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COUNTRY RISK, FOREIGN BORROWING AND THE SOCIAL DISCOUNT RATE IN AN OPEN DEVELOPING ECONOMY

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ABSTRACT

Most discussions on the social rate of discount have assumed that the economy under consideration is isolated from the rest of the world, and that there are no capital movements. This paper explicitly analyzes the determination of the social rate of discount in a small open developing economy. It is shown that under general conditions, the discount rate will be a weighted average of the marginal return to capital in the private sector (ρ), the rate of time preference (r), and the marginal cost of foreign indebtedness (π). It is also shown that unless the country faces an upward-sloping supply curve for foreign funds the weights of ρ and r will be zero. Finally, it is shown that if the country in question faces a foreign borrowing constraint imposed from abroad, the social rate of discount becomes equal to a weighted average of the domestic marginal return to capital and the rate of time preferences. Data for a group of LDCs is then used to show that financial markets have indeed attached a default country risk premium to LDCs. This provides some evidence in favor of the hypothesis that developing countries face an upward-sloping supply curve of foreign funds, and that, in general, the social rate of discount should be a weighted average of ρ, r and π. Finally, some numerical examples are used to show that ignoring the open economy aspects can result in a substantial overstatement of the social rate of discount.

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The definition of the "appropriate" social discount rate has been one of the subjects more frequently discussed in the literature on social project analysis. 1/ However, most of the competing candidates for "the" social rate of discount have been derived assuming that the economy in question is in some sense isolated from the rest of the world, and that there are no international capital movements. 2/ Under these assumptions, it has been generally argued that one dollar used in a public project has to come partially from a reduction in private investment and partially from an increase in private savings (see, for example, Marglin, 1963b; Harberger, 1969a,b; Baumol, 1968; Dasgupta, Marglin and Sen, 1972; Sjaastad and Wisecarver, 1977; and Lind, 1982). However, once the assumption of no international capital movements is relaxed, there is a third source from which one dollar used in a public sector project can be obtained: the international capital market. The rapid integration of the world capital markets during the late 1970s and 1980s indicates that ignoring this source of funds in the computation of the social rate of discount can result in misleading decisions regarding public investment. The policy implications of ignoring the role of foreign borrowing in computing the social rate of discount can be particularly important in the case of developing countries. Although these countries have borrowed significant amounts from the international capital market in recent years, most computations of the social rate of discount actually ignore this fact, and assume that there is no international capital mobility. 3/

The purpose of this paper is to formally incorporate into the analysis of the social discount rate the fact that most countries have some kind of access to the international capital market. In doing this, the

relation between foreign borrowing, country risk and the social rate of discount is emphasized. The paper also illustrates, using actual data from two developing countries, how the traditional neglect of open economy aspects can result in biased computations of the social discount rate. The plan of the paper is as follows: Section I presents a brief review of the literature on the social discount rate. Section II extends the model due to Sjaastad and Wisecarver (1977) to the case of an economy that has access to the world capital market. This section also presents a brief discussion on the concept of country risk, which is central to the adequate analysis of the social discount rate in an open economy. In Section III, the determinants of the country risk premium are empirically analyzed. It is shown, using data for 19 LDCs for years 1979 and 1980, that the country risk premium charged by the international financial community to developing countries is positively related to the debt-output ratio in the borrowing countries. In Section IV, data from Chile and Costa Rica are used to illustrate how the incorporation of open economy aspects can in practice affect actual computations of the social discount rate in these countries. Finally, Section V contains some concluding remarks.

I. The Social Rate of Discount: A Brief Review

Traditionally, there have been a number of competing candidates for the social rate of discount. Among the most popular, it is possible to mention: the private rate of time preferences, the "social" rate of time preferences, the marginal productivity of capital in the private sector, and a weighted average of the rate of time preference and the marginal productivity of capital in the private sector. 4/

I.1 The Rate of Time Preferences (Private and Social)

Proponents of the rate of time preferences have argued that since social welfare depends on future streams of consumption, and r is the intertemporal price of a unit of consumption, flows generated by a public project should be discounted at the rate of time preferences. However, it has often been argued -- most notably by Marglin (1963a) and Sen (1967) -- that due to the existence of external effects in consumption, there is a difference between the private rate of time preferences and the "social" rate of time preferences. If individuals' utility functions don't depend only on their consumption now, but also on the consumption of their heirs, on the consumption of others now, and on the consumption of others' heirs, the "social" rate of time preferences (which incorporates these externalities) will be lower than the private rate of time preferences. This proposition has been given the name of "the isolation paradox," and was originally set forward by Sen (1961) and later developed by Marglin (1963a) and Sen (1967). Recently Warr and Wright (1981), however, have argued that even in an economy with externalities of the kind suggested by the isolation paradox, the appropriate social rate of discount is the private rate of time preferences.

Most supporters of the social rate of time preferences have also recognized that in the presence of distortions like corporate and personal income taxes further adjustments should be made. In particular, it has been argued that since investment in a public project displaces private investment and private consumption, the initial outflow of capital should be valued using a shadow price of public funds (α). According to this view, a public project that yields a perpetuity should be undertaken if (see Marglin, 1963a):

$$\int_0^\infty B(x,t)e^{-rt}\,dt - \alpha K(x) \geq 0 \qquad (1)$$

where r is the social rate of time preferences, B(x,t) is the net benefit from a project of scale x in period t, K(x) is initial investment, and α is the shadow price of public funds, defined as (see Marglin, 1963b, equation (3); see also Dasgupta, Marglin and Sen, 1972, ch. 14):

$$\alpha = \theta \frac{\rho}{r} + (1-\theta) \qquad (2)$$

where ρ is the marginal rate of return in the private sector, and θ is the fraction of private investment displaced by one dollar used in the public project. On the other hand, $(1-\theta)$ is the proportion of private consumption displaced by one dollar spent in the public project. 5/

I.2 The Marginal Rate of Return in the Private Sector

An alternative view postulates that the appropriate social discount rate should be the marginal rate of return to investment in the private sector (see for example, Hirshleifer, DeHaven and Millman, 1960; Baumol, 1968; and Nichols, 1969). Proponents of this view have generally argued, based on efficiency grounds, that since the best alternative use of one dollar invested in a public project is to invest it in the private sector, the minimum return that should be required from government projects is the marginal rate of return in the private sector ρ. 6/

Some authors -- most notably Baumol, 1968 -- have recommended the use of the private rate of return as a way to solve the "unavoidable indeterminacy in the choice of [the social rate of discount]" (Baumol, 1968, p. 789). Sjaastad and Wisecarver (1977), however, have argued that in the discussion on the appropriate social rate of discount, the role of the private rate of return has been reduced to being one component of different weighted average

formulations. Recently, however, Stiglitz and Atkinson (1980) have used an overlapping generations model to derive the social discount rate. In this model, if "an optimal policy exists, [there are] identical individuals, all pure profits are taxed away, [and there is] a completely flexible debt policy,....the social rate of discount is the private rate of return" (Stiglitz and Atkinson, 1980, p. 478). Dasgupta, Marglin and Sen (1972) also argued that assuming optimal growth, and a two-period model, the social rate of discount can be approximated by the marginal return to capital in the private sector.

I.3 Weighted Average of r and ρ

Harberger (1969a,b) and Sandmo and Dreze (1971) have argued that the appropriate social rate of discount for public projects should be a weighted average of the rate of time preferences (r) and the marginal rate of return in the private sector. 7/ The main argument for this proposition is that one dollar used in a public project displaces both private investment, in a proportion λ with an opportunity cost of ρ, and private consumption in a proportion $(1-\lambda)$ with an opportunity cost of r. According to this view, the required return of the public project should be enough to compensate both for the displacement of private investment and for the reduction of private consumption. The social discount rate is then defined as a weighted average of ρ and r with weights of λ and $(1-\lambda)$ respectively (see Harberger, 1969a,b, and Sandmo and Dreze, 1971, for a detailed discussion). 8/

$$\omega = \lambda\rho + (1-\lambda)r \qquad (3)$$

If there are distortions in the form of taxes, ρ and r will differ. In particular, if i is the market rate of interest, τ the rate of the

corporation income tax and t the rate of the personal income tax, we can write: $\rho = i/(1-\tau)$ and $r = i(1-t)$. It may be seen from equation (3), then, that if there are no distortions (i.e., $\tau = t = 0$), the social discount rate will be equal to the market rate of interest ($\omega = i = \rho = r$). It may also be noted from (3) that depending on the value of the weights λ and $(1-\lambda)$, the weighted average approach yields ρ and r as special cases (see Harberger, 1969a).

The main insight of Harberger's and Sandmo and Dreze's analyses is the interpretation of the weights λ and $(1-\lambda)$ in the definition of ω in equation (3). According to Harberger (1969a), assuming the existence of a well-functioning capital market, one dollar extracted from this market to finance a public project will produce a marginal increase in the market rate of interest (i), generating an increase in both the pre-tax marginal rate of return of the private sector (ρ) and on the after-tax rate of return on private savings (r). The increases in ρ and r, in turn, will result in private investment and private consumption being displaced. Then, the weights in (3) can be viewed as:

$$\lambda = - \frac{(\partial I/\partial i)}{(\partial S/\partial i)-(\partial I/\partial i)}; \quad (1-\lambda) = \frac{(\partial S/\partial i)}{(\partial s/\partial i)-(\partial I/\partial i)} \qquad (4)$$

where I is private investment and S is private savings.

Sjaastad and Wisecarver (1977) have shown that for the case of perpetuities, Marglin's approach -- which combines r as the discount rate with α as the shadow cost of public funds -- is equivalent to the weighted average view (ω) of Harberger, Sandmo and Dreze. They have also shown that in the case of a finite life project, if it is assumed that the depreciation is not fully consumed, the weighted average approach ω is equivalent to Marglin's suggestion of using r and α.

II. Foreign Borrowing and the Social Discount Rate in an Open Economy

In this section, a simple model to compute the social rate of discount in an economy that has access to the world capital market and can borrow from abroad is presented. The model is an extension to the case of an open economy of the model presented by Sjaastad and Wisecarver (1977). In order to concentrate on the discussion of the social rate of discount with foreign borrowing, the model presented in this section abstracts from a number of other complications.

Assume the case of a small open economy that has access to the world capital market. Also, and in order to simplify the analysis, assume that all shadow prices, except the discount rate, are equal to their market prices. In this case it is important to make the following distinction between (real) income (y) and (real) output (q):

$$y = q - vD \tag{5}$$

where D is the stock of foreign debt, and v is the (average) cost of this debt. 9/

Consider the case of a public sector project that generates a perpetuity. Assume that the project's initial investment is equal to ΔI^g where, following the notation in Sjaastad and Wisecarver (1977) the operator Δ denotes deviations of a variable from the path it would have followed in the absence of the public sector project. As a consequence of this public sector project, the following permanent change in income, and thus in potential consumption, will result:

$$\Delta y = \delta \Delta I^g + \rho \Delta I^p - \pi \Delta D \tag{6}$$

where δ is the realized rate of return on the public sector project, ΔI^p is the amount of private investment displaced by the public project ($\Delta I^p < 0$), ρ is the marginal rate of return in the private sector, and π is the expected marginal cost of additional foreign debt. It should be noted that the (permanent) change in real output is $\Delta q = \delta \Delta I^g + \rho \Delta I^p$.

Assuming, without loss of generality, that $\Delta I^g = 1$; that a fraction γ (possibly zero) of these funds is obtained at the expense of private investment (i.e., $\Delta I^p = -\gamma$), that a fraction β (also possibly zero) comes from an increase in private savings (reduction of private consumption), and that a fraction $(1-\gamma-\beta)$ of the investment funds are generated by an increase in foreign indebtedness ($\Delta D = 1 - \gamma - \beta$), equation (6) can be written as:

$$\Delta y = \delta - \gamma\rho - (1-\gamma-\beta)\pi \tag{7}$$

The general decision rule with respect to public sector projects is that they should be undertaken if the net present value of the (potential) increase in consumption, discounted at the (social) rate of time preferences r, is equal to or greater than foregone consumption in the first period β (see Sjaastad and Wisecarver, 1977, p. 516). Then, in our open economy case, the project should be undertaken if:

$$\int_0^\infty [\delta - \gamma\rho - (1-\gamma-\beta)\pi]e^{-rt}\, dt \geq \beta \tag{8}$$

Since δ is the return on the public sector project, the social discount rate for the case of an open economy that can borrow abroad (ω') is found by solving (8) for the value of δ that assures us that equation (8) holds, at least, with equality:

$$\delta \geq \gamma\rho + \beta r + (1-\gamma-\beta)\pi \equiv \omega' \tag{9}$$

From (9) it seems that the weighted average approach to the discount rate, advocated by Harberger (1969a) and Sandmo and Dreze (1971) can be extended in a straightforward fashion to the case of an open economy. Now, instead of the social rate of discount being a weighted average of ρ and r, it is a weighted average of ρ, r and π. However, in order to fully understand equation (9), it is necessary to carefully analyze the meanings of weights γ, β and $(1-\gamma-\beta)$. If, for example, γ and β are equal to zero, as they may very well be, the social discount rate will be equal to the (marginal) cost of foreign debt to this particular country (π). This result would have a considerable impact on public sector investment decisions in most countries. Typically, LDCs have used (real) social rates of discount around 15%, while during most of the late 1970s they could obtain foreign funds in the world capital market at real interest rates between 2% and 3%! On the other hand, it is also possible that $\gamma+\beta=1$, in which case the marginal cost of foreign borrowing will play no role in the determination of the social rate of discount.

In the closed economy case γ and β, denoted as λ and $(1-\lambda)$ in Section I.3, were defined in the following way:

$$\gamma = \frac{-\frac{\partial I^p}{\partial i}\frac{\partial i}{\partial I^g}}{\frac{\partial S \partial i}{\partial i \partial I^q} - \frac{\partial I^p \partial i}{\partial i \partial I^g}}; \quad \beta = \frac{\frac{\partial S}{\partial i}\frac{\partial i}{\partial I^g}}{\frac{\partial S \partial i}{\partial i \partial I^g} - \frac{\partial I^p}{\partial I}\frac{\partial i}{\partial I^g}}$$

The notion behind these definitions is that in a well-functioning capital market, the extraction of one dollar to fund a public project would place an upward pressure on the market interest rate i, and thus would <u>displace</u> private investment and induce an increase in private savings (Harberger, 1969a, 1985). That is,

$$\frac{\partial I^p}{\partial i}\frac{\partial i}{\partial I^g} < 0 \quad \text{and} \quad \frac{\partial S}{\partial i}\frac{\partial i}{\partial I^g} > 0.$$

However, in an open economy where capital can move across countries, it is expected that the domestic interest rate i will be related in some way to the interest rate at which the country can borrow in the world capital market. For example, in the extreme textbook case of a small open economy with perfect capital mobility, risk-neutral agents and pegged exchange rate (with zero expected devaluation), i will be equal to the world interest rate i*, and will not be affected by the public sector project. 10/ In this textbook case, the small country will face an infinitely elastic supply curve of foreign funds, and $(\partial i/\partial I^g) = (\partial i^*/\partial I^g) = 0$. Consequently, $\gamma = \beta = 0$, and ω' will collapse to π!

In a more general case, however, it can be postulated that even a small economy with perfect capital mobility will face an upward-sloping supply curve of foreign funds. For example, it can be assumed, following the literature on country risk, that a higher level of foreign indebtedness will be related to a higher probability of default (or rescheduling), as perceived by lenders, and to a higher cost at which this particular country can borrow from the international financial community. 11/ In this case then, a public sector project that is (partially) financed with additional foreign debt will result in a higher default probability (as perceived by lenders) and in a higher interest rate charged on foreign loans. Whether this higher interest rate should be considered as a higher cost of borrowing will depend on the relationship between the probability of default (rescheduling) as perceived by the lenders and as perceived by borrowers. Of course, if the perceived probability of default is the same for lenders and borrowers, the higher

interest rate charged to the developing country will not represent a higher economic cost of foreign funds. However, if, as Harberger (1980) has postulated, the probability of default perceived by lenders exceeds that perceived by borrowers, a fraction of the higher interest rate charged will indeed represent a higher economic cost of borrowing from abroad. 12/ It follows that the expected cost for the domestic economy of borrowing from abroad will depend on the differential of perceived probabilities of default by borrowers and lenders. Assuming risk neutrality and a one-period loan, the expected (average) cost of borrowing from abroad will be (where i* is the risk-free world interest rate): 13/

$$v = [(i^{*}+p)(1-g)/(1-p)]-g \qquad (10)$$

where p is the probability of default as perceived by the lender and g is that perceived by the borrower; both p and g are assumed to be increasing functions of the debt output ratio (D). It may be seen from (10) that if p=g, then v=i*, and the average cost of borrowing from abroad will be independent of the debt-output ratio and will be equal to the risk-free world interest rate. On the other hand, if, as Harberger (1980) has postulated, p>g, v will be an increasing function of the level of foreign debt of the particular developing country. 14/ Unless otherwise explicitly mentioned in the rest of this paper it will be assumed that this is the case.

Under these circumstances (i.e., p>g), a public sector project will result in a higher (average and marginal) cost of foreign borrowing, and in a displacement of private investment and private consumption. The weights of ρ and r in equation (9) will be different from zero, with their exact value depending on the relevant elasticities. In this case a public project will be financed partially by an increase in foreign debt, and partially by an

increase in private savings and reduction in private investment. Then, in the presence of a country risk premium and differential probabilities of default perceived by borrowers and lenders, the social opportunity cost of capital will be a weighted average of π, r and ρ.

Assuming different perceptions of the probabilities of default by borrowers and lenders ($p>g$), the effect of obtaining one dollar to finance a public project is depicted by figures 1 and 2. In figure 1, panel A, schedule S represents savings, and the investment schedule is I; t is the personal income tax, τ is the corporate income tax, i is the market interest rate, ρ is the before-tax marginal return to capital in the private sector and r is the after-tax (real) return to savings. 15/ Initially, at the prevailing interest rate, domestic savings are S_o and investment is I_o. The excess of investment over savings (I_o-S_o) is financed by (net) foreign borrowing equal to B_o in panel (B) (i.e., $I_o-S_o=B_o$). In this panel the average and marginal costs of borrowing are depicted as AC and MC respectively. Finally, D_o in panel (B) is the demand for foreign funds.

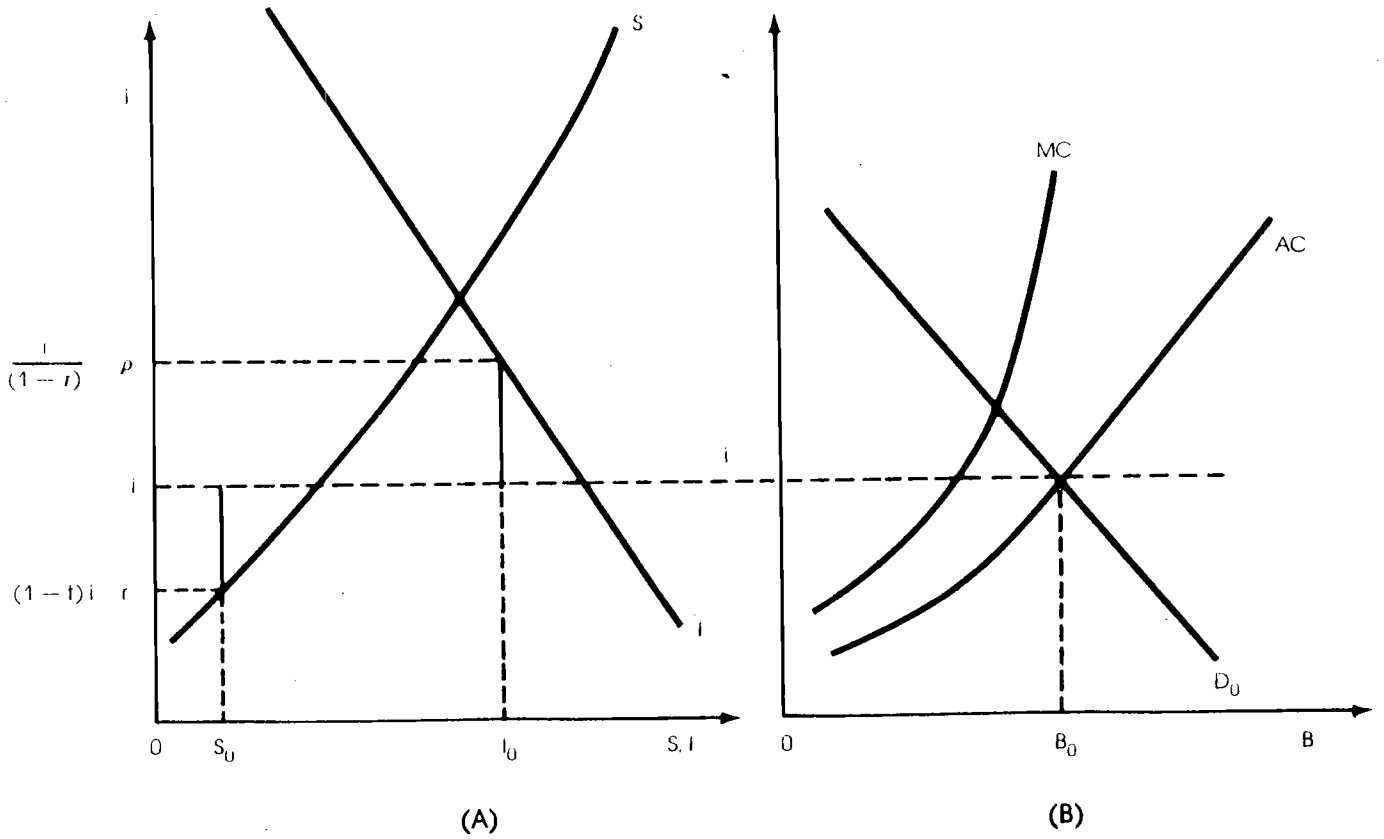
Assume now that there is a public sector project and that the increased demand for public funds is reflected by a rightward shift of the demand schedule for foreign funds in panel B in figure 2. 16/ The horizontal shift of this curve -- from D_o to D_1 -- is equal to the amounts of funds actually demanded by the public sector. As can be seen from figure 2, this higher demand results in a higher interest rate i, higher foreign borrowing (B_1), higher domestic savings (S_1) and lower private domestic investment (I_1). The sum of (B_1-B_o), (S_1-S_o) and (I_o-I_1) is equal to the amount of funds used by the public project. These funds came partially from higher private savings (lower consumption), partially from displaced private investment and

partially from higher foreign borrowing. The shaded areas in figure 2 represent the welfare cost associated with the extraction of these funds from the market to be used in the public sector project. The social opportunity cost of these funds is a weighted average of these welfare areas. The weights are given by $(S_1-S_o)/A$, $(I_o-I_1)/A$, and (B_1-B_o), where $A=(S_1-S_o)+(I_o-I_1)+(B_1-B_o)$. It is important to stress that this result depends critically on the assumption that $p>g$. If, on the contrary, it is assumed that borrowers and lenders have the same perception of the probability of default, AC and MC would be infinitely elastic.

From figures 1 and 2, it is also clear that if there is credit rationing from abroad (i.e., the country cannot borrow more than B_o per period) the new demand for public funds will be met fully by additional domestic private savings and displaced domestic private investment. Under these circumstances, of course, the social rate of discount will be a weighted average of ρ and r only. On the other hand, if the country in question faces an infinitely elastic supply of foreign funds, or if the perceived probabilities of default by borrowers and lenders are the same (i.e., $p=g$), the welfare cost of the funds extracted to be used in the public sector project will be equal to the amount of these funds times the cost of foreign borrowing. This case is illustrated in figure 3.

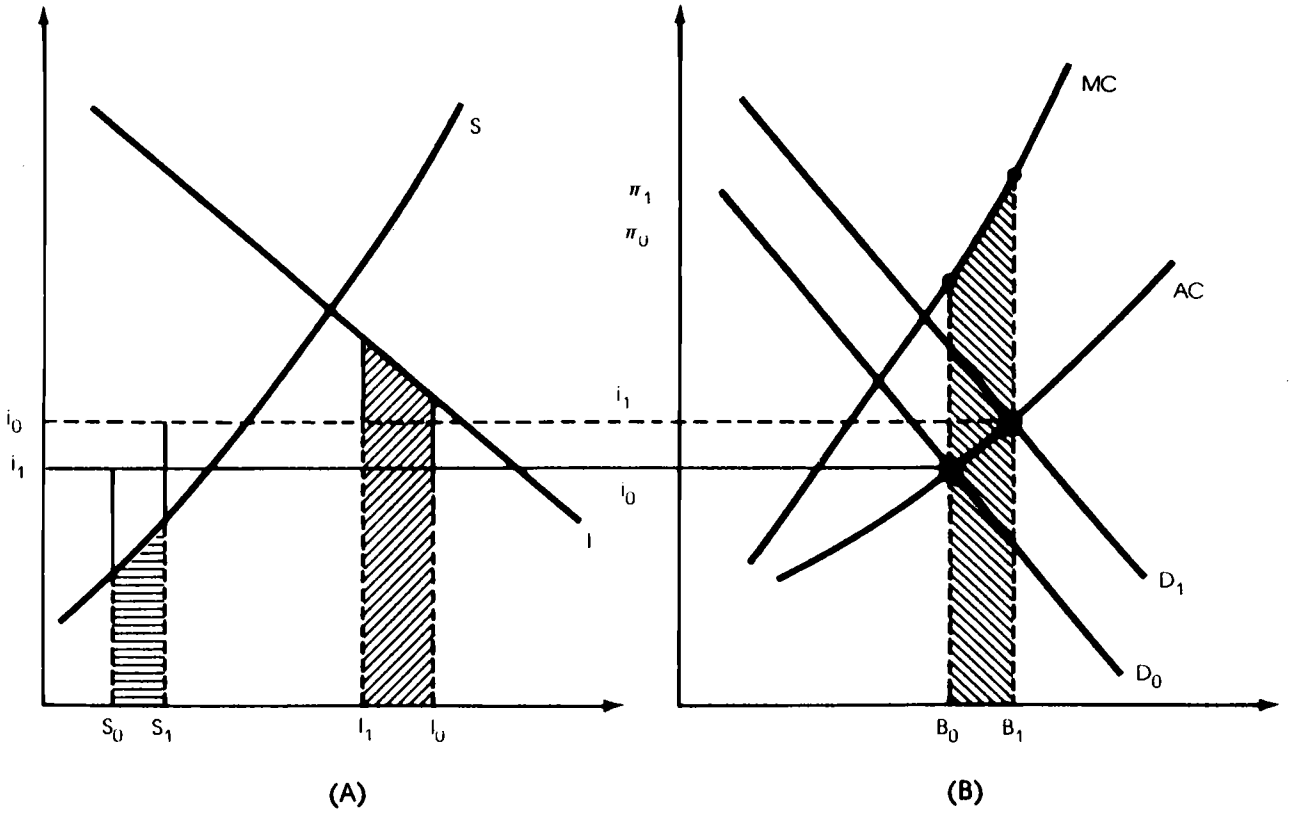
To sum up, in the case of a small open economy, the social rate of discount (ω') will be different from the world interest rate only if it is assumed that, due to the presence of a country risk premium, this small country faces an upward-sloping curve for foreign funds or if borrowers and lenders have a different perception of the underlying probability of default or rescheduling.

Figure 1



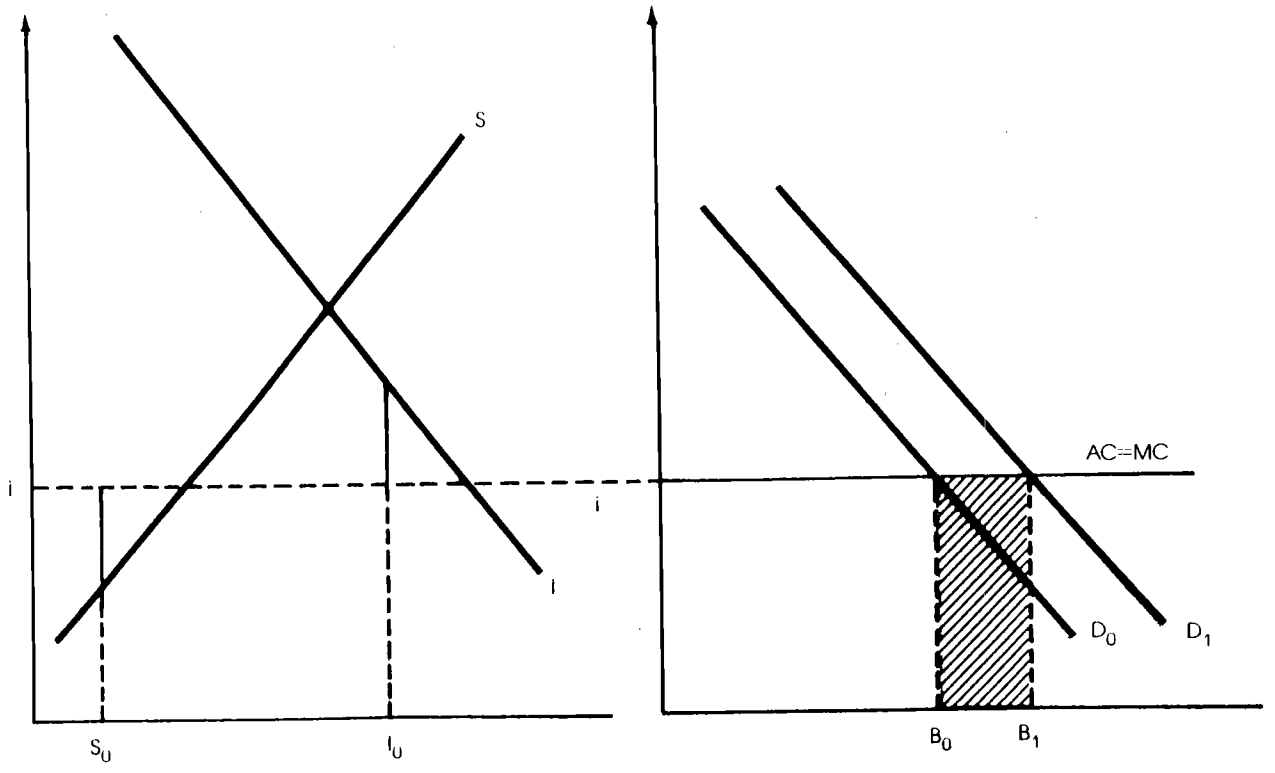
World Bank – 27343

Figure 2



World Bank – 27344

Figure 3



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The existence of a country risk premium and its relation to the level of foreign debt is basically an empirical question that will be tackled in detail in the next section. It should be noted, however, that a number of researchers have failed to find a positive relation between the risk premium and the level of indebtedness of borrowing countries. Feder and Just (1977), for example, found a very low (approximately 0.1) and insignificant coefficient for the debt-output ratio in their regression analysis. Moreover, in their "preferred" equation, they simply dropped the debt-output ratio from the estimation. Sachs (1981), on the other hand, found a nonsignificant coefficient of 0.0008 for the debt-output ratio in his cross-section analysis of the country risk premium. 17/

III. Foreign Borrowing and Country Risk: Some Empirical Evidence

According to the preceding discussion, the weights of ρ and r in the social discount rate equation (9) will be different from zero only if an increase in public investment can affect the equilibrium domestic interest rate i. As was discussed, in an open economy with capital mobility, this requires that: (a) an increase in public borrowing have a positive effect on the interest rate at which the country can borrow in the world capital market, and (b) that lenders have a different (higher) perception of the probability of default (or rescheduling) than borrowers. From an empirical point of view, it is extremely difficult to figure out whether borrowers and lenders indeed have different perceptions about the probabilities of default. For this reason, the empirical discussion presented in this section deals with the less ambitious question of whether the interest rates charged to developing countries when they borrowed from abroad have been positively affected by the

level of their foreign debt. A positive answer to this query is a necessary (but not sufficient) condition for establishing that the weight of π -- the marginal cost of foreign funds -- in equation (9) is different from zero. 18/

In the case of a small economy that cannot affect the world rate of interest, the cost of foreign funds obtained from abroad is formed by two elements: (1) "the" (exogenously given) risk-free world interest rate (i^*); and (2) a country-risk premium (s) related to the probability of default (p). This probability, in turn, is assumed to depend on a number of variables including the level of indebtedness of the economy (see Sachs, 1983, and Edwards, 1984a). In this section, the possible relation between the level of indebtedness in LDCs and the country risk premium is empirically analyzed using cross-section data for 19 developing countries for the years 1979 and 1980.

Suppose that the probability of default as perceived by the lender (p) depends positively on the debt-output ratio D, and on other variables, like the debt service ratio, which can be summarized by a vector x. In order to simplify the discussion, consider the case of a one-period loan, where in case of default the foreign lender will completely lose the interest and principal. If the world risk-free interest rate is given by i^*, the equilibrium condition for a risk-neutral bank will be given by:

$$(1-p)\,[1 + (i^*+s)] = (1+i^*) \tag{11}$$

From here, this country's risk premium can be written as:

$$s = \left[\frac{p}{1-p}\right]k \tag{12}$$

where $k = (1+i^*)$. 19/ Since the probability of default p depends positively on the debt-output ratio D, the country in question will face an upward-sloping supply curve for foreign funds. Moreover, according to (12), when the probability of default approaches unity, the country risk premium s will approach infinity. This means that developing countries will face an upward sloping supply curve of foreign funds up to a certain point, and that as the probability of default approaches unity, a credit ceiling will be reached. At that point, the country in question will be completely excluded from the world's credit markets. 20/

In the empirical analysis, it is assumed that the world's risk-free interest rate i^* can be approximated by the LIBOR rate, and that the risk premium s is given by the spread over LIBOR charged to different countries on foreign loans. 21/ Regarding the probability of default, I follow the standard convention and assume that p has a logistic form:

$$p = \frac{\exp \Sigma\beta_i y_i}{1 + \exp \Sigma\beta_i y_i} \qquad (13)$$

where the y_i's are the determinants of the probability of default (including the level of indebtedness) and the β_i's are the corresponding coefficients. Combining (13) and (12), and adding a random disturbance ε, the following equation, which can be estimated using conventional methods, is obtained:

$$\log s_n = \log k + \Sigma\beta_i y_{in} + \varepsilon_n \qquad (14)$$

where the subindex n refers to the n^{th} country.

A number of studies have suggested a list of possible determinants of the probability of default. 22/ In the empirical analysis presented in this paper, the following variables were considered as potential determinants of

s: (1) The debt-output ratio. As has been argued above, it is expected that this variable will have a positive coefficient in the regression analysis. This variable can be considered to be an indicator of the degree of solvency of a particular country. The data on the debt-output ratio refers to public and publicly guaranteed debt and were obtained from the World Bank Tables. (2) Ratio of international reserves to GNP. This indicator measures the level of international liquidity held by a country and as suggested in Edwards (1984a), it is expected that its coefficient will be negative. This variable was constructed from data obtained from the International Financial Statistics. (3) Loan duration. This variable is measured in years, and measures the (weighted) average maturity of loans granted to a particular country. As has been shown by Feder and Ross (1982), its a priori sign in the regression analysis is ambiguous. The weighted average was constructed from data reported in Borrowing in International Capital Markets. (4) Loan volume. This variable shows the average value of each loan, and was obtained from Borrowing in International Capital Markets. Also, a priori, its sign is ambiguous. (5) Propensity to invest. This variable, measured as the gross investment to GNP ratio, will tend to capture the country's perspectives for future growth. As is shown in Sachs and Cohen (1982) and in Edwards (1984), it should be negatively related to the spread. This indicator was obtained from data reported in the World Tables and in World Development Report (various issues). (6) Ratio of the current account to GNP. Sachs (1981) has argued that this variable will be negatively related to the probability of default. The data on this variable were obtained from World Tables and various issues of the World Development Report.

The spread variable was constructed, in each year, as a weighted average of spreads actually charged for public and publicly guaranteed loans granted to each particular country, where the weights were given by the value of each loan. The basic data were obtained from various issues of the World Bank's Borrowing in International and Capital Markets. (See Edwards, 1984a, for further details.)

Equation (14) was estimated using two-stages least squares for 1979 and 1980. The reason for using this procedure is that the ratio of reserves to GNP is an endogenous variable, that will be affected by the behavior of the domestic interest rate. 23/ The results obtained from the estimation of (14) are presented in Table 1. As may be seen, these results are quite interesting. First, the most important finding in terms of this paper is that contrary to the previous results of Feder and Just (1977) and Sachs (1981), a significantly positive coefficient for the debt-GNP ratio is found (see also Edwards, 1984a). In terms of the discussion in the preceding sections, this result provides some evidence supporting the idea that LDCs face an upward-sloping supply of foreign funds and that, consequently, their social rate of discount will in fact be a weighted average of three terms. The fact that the estimated semi-elasticity of s with respect to the debt-output ratio is fairly large suggests that π might carry a nontrivial weight in the computation of the social rate of discount in an open economy. Another important implication of these results is that they provide some evidence in favor of the hypothesis recently advanced by Harberger (1983) and Edwards (1984b), among others, that there are externalities in the process of LDCs borrowing. From a policy perspective, this implies that these externalities could be dealt with by imposing an optimal tax on foreign borrowing in these countries (see also the discussion in Hanson, 1974).

TABLE 1

The Determinants of Country Risk in Developing Countries:

1979 and 1980

(Two Stages Least-Squares)

	1979	1980
Intercept	-0.116 (-0.246)	0.224 (0.234)
Debt/GNP	0.651 (2.298)	1.196 (3.001)
Reserves/GNP	-0.146 (-1.953)	-0.192 (-1.560)
Loan Duration	0.036 (0.981)	0.042 (0.486)
Loan Volume	-0.001 (-1.045)	-0.001 (-0.963)
Investment/GNP	-0.0216 (-2.252)	-0.039 (-2.126)
Current Account/GNP	-0.269 (-0.324)	-0.070 (-0.053)
R^2	0.756	0.690
F	3.87	3.33

Note: The numbers in parentheses are t-statistics.

The results presented in Table 1 also indicate that there is a marginally significant negative relation between the reserves-GNP ratio and the spread over LIBOR. Also, as has been suggested by Sachs (1981) and Edwards (1984a), the regression results indicate that there has been a significantly negative relation between the perceived probability of default and the average propensity to invest. The other possible determinants of the country-risk premium turned out to be insignificant for both years.

IV. The Social Discount Rate in an Open Developing Economy: Some Numerical Illustrations

The purpose of this section is to illustrate how the incorporation of open economy considerations can affect the actual computation of the social rate of discount. The discussion is carried out in general terms, even though the values of some parameters are taken from actual LDC cases. In particular, information on Costa Rica and Chile is used to provide some "realism" to the computations presented in this section.

Generally, the social rate of discount used for public investment decisions in LDCs has been computed using one of the closed economy approaches reviewed in Section I. It is quite common to find that in the National Planning Offices it is thought that the social rate of discount is a weighted average of ρ and r. However, it is also common to find that a weight of zero (or approximately zero) is assigned to r, and that in practice some estimated value of ρ is used as the relevant rate of discount. This has been the case, for example, in Costa Rica and Chile, where using a methodology based on National Accounts data, the following (real) rates of discount have been computed: ρ Costa Rica = 16.5% and ρ Chile = 13%. 24/

By using these rates of discount, it was implicitly assumed that in these countries, funds used in a public sector project only displaced private investment. This, however, has not been the case. During the recent period, public projects have resulted in an increase in foreign indebtedness in these countries. Between 1977 and 1980, for example, Costa Rica had ample access to the world capital market. During this period, Costa Rica's public sector contracted credits in the Eurocurrency market for more than 600 million U.S. dollars. The average premiums contracted on these credits were: 1977 = 1.750; 1978 = 1.054; 1979 = 1.123; and 1980 = 1.180. If we use the percentage change of the U.S. Wholesale Price Index as an indicator of world inflation, the real cost of foreign borrowing for the years these credits were contracted would have been: 1.93%, 2.05%, 0.6%, and 5.01%. These rates are significantly lower than the 16% used as the social rate of discount by the Costa Rican National Planning Office! The case of Chile is similar. Between 1977 and 1980, almost 2 billion dollars were obtained in Eurocurrency credits to finance public sector projects. The average terms on these credits were: 1977, 1.984 points over LIBOR; 1978, 1.452 points over LIBOR, 1979, 0.861 points over LIBOR, and 1980 0.923 points over LIBOR. 25/ Other LDCs have also had ample access to the Eurocurrency credit market, as is reflected by the long lists of credits to developing countries reported in the World Bank's Borrowing in International Capital Markets.

In order to illustrate how the assumption of access to the world capital market can actually affect the computation of the social rate of discount, consider the following case. Assume an elasticity of private investment (η_I) with respect to ρ of -0.5 and an elasticity of supply of savings (ε_S) of 0.2. Also assume that $p>g=0$ and that the elasticity of the

supply of foreign funds (ε_f) is 0.5. The weights in the social rate of discount equation (14) will then be: $\gamma = 0.42$; $\beta = 0.16$ and $(1-\gamma-\beta) = 0.42$. Further assume that $\rho = 16\%$, that $r = 3\%$ and that $\pi = 6\%$. 26/ Then,

$$\omega' = 0.42 \times 16\% + 0.16 \times 3\% + 0.42 \times 6\% = 9.72\%$$

This resulting social rate of discount (9.72%) is significantly lower than the 16% used by the Costa Rica Planning Office. An interesting question is to compare ω' with the closed economy estimate of a weighted average social discount rate (ω). Given the assumed elasticities, the weights of this closed economy estimate would be $\lambda = 0.71$ and $(1-\lambda) = 0.29$, and ω will be equal to 13.5%. This is still significantly higher than the open economy result of 9.72%. These findings clearly show that ignoring the fact that most developing countries are open economies that have some kind of access to the world capital market can result in a computed social rate of discount that is too high when compared to the correctly computed social discount rate.

V. Concluding Remarks

In this paper, it has been argued that in an open economy that has access to the world capital market, the social rate of discount is a weighted average of the marginal return in the private sector (ρ), the rate of time preferences (r), and the marginal cost of foreign indebtedness (π). It was further argued that if a country cannot borrow all it wants at given world interest rates, and the perceived probabilities of default by lenders and borrowers differ, the weights of ρ and r will be zero, and the social rate of discount will be equal to the cost of borrowing abroad.

However, if there is a country risk premium and the perceived probabilities are different, the country in question will face an upward-sloping supply curve for foreign funds, and public sector projects will affect the relevant marginal cost of foreign indebtedness. In this case the social discount rate is a weighted average of ρ, r and π, and will generally be lower than the closed economy weighted average of ρ and r.

The empirical evidence presented in this paper suggests that there has been a strong positive relationship between interest rate spreads charged on international loans to developing countries and the level of foreign indebtedness. This finding provides some support to the proposition that all three weights in ω' are different from zero. This presumption, however, depends on the hypothesis that lenders have a higher perceived probability of default than borrowers. Future research in the area, then, should be aimed at devising ways to find out whether this is a reasonable hypothesis. Finally, using realistic values for the relevant parameters, it was shown that the bias in the computation of the social rate of discount when open economy aspects are ignored can be substantial. In particular, it was shown that the closed economy computations usually used in LDCs can overstate the social rate of discount by as much as 65%.

Footnotes

1/ See, for example, Arrow and Kurz (1971), Baumol (1968), Dasgupta, Marglin and Sen (1972), Eckstein (1961), Harberger (1969a,b, 1985), Little and Mirrlees (1974), Marglin (1963a,b), Sandmo and Dreze (1971), Sen (1967), Squire and Van der Tak (1975), Sjaastad and Wisecarver (1977), Somers (1971), Warr and Wright (1981), and Lind (1982).

2/ An exception to this is the paper by Sandmo and Dreze (1971). Another group of papers, in the tradition of the international trade literature, have explicitly assumed the case of an open economy. However, in these papers capital is not allowed to move internationally. See, for example, Findlay and Wellisz (1976), and Srinivasan and Bhagwati (1978).

3/ On the increasing use of the international capital market by LDCs see the World Bank World Development Report (1981). In the early 1980s, and as a consequence of the international debt crisis, LDCs' access to international financial markets has been reduced. However, it is expected that during the foreseeable future, LDCs will still obtain substantial amounts of funds from the international financial markets. See, for example, the discussion in Cline (1983).

4/ For a thorough review on the social rate of discount, see Chapter 1 in Lind (1982). All the papers in that volume refer to different issues related to the computation of the appropriate social rate of discount. However, as it has traditionally been the case, in these papers, open economy consideration are again ignored when discussing the computation of the social rate of discount.

5/ This formulation assumes that all the net benefits from the project are consumed. If it is assumed that only a fraction of these benefit is consumed, and the rest is reinvested, the shadow cost of public investment (α) should be redefined. See Marglin (1963a) and Dasgupta, Marglin and Sen (1972, ch. 14). On the problem of reinvestment and the social rate of time preferences see also Mendelsohn (1981).

6/ This proposition, as most of the discussion in this paper, abstracts from the problem of risk aversion. On this issue see, for example, Bailey and Jensen (1972).

7/ Both Harberger and Sandmo and Dreze (as other authors) are reluctant to address the issue of consumption externalities and differences between the social and private rates of time preferences. For this reason in the rest of this paper no distinction will be made between them.

8/ Usher (1969), in a Comment to Baumol's (1968) article, also found that the social rate of discount lies between the rate of time preference and the rate of return in the private sector. It should be noticed, however, that in a recent paper, Stiglitz (1982) has argued that under certain conditions the social rate of discount may lie outside the values given by a linear combination of the rate of time preference and the private sector marginal rate of return.

9/ There is no a priori reason to assume that the average cost of the foreign debt will be equal to its marginal cost. In fact, the divergence between marginal and average cost of the foreign debt plays on important role in the discussion presented below. Notice that a simplifying assumption in (5) is that the same interest rate (v) applies to all foreign debt.

10/ Throughout this paper we will abstract from the problem of exchange risk.

11/ On country risk see, for example, Eaton and Gersovitz (1981), Sachs and Cohen (1982), Sachs (1983) and Edwards (1984a,b).

12/ In a simple rational expectations setting lenders and borrowers will have the same perceived probability of default. However, if it is assumed that borrowers and lenders have access to a different information set the perceived probabilities will differ among them. In reality borrowers and lenders have different sets of information on which they condition their expectations. This justifies our assumption of different perceived probabilities of default.

13/ Assuming that in the case of default, both interest and principal are not paid back, in the one-period case, banks will be in equilibrium if $(1+i^*) = (1+i^c)(1-p)$, where i^c is the interest rate they charge for the loan. The expected average cost for the borrowing country (v), however, will depend on its actual cost i^c and on the borrower's perceived probability of default (g): $(1+v) = (1+i^c)(1-g)$. By replacing i^c in this expression, equation (10) is obtained.

14/ From (10) it can be seen that (where p' and g' are the derivatives of p and g with respect to D): $\frac{dv}{dD} = (1 + \frac{i^*+p}{1+p})[p'\frac{(1-g)}{(1-p)} - g']$. Thus, in rigor, a sufficient condition for $dv/dD \geq 0$ is that $p>g$ and $p' \geq (\frac{1-p}{1-g})g'$.

Notice, however, that even assuming that p=g, it is possible to obtain a cost of borrowing that depends positively on the level of foreign borrowing. This will be the case if only a fraction of the loan is expected to be lost in case of default (or rescheduling). If borrowers expect that in case of default they will not pay a smaller fraction of the loan than what lenders think they will lose, v will still be a positive function of D.

15/ This is an extension to the open economy case of the diagram in Harberger (1969a).

16/ In terms of the diagrammatic representation, it is also possible to start the analysis with a rightward shift of I. The final result, of course, will be the same.

17/ See, however, Edwards (1984a).

18/ Of course, the sufficient condition is that the cost of borrowing increases with the level of indebtedness and that borrowers and lenders have different perceptions.

19/ If, alternatively, it is assumed that if default occurs only a fraction ϕ of interest and principal is lost, equation (12) will be given by $s = [(1-\phi)p/(1 - (1-\phi)p)]k$. This case -- where only a fraction of the loan is lost -- corresponds more closely to the real world cases of debt rescheduling. For an alternative way of deriving an equation similar to (12) see Feder and Just (1977).

20/ This corresponds to what has generally been assumed in theoretical discussions regarding the probability of default and country risk premium. See, for example, Eaton and Gersovitz (1981), Sachs and Cohen (1982) and Harberger (1983).

21/ The assumption that the spread over LIBOR captures the probability of default has some problems, since the cost of a loan also has some additional minor elements, like fees and commissions. Unfortunately it has not been possible to collect data on these components of the cost. Mills and Terrell (1984) have found that front-end fees added an average 24 basis points to the spread charged to developing countries. An alternative way of empirically analyzing the determinants of country risk

premium would be to look at the behavior of yields on developing countries' bonds. On this, see Edwards (1985).

22/ See, for example, Feder and Just (1977), Sachs and Cohen (1982), Sachs (1983), Edwards (1984a).

23/ According to the theory of the demand for international reserves, the desired quantity of reserves will depend, among other things, on the opportunity cost of holding them. This opportunity cost, in turn, will be related to the domestic interest rate. See, for example, the discussions in Edwards (1983) and Frenkel (1984). In the estimation of (13), the following instruments were used: the average propensity to import, the value of exports, the variability of exports and the other exogenous variables in the model. The countries included in the sample are: Argentina, Brazil, Colombia, Ecuador, Greece, Indonesia, Ivory Coast, Korea, Malaysia, Mexico, Morocco, Panama, Philippines, Portugal, Spain, Thailand, Uruguay, Venezuela and Yugoslavia.

24/ See OFIPLAN (1978) and Moran and Wagner (1974).

25/ After the debt crisis, both of these countries have faced serious difficulties for borrowing from abroad. However, the exercise presented in this section is still valid, in the sense that it illustrates how the social rate is affected in an open economy situation.

26/ From the definition of the weights in equation (13) it is clear that $\gamma = [-\eta_I/(\varepsilon_s + \varepsilon_f - \eta_I)]$ and $\beta = [\varepsilon_s/(\varepsilon_s + \varepsilon_f - \eta_I)]$. Since π is the marginal cost of borrowing from abroad, the assumed value 6% is consistent with an average (real) cost of borrowing of 2% and the assumed elasticity of foreign borrowing $\varepsilon_s = 0.5$ [i.e., $6\% = 2\% \left(1 + \frac{1}{0.5}\right)$]. Notice that an average real cost of borrowing of 2% is <u>high</u> for historical standards.

Only in the recent period world real interest rates have increased significantly. Finally the assumed value of ε_s is consistent with the semi-elasticity of around 0.6 and 1.2 found in the empirical analysis of Section 4.

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