above expression for π and $\frac{d\pi}{dD_1}$ into (3').