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# A DELICATE EQUILIBRIUM:
# Debt Relief and Default Penalties in an International Context

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Abstract

Debt relief and penalties are discussed in connection with sovereign-country loans. We focus on conditions for the existence of penalties that are too low for ensuring Pareto efficiency, and show the possible time inconsistency of optimal debt contracts. A methodology for ascertaining debt relief implicit in international loans is outlined.

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## Summary

The paper discusses two central ingredients in the theory of sovereign-country debt, namely, default penalties and debt relief. The analysis is carried out under the assumption that debt contracts maximize the welfare of the borrower subject to the constraint that the lender gets a competitive rate of return. Contracts are also constrained to be incentive-compatible.

It is argued that, in equilibrium, default penalties are likely to be too low to ensure Pareto efficiency. Two reasons are given. The first one is that to the extent that penalties are costly to the lender, the latter may have no incentives to punish a borrower who defaults. The second explanation for low penalties is imperfect information. If the lender does not know exactly the events that befell on the borrower, a high penalty could be imposed on someone who has a justifiable reason to default. At the time of writing the debt contract, therefore, the bigger is the penalty, the bigger will be the expected cost of borrowing. An optimal contract offers the best combination of costs, which now involve interest rates and penalties. Examples are shown where the penalty is bounded and does not give rise to a Pareto optimum.

The above optimal penalties-cum-interest contracts are bound to be time inconsistent. If possible, the lender will increase the penalty after the debt contract has been signed, because it is to his advantage to maximize the probability of repayment. This insight suggests that extreme caution should be exercised when a third party is called to arbitrate between lender and borrower, especially when arbitration involves no debt relief, and not all the repayment conditions are fully specified (that is to say, when the contract has some "implicit" clauses). For, the above-mentioned time inconsistency suggests that the arbiter may risk tilting the scales in favor of the lender.

The paper argues that debt relief could very well be a characteristic of optimal contracts, and proceeds to develop a framework for establishing the conditions for debt relief. In essence, what this methodology suggests is to estimate the implicit probability of default from actual debt contracts, and to calculate the probability distribution of current key macroeconomic variables from the perspective of the time at which the loans were granted. If current macroeconomic variables are unfavorable to the borrower and fall within a region which, according to the probability distribution alluded to before, has a probability smaller than the probability of default implicit in debt contracts, then we argue that a prima facie case could be made for debt relief.

## I. Introduction

The present paper discusses two central issues involving debt contracts: default penalties and debt relief. Both have received considerable attention in the economics literature, although the terminology tends to vary from paper to paper.

Take, for example, the concept of debt relief. In standard general equilibrium models with complete markets, individuals and firms are assumed to engage in different types of trade contracts. When those contracts involve trading present goods, say, for future goods, it corresponds to a situation in which a buyer of present goods borrows from the seller and, in exchange, promises to deliver future goods. If there is uncertainty, these contracts are made contingent on the "state of nature," i.e., repayment is a function of the outcome of the associated random process. Thus, conceivably, full repayment would occur if things turn out to be "good" for the borrower, but a "cut" would be granted if the borrower is hit by a "bad" shock. Thus, general equilibrium theory--the bread-and-butter of modern economics--contemplates and explains the possibility of a debt relief.

The above standard theory of debt relief assumes that both borrower and lender will always honor the debt contract. This implies that the borrower will repay the contracted amount even when it may be to his advantage to pay less, and, similarly, it also means that the lender will not claim that the borrower owes him more than what is specified in the contract even when the terms of the latter are not fully specified (i.e., even when portions of the contract are implicit). This assumption is, of course, highly unrealistic, particularly when debt contracts involve sovereign countries, whose decision to repay, for example, is partly determined by a democratic process in which considerations having to do with the welfare of the state may override moral principles. 1/

Economic theory has not been slow to respond to the challenge. As a matter of fact, the economics of "moral hazard"--as this branch of the literature is generically called--dates back to, at least, the pioneering work of Kenneth Arrow (1968). 2/ This approach, however, came to full bloom only in the 1970s (see, for example, the collection of papers in Diamond and Rothschild (1978)), and was formally introduced in the field

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1/ In some cases moral principles are themselves quite blurry, like when the debt is originally contracted by a de facto government.

2/ The term "moral hazard" has apparently been taken from the insurance literature. It involves situations in which one of the parties could misrepresent the facts.

of international finance by Eaton and Gersovitz (see the useful survey by Eaton, Gersovitz and Stiglitz (1986)). 1/

In a moral-hazard model it is typically assumed that the debtor will only comply with the (explicit or implicit) letter of the contract if, and only if, the costs associated with paying less exceeds the associated benefits. These costs are usually assumed to be penalties that creditors can impose on debtors. Thus, for example, in case of default, creditors could block the country from receiving trade credit and, hence, cause it to lose some of its "gains from trade" (see Aizenman (1987), and Borensztein and Ghosh (1988). Naturally, the larger the penalty, the less likely it is for the borrower to default. Conceivably, thus, the penalty could be so large that the borrower would always find it to his advantage to comply with the contract. In that case, therefore, the outcome of debt contracts would coincide with that of "naive" general equilibrium theory in which moral hazard problems are assumed away.

The last observation gives us an important insight into this new theory of lending with default risk, and reveals one of its weaknesses (or, more appropriately, one piece of "unfinished business"). It turns out to be to the advantage of both borrowers and lenders to be able to write contracts that are free from moral hazard problems. The penalty must be large but that has no negative welfare effects, because the penalty is paid only if the country decides to default. Hence, since a big penalty implies no default, the penalty is never paid. In practice, however, penalties do not appear to be very big and default is not unheard of (see Kaletsky (1985), Eichengreen and Porter(1986)), so it looks like the theory has to be extended to explain why penalties are not effective enough to achieve moral-hazard-free equilibria.

Section 2 of the paper takes a closer look at the theory of penalties. There and in the subsequent sections we take the "optimal contracts" approach, which amounts to assuming inter alia that debt contracts are Pareto Optimal, i.e., they cannot be modified without reducing the welfare of at least one of the parties to the loan contract. 2/ We conduct our discussion in terms of a two-period framework, where the loan is granted in the first period and repaid in the second. Two independent explanations for the existence of relatively small penalties

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1/ It is worth mentioning that this type of research appeared in working-paper form before we even heard the first squeaks about the current "debt crisis."

2/ Notice that this way of looking at the problem abstracts from the coordination issues among creditors that has played such a prominent role in the debt-forgiveness literature (see, e.g., Sachs (1988), Corden (1988), Helpman (1988), Krugman (1988)).

are presented there. The first one is that if the penalty has to be imposed after the borrower defaults, then the lender may have no incentive to impose it. This would be so, for example, if carrying out the penalty is costly to the lender, like when the lender is also hurt by a cut in trade credits. Under these circumstances, the lender has no hope to recover what is owed to him; thus, the only thing the lender would get is the cost of imposing the penalty. Consequently, costly penalties are not likely to be carried out, which puts a natural upper bound on observed penalties (this argument is in line with the points made in Kaletsky (1985)).

Our second reason for low equilibrium penalties is independent of the above. Thus, for the sake of clarity, we will assume that penalties can be precommitted. To bring this point home, we examine the case in which loans are closely monitored, and a penalty is automatically incurred if the country's loan application (or rescheduling) is turned down. Here, again, large penalties would be the optimal solution if monitoring is perfect. However, we show that an upper bound could emerge if monitoring is less than perfect and, say, good loan prospects have a positive probability of being rejected. The reason for this is that the penalty could now fall upon an "innocent" borrower; hence a contract that specifies large penalties may end up imposing them even when the borrower is well behaved.

Perhaps the most interesting implication of the above model is that lenders may be tempted to increase the penalty <u>after</u> the borrower has accepted the loan because penalties could be less expensive than a careful monitoring. This potential "time inconsistency" of optimal penalties suggests that future innovations that facilitate penalties may induce lenders to adopt them. This has a direct implication for after-debt-crisis arrangements through which banks are cartelized and are thereby able to impose bigger penalties on problem debtors. We argue that if this cartelization was anticipated in original contracts, then bank cartels could just be a way of implementing those contracts. However, a major insight of this section of the paper is that the sudden--i.e., largely unanticipated--presence of outside parties into the debt renegotiation process--particularly, when bigger penalties are involved--may, in fact, help enforce a contract that was not intended by any of the parties. In our example, lenders end up getting the lion's share.

Section 3 of the paper is somewhat independent of the previous one, and is concerned with debt relief. In particular, it discusses a methodology that relates risk premia to probabilities of default. In a very tentative exercise we apply the methodology to the case of Argentina, and show that one could not rule out debt relief as the outcome of an optimal contract. In essence, what this methodology suggests doing is to estimate the implicit probability of default from actual debt contracts,

and to calculate the probability distribution of current key macroeconomic variables from the perspective of the time at which the loans were granted. If current macroeconomic variables are unfavorable to the borrower and fall into a region which, according to the probability distribution alluded to before, has a probability smaller than the probability of default implicit in debt contracts, then we will argue that a prima facie case could be made for debt relief.

Section 4 closes the paper with some conclusions.

## II. A Theory of Penalties, Monitoring and Default

The central points of this section can be made in terms of a very simple model. We will assume that the country can borrow from a large set of competitive "banks." The opportunity cost of funds for banks is exogenous with respect to the loans funnelled toward this particular country (small-country assumption) and is denoted by $\rho$. We assume that the country can use the borrowed funds in "legitimate" or in "illegitimate" activities. If funds are applied to a legitimate activity, their marginal productivity is $\alpha$ (not necessarily a constant), while, if they are used in an illegitimate activity, their marginal productivity is $\theta\alpha$, where $\theta$ is a nonnegative constant and $\theta \leq 1$. Thus, the illegitimate activity never dominates the legitimate one from a technological point of view. The advantage of the illegitimate activity, however, stems from the existence of informational asymmetries. In this respect, we assume that if the country invests in the legitimate activity, everybody is able to observe it, and, if solvent, the country is thus obliged to pay back $(1+\rho)$ "next period" per unit of borrowed funds. 1/ On the other hand, if funds are invested in the illegitimate activity, then the borrower is unable to detect any marginal output, the country could declare itself insolvent and pay nothing to the lender. 2/, 3/

Consequently, marginal profit associated with legitimate investments is given by

$$(1) \qquad \alpha - (1+\rho)$$

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1/ For the present discussion it is enough to divide time into "present" and "future." "Next period," then, corresponds to the future.

2/ In reality there are always some assets that could be attached by the lender. Extensions to this case, however, would complicate the analysis with no appreciable gain in economic insight.

3/ Legitimate and illegitimate are just labels. A possible interpretation for a legitimate investment could be just regular investment, while illegitimate investments could be thought as consumption. The latter is obviously much harder to attach than the former.

Moreover, marginal profit of investing in an illegitimate activity would be

(2) $\theta\alpha$

Under the present circumstances, if expression (2) is larger than expression (1), funds are channelled to illegitimate activities (at the margin), the lender gets nothing in return, and, consequently, the country is unable to borrow the marginal funds. 1/ Borrowing, however, would exist if there was a level of investment for which the opposite inequality prevails, i.e.,

(3) $\alpha - (1+\rho) \geq \theta\alpha$

Equation (3) illustrates a point which is well known since the pioneering work of Eaton and Gersovitz (1981), namely, that, contrary to pure neoclassical theory, investment will stop short of the level at which the gross marginal productivity of capital equals the interest factor, $1+\rho$, even though the country has unlimited access to international capital mobility. Thus, in the present context, neoclassical theory would give the right answer only in the special case where the illegitimate use of funds yields no return, i.e., $\theta=0$. The intuition behind this result is quite straightforward: If marginal profit from legitimate investments was zero, while that of illegitimate ones was positive, it would obviously pay the country to choose the second course of action. Thus, marginal profits in the legitimate activity could be zero in equilibrium (the neoclassical implication) only if the marginal product of illegitimate investments is also zero.

In the interesting case in which the country gets a positive return from illegitimate investments (i.e., $\theta>0$), the above argument shows that there will be less international investment in this country than what is called for by purely efficiency considerations. There exists, therefore, room for improving worldwide welfare by means of devising a system that reduces the incentives to cheat. One such device could be default penalties.

Consider, for example, the case in which there is a default penalty P if less than total debt is repaid (this is a common assumption in the debt literature; see, for example, Eaton, Gersovitz and Stiglitz (1986)). 2/ Clearly, the repayment condition (3) now becomes

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1/ In case of a tie we assume the country chooses the legitimate activity.

2/ An exception is Calvo (1988) where the penalty is assumed to be an increasing function of the extent of default.

$$(4) \qquad \alpha - (1+\rho) \geq \theta\alpha - P$$

or

$$(5) \qquad \alpha \geq (1+\rho-P)/(1-\theta)$$

Obviously, therefore, we could eliminate all incentives to cheat by setting P large enough. Equation (5) shows how central is the existence of relatively small default penalties for default cum solvency to be a real possibility. Notice, also, that under the present assumptions the borrower will always agree to higher default penalties at the time of signing the loan contract. This is so because penalties give a way for the borrower to close the gap between the marginal productivity of capital and the international interest rate factor, thus increasing ex-ante expected income. Furthermore, under perfect foresight (or perfectly contingent contracts) the penalty is never imposed, so its being large serves only as a deterrent but it costs the borrower nothing--it just makes him more credible. So, the question arises, why are penalties not big enough to deter solvent defaults at full efficiency (i.e., $\rho=\alpha$)?

Suppose that penalties were costly to the lender, and let the cost be $\beta P$, where $\beta>0$. Since, as argued above, in equilibrium the penalty is never imposed because the country never defaults, 1/ the competitive rate of interest charged to this country is still $\rho$. Thus, if P is credible, conditions (4) or (5) would still hold. The problem here is, however, that P will not be credible unless the lender can precommit P by, for example, prearranging for some outside institution to carry out the penalty for him. This is so because the borrowing country knows that if it defaults the lender would have no incentive to impose the penalty, for the latter will only increase the lender's cost. In equilibrium, therefore, the situation is equivalent to there being no penalty, and we revert to condition (3). This shows how sensitive the equilibrium solution may be to changes in the credibility of penalties, and it provides a rationale for relatively small penalties at equilibrium.

Another mechanism to improve the efficiency of the loan market is loan monitoring (see Diamond (1984), Townsend (1979)). By definition, monitoring is an activity that occurs before or simultaneously with funds' disbursement. Thus, the lender could, in principle, ensure that the loan is used for a legitimate activity. In practice, however, monitoring has two problems: (1) it is costly and (2) it is imperfect, i.e., there is a positive probability that it gives inaccurate information.

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1/ Extensions to account for default at equilibrium are discussed at the end of this section.

Suppose monitoring is costly but perfect, and let the cost per unit of loan be $\gamma$. In this case the borrowing country who is being monitored knows that, if it chooses the illegitimate activity, no funds will be available. Hence, its only realistic option is to use the funds for legitimate investments. Since the cost to the lender has now risen to $\gamma+\rho$, loans will flow into the country as long as

$$(6) \qquad \alpha - (1+\rho+\gamma) \geq 0$$

Clearly, this could represent a significant efficiency improvement if $\gamma$ is relatively small. Since monitoring is likely to be subject to increasing returns to scale, $\gamma$ could be significantly reduced by pooling loans from different banks. This suggests, incidentally, that the emergence of bank syndicates in the 1970s may have led to substantially smaller $\gamma$'s, which may help to explain the relatively small "risk premia" on those loans and the extraordinarily large flow of funds that were channelled that way (see Folkerts-Landau (1985)). 1/

To simplify the discussion, but without loss of generality, we will further assume that without credible penalties or monitoring the country will always have incentives to choose illegitimate investments (i.e., inequality (3) is never satisfied). In this setup monitoring would be credible because in its absence the borrower will always choose the illegitimate activity.

Let us now consider the case in which monitoring is imperfect. This situation could arise if, due to imperfect information, a "good" borrower could be mistaken by a "bad" one. An interesting instance is when the lender employs a wrong or incomplete model, like when a country is denied credit because one of its neighbors declared a debt service moratorium, even when the country has no intention to default.

We will denote by q the probability that monitoring transmits the right signal (i.e., legitimate if legitimate, etc.). Thus, (1-q) is the probability of getting the wrong signal (i.e., illegitimate if legitimate, etc.) Without loss of generality we assume $q \geq 1/2$. If the borrowing country is monitored and considered unreliable, then no loan (at the margin) will be forthcoming. As a result no marginal investment occurs and the country incurs a cost C. Hence, if the borrower's investment is

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1/ This effect must be distinguished from the possible higher penalties that may be involved if each participant in the bank syndicate credibly vowed to exclude a default country from future lending (see Folkerts-Landau (1985)).

legitimate his payoff will be given by equation (6) with probability q and (-C) with probability 1-q. 1/ Thus, his expected profit will be

(7) $[\alpha - (1+\rho+\gamma)]q - (1-q)C$

On the other hand, if his choice is illegitimate, then his expected profit would be

(8) $\theta\alpha(1-q) - Cq$

Consequently, the legitimate activity will be selected if (8) does not exceed (7), which implies

(9) $[\alpha - (1+\rho+\gamma)]q + (2q-1)C \geq \alpha\theta(1-q)$

Clearly, if, as in the above simple case, q=1 and C=0 (perfect monitoring and no side effects from choosing an illegitimate investment), then inequality (9) boils down to (6). Moreover, if C=0 and q=1/2 then

(10) $\alpha - (1+\rho+\gamma) \geq \alpha\theta$

which can never hold true because we assumed that inequality (3) never holds. This shows that (a) if perfect monitoring succeeds in bringing some loanable funds to the country (i.e., inequality (6) holds for some level of foreign loans), and (b) no loan would be possible if there exists no monitoring or penalties (i.e., inequality (3) never holds), then there exists some sufficiently low critical level of monitoring accuracy, $q^c>1/2$, such that monitoring becomes ineffective for improving the capital market for all $q<q^c$.

A look at equation (9) quickly reveals that costs incurred by the borrower when he is deemed not creditworthy, C, help ensuring that legitimate investments are undertaken if q>1/2 (a very mild constraint). However, the marginal impact of C on the left-hand-side of inequality (9) is just

(11) $2q-1 < 1$, unless $q=1$.

Thus, the effectiveness of an increase in credit-rejection costs to induce

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1/ We are implicitly assuming that the marginal cost of credit is $1+\rho+\gamma$. This is correct in the present example because, in equilibrium, there will be no default.

legitimate investments is an increasing function of the accuracy of monitoring. 1/

From a formal point of view, C plays very much the same role as penalties, P, in our previous examples. Thus, if C was costly to the lender we would, once again, face the problem of its credibility. However, we have in mind a situation where C is an essential part of the monitoring process. It could stand, for example, for the "time lost" if the country is not considered creditworthy. The cost is, however, dependent on institutional arrangements, like when banks wait for a "green light" from the IMF before extending new credit. In this context, not reaching an agreement with the Fund may imply loosing the marginal productivity of capital net of the associated interest payments times the new capital that would otherwise have flowed in. Notice, incidentally, that these costs could therefore be modified by the granting of so-called "bridge loans."

As a matter of fact, the country itself could modify the costs of not getting credit by changing the sectoral allocation of capital. This is a subject that has been extensively explored by Aizenman (1987, 1988) and Borensztein and Ghosh (1988) under the assumption of non-stochastic penalties. They show that in the quest to increase their access to international credit, countries may tend to follow trade-oriented policies beyond the point dictated by comparative advantage. This is an intriguing result, because although it helps to explain the NIC's export-oriented policy, it does not seem compatible with the record of heavily indebted countries, who, to the contrary, appear to have followed inward-looking industrial policies (before the present debt crisis episode). As the following arguments show, however, the existence of inaccurate monitoring places a natural upper bound to credit-rejection costs, C, and could thus be employed to argue that the optimal degree of openness is less than suggested by Aizenman-Borensztein-Ghosh analysis.

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1/ Notice that in equilibrium the borrower always chooses legitimate investments and yet, under imperfect monitoring, some loan applications are rejected even when the lender knows that the borrower is perfectly reliable. Thus, if the lender was free to revise the rule, he would accept all loans. This is another example of potential time inconsistency. However, if the borrower anticipated such a revision of the rule, it would always pay him to cheat, and no loans would occur in equilibrium. In a more realistic scenario with heterogeneous borrowers, there will be some role for ex-post monitoring since the penalty may not be enough to deter everybody from cheating. This will allow the capital market to function even when lenders are free to change the rules ex post.

To simplify the exposition, let us further assume that $\alpha$ is a constant. Therefore, in equilibrium, the country's net income from borrowing is expression (7) times total borrowed funds (the upper limit of which will, without loss of generality, remain exogenous for the present discussion). Hence, if monitoring is imperfect (i.e., $q<1$), then net expected income is a decreasing function of C. This is so, because under imperfect monitoring a country could incur credit-rejection costs even when it chooses legitimate investment projects. On the other hand, if credit is to become available to this country, the incentive-compatibility constraint (9) must hold. This implies that the net-income maximizing C is the lowest possible value of C that is consistent with inequality (9). This implies, of course, that optimal C, $C^*$, satisfies (9) with equality. Hence,

$$(12) \qquad C^* = \{\alpha\theta(1-q)-[\alpha-(1+\rho+\gamma)]q\}/(2q-1)$$

Thus, in the relevant region where $C^*$ is nonnegative, one can readily verify that $C^*$ is a decreasing function of monitoring accuracy and the marginal productivity of capital, q and $\alpha$, and an increasing function of monitoring and interest costs, $\gamma$ and $\rho$, and of the productivity of illegitimate projects, $\theta$.

In a competitive banking environment, where banks compete both in terms of interest charges and monitoring cum credible penalties, it is not possible that C exceeds $C^*$ at equilibrium; for, as one can easily verify, if that were the case, an individual bank could get nonzero profits and increase the country's expected income by offering lower penalties coupled with a rate of interest higher than $(\rho+\gamma)$. Hence, the competitive solution coincides with the net-income maximizing solution discussed above.

Thus far, our discussion is predicated on the assumption that the country takes the loan. Loans will be taken, however, only if they are profitable, i.e., if expression (7) is nonnegative. This fact can be used to show that in the present context penalties may not be able to ensure moral-hazard free equilibria, even in the polar case in which monitoring costs are zero (i.e., $\gamma=0$). The proof is simple. Let us assume $\alpha=1+\rho$ and $\gamma=0$; then, by (12), $C^*>0$ and, hence, expression (7) is negative (i.e., profits are negative). Thus, loans are not profitable and will not be taken. The intuition for the result is also very straightforward. We are examining a situation where the marginal cost of funds is equal to their marginal product. Thus, in a moral-hazard free world, funds would flow into the country at no risk for borrowers or lenders. In our set up, on the other hand, penalties are designed to discourage cheating and are, therefore, positive. Hence, if a borrower can be found, the loan would be riskless from the point of view of the lender. However, the borrower would not be willing to take the loan, because (a) marginal cost =

marginal product, but (b) there is a positive probability of being (unjustly) punished. So net revenue is negative.

The assumption $\alpha=1+\rho$ is extreme and was only made to simplify the exposition. It should be clear, however, that the imperfect-monitoring model could be employed to show that the risk of being punished for the wrong crimes prevents a country from fully exploiting its intertemporal gains from trade, even though the size of penalty could be (credibly) written into the loan contract.

In the first model of this section equilibrium penalties were shown to be small because of lack of credibility. In the second model, where credibility was taken for granted (i.e., C is predetermined, it cannot be changed ex post), penalties are small because of imperfect monitoring. Thus, the next natural step is to examine the credibility of penalties in the context of the imperfect-monitoring model.

Penalty credibility is a very delicate matter. We have shown that if penalties are costly to the lender, their credibility could be greatly impaired. However, we have also argued that their credibility could be enhanced if penalties are made an essential part of the monitoring process. Interestingly, in discussing the credibility of $C^*$ we may actually face the opposite problem. Since $C^*$ is smaller than the monitoring-related maximum, it would be tempting for the lender to increase penalties ex post, i.e., when the loan is already in process and the country is "hooked" to this particular lender (or lenders), and adopt a less costly--and, hence, more imperfect--monitoring. 1/ How feasible is this in practice is an open question; but this is another example where, once again, lenders would welcome the intervention of a third party that helps to increase the penalty after the contract has been signed. If the third party was not anticipated in the contract, though, its presence ex post may in fact enforce the wrong contract, not the one that lenders and borrowers intended to sign.

Thus far, we have no story to justify default or debt relief. Fortunately, the latter can be easily remedied by a straightforward extension of the model(s). Suppose there are two possible states of nature: the good and the bad. In the good state the marginal productivity of capital is $\bar{\alpha}>0$, while in the bad state it is 0. We assume that in the

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1/ This falls outside the model, but easy extensions would yield this kind of result. For example, we could assume that the lender can choose monitoring accuracy, q, at a cost. Thus, the optimal ex ante contract will endogenize q and C. Ex post, however, once the borrower has taken the loan, incentives change. If C is costless, for example, the lender will be tempted to rely entirely on high C.

bad state it is impossible for the country to pay back its debts. In order to be able to use the former apparatus, we will now identify $\alpha$ with the expected marginal productivity of capital. Thus, by definition,

$$\alpha = \bar{\alpha} g \tag{13}$$

where g is the probability of the good state.

Furthermore, let us now denote the international rate of interest by $\rho^*$, and let $\rho$ stand for the interest charged to this particular country. Hence, recalling that lenders are assumed to be risk neutral, if the only state in which the country defaults is the bad state, then in equilibrium we have

$$\rho = \rho^*/g \tag{14}$$

Since the incentive-compatibility constraint is relevant for the good state of nature only, it is quite clear that all of the above results remain the same when $\alpha$ and $\rho$ satisfy (13) and (14). Consequently, the borrower will not pay back its debts with probability (1-g) and the country-specific interest rate, $\rho$, will be correspondingly larger to compensate banks for this, possibly unlikely, event. If this arrangement were legally binding and well understood by everybody concerned, then cessation of payment in the bad state would not carry any stigma. The problem in practice, however, is that although loan contracts normally contain positive risk premia, conditions for default are unlikely to be fully specified. Therefore, a long negotiation process could be set in motion. 1/ The latter, incidentally, could be costly to the debtor and could operate, therefore, very much like penalties. If the process ensuing a default is well understood, the penalty itself would have been taken into account in the original (implicit) contract. Once again, however, it is not clear that bringing new players into the picture is desirable, unless their eventual participation was taken into account in the original contract.

## III. Debt Relief

Previous remarks have made it abundantly clear that optimal ex-ante loan contracts are bound to be time inconsistent, i.e., lenders, and borrowers as well, may have incentives to pretend, ex post, that the terms

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1/ This does not apply to our overly simple example in which the borrower has no attachable wealth in the "bad" state, but, as the reader can verify, it would be a feature of more realistic models where some assets can be attached by the lender.

of the contract were different from those agreed upon ex ante. In this respect, we discussed the possibility that the lender or lenders be tempted to increase penalties ex post. In practice this may take the form of banks forming coalitions to increase penalties directly, and/or seek support from the international community.

Another aspect that may tend to be misrepresented ex post is ex-ante arrangements for partial or total default in the "bad" states of nature. This is obviously more likely to be so if the conditions for default are not fully specified in the original contract, i.e., if some default conditions are "implicit" in the loan contract.

A relevant question in this respect is: Does the above imperfect-enforceability scenario justify some kind of outside intervention? Our previous discussion suggests that the question has a rather subtle answer. If lender and borrower were fully aware of the ex-post situation, and none of them expected outside intervention, then there is no obvious reason to justify ex-post intervention. However, this type of equilibrium is not Pareto Optimum because the contract was signed under the assumption that some of its terms could not be enforced ex post. Therefore, there is room for outside intervention ex ante. For example, an outsider could be asked to participate in the loan contract so as to ensure the ex-post enforcement of the contract. The point to keep in mind, however, is that if the objective is to ensure the validation of ex-ante implicit contracts, then for outside intervention to be justified ex post, it is necessary that this kind of intervention be well understood ex ante by both parties to a loan contract, to such an extent that the contract would not, or could not, be carried out in the absence of such participation.

Did the 1970's international loan contracts anticipate the participation of outside parties? According to the above discussion this is the acid test that any such participation has to pass in order to be justifiable. Unfortunately, however, such a test is likely to be very hard to carry out in practice, because most international contracts do not explicitly mention that the parties will resort to international financial institutions in order to resolve the debt problems.

There is, however, a related question that may be somewhat easier to handle, namely, suppose that outside intervention can be taken for granted, and that, therefore, outside parties are (at least implicitly) obliged to adjudicate on this issue, is there anything that one could infer from explicit contracts about implicit penalties and partial default? The remainder of this section will be devoted to discuss a possible methodology to answer only a part of the latter question, namely, whether implicit contracts accounted for the possibility of partial debt relief.

Most international loan contracts specify an interest rate above LIBOR. In a competitive market (which we assume) this may reflect transaction costs (e.g., monitoring costs, $\gamma$, in our previous discussion), risk aversion, or the possibility that the debt will not be paid in full. Given that a good portion of total official loans was made through bank syndicates (see Folkerts-Landau (1985)), we could perhaps assume, as a first approximation, that transaction costs are nearly zero and, as in our previous analysis, that lenders are risk neutral. This leaves us with only one factor: default risk.

Consider a one-period loan with interest rate i+k, where i is the LIBOR interest rate, and k is the risk premium. Let us further assume that p is the probability that the country will pay less than 100 percent of its debt, and, for simplicity, let $\sigma$ be the share of the debt that will be repaid in case of default. 1/ Hence, the expected return from a one-period loan would be:

$$(15) \qquad (1+i+k)(1-p+p\sigma)$$

By definition, (1+i+k) is contractual repayment at the end of the period per unit of loan; (1-p) is the probability of full repayment, and p the probability that only a share $\sigma$ will be repaid. Adding up yields (15).

A bank, however, has the option of investing in the interbank loan market and get

$$(16) \qquad 1+i$$

at the end of the period. Thus, since in competitive equilibrium banks should be indifferent between those two alternatives, we have, equating (15) and (16),

$$(17) \qquad p = \left(1 - \frac{1+i}{1+i+k}\right) / (1-\sigma)$$

The last equation could be used to calculate the default probability given $\sigma$. For example, if we were interested in estimating a plausible lower bound for p given $\sigma$, we should choose realistically high i and low k. For example, for one-year contracts we could set i=20 percent and

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1/ A richer scenario would specify a range of repayment shares with different probabilities. However, the present assumption is enough to illustrate the basic point and, given the complexity involved in actual defaults, the two-options assumption may even be "realistic."

k=1 percent. Table 1 shows the results. Thus, if the country was expected to pay 50 percent of its debt in case of default, the implicit probability of default could not have (realistically) been smaller than 1.65 percent.

Table 1. Default Probabilities

| $\sigma$×100 | p×100 |
|---|---|
| 00 | 0.83 |
| 10 | 0.91 |
| 20 | 1.03 |
| 30 | 1.18 |
| 40 | 1.38 |
| 50 | 1.65 |
| 60 | 2.07 |
| 70 | 2.75 |
| 80 | 4.13 |
| 90 | 8.26 |

The next important issue is to determine the set of debt-relief-triggering indicators. This is, of course, a very hard problem. Fortunately, however, we can get some clues from the theory of optimal implicit contracts. Thus, if, as widely accepted, a nation's welfare is closely linked to its sustainable (or "permanent") consumption level, and the latter is tightly linked to its net permanent income (i.e., net of loan repayments), then, conceivably, an optimal loan contract would aim at insulating net permanent income from random fluctuations (particularly, if the country exhibits risk aversion, and lenders are risk neutral). This suggests that (optimal) loan repayment would tend to increase with positive shocks to permanent income, and to decrease when shocks are negative (recall last part of Section 2). An implication of the latter is that debt relief is more likely to be exhibited in an optimal implicit contract, the bigger are the negative shocks to permanent income. Consequently, looking at Table 1, it could be argued that some debt relief would be called for if permanent income fell into a range that had probability smaller than 0.83 percent at the time of signing the contract.

The case of Argentina is very interesting in this respect. A regression of annual GDP on a time trend for the period 1957-1980 yields: 1/

1/ Data was taken from line 99b.p of International Financial Statistics, various issues.

$$(18) \qquad y = \underset{(297)}{9.32} + \underset{(21)}{0.029}\ T$$

where y is the logarithm of GDP and T is calendar time. This implies, of course, that the country grew, on average, at the rate of 2.9 percent per year. More interestingly, the Durbin-Watson statistic is 1.5, which means that serial correlation of equation's residuals does not seem to be a major problem. In economic terms, this type of result suggests that the country does not seem to have gone through extended periods of recession or expansion with respect to trend. 1/ Furthermore, it suggests that lenders might have used a trend line like (18) to forecast 1980s' GDP. What would be the implications if they actually did so?

The standard error associated with equation (18) is 4.71 percent. The latter could be used as an estimate of the standard deviation of the error term in equation (18), and, thus, to calculate the distance of each observation from its corresponding forecast in terms of standard deviations. These results are shown in Table 2 (see also Figure 1).

Table 2. Forecast Errors

| Year | Standard Deviations Below Forecast |
|---|---|
| 1981 | 2.55 |
| 1982 | 3.98 |
| 1983 | 4.17 |
| 1984 | 4.18 |
| 1985 | 5.81 |
| 1986 | 5.20 |

[Insert Figure 1]

1/ This is, incidentally, quite remarkable because 1-to-3 year GDP cycles are very common in industrialized and other Latin American countries. Similar regressions for other countries yield a Durbin-Watson statistic of 0.25 for the United States and Colombia, 0.85 for Mexico, 0.34 for Chile, 0.39 for Venezuela and 0.19 for the Philippines. Brazil, on the other hand, comes closer to Argentina with a Durbin Watson of 1.32.

Interestingly, all of these observations fall into a range that has probability less than 0.7 percent, which is smaller than the 0.83 percent mark discussed in connection with Table 1. This could thus be conceivably utilized to build up a case for debt relief.

The above remarks are just suggestive. A more serious attack on the issue should be able to grapple with at least the following two queries: (a) has income suffered a permanent or just a temporary shock? and (b) income is a variable that reflects, among other things, internal policy, shouldn't we, thus, try to isolate domestic factors--which are controllable by the country's policymakers--from those that are mostly exogenous (like the price of copper for Chile, or that of wheat for Argentina)?

We will not attempt to give a full answer to these queries. I would like to point out, however, that there is some ongoing research (e.g., Baxter (1988) and Kaminsky (1988)) on detecting permanent regime changes that ought to be useful in the present context. 1/ At any event, however, our analysis suggests that the objective is not necessarily to look for more sophisticated empirical methods, but rather to use models similar to those employed by lenders. This would call for studying the technical memoranda that served as a basis for granting those loans.

Query (b) has to do with the issue of moral hazard. Suppose that permanent income can be manipulated by policymakers and loan repayment decreases with negative shocks to permanent income. Hence, if debt relief as a function of permanent income loss is generous enough, policymakers may find it to their advantage to actually engineer a negative shock (by, for example, failing to implement an adjustment program, or generating policy uncertainty). An alternative would be to write contracts that take into account only fully exogenous variables like terms of trade. However, an important disadvantage of this approach is that variables like terms of trade cannot capture important random shocks like those associated with political uncertainty, trade-union policies, etc. These shocks are not easy to manipulate by a finance minister, and are hard to write into a contract, either explicitly or implicitly. Going back to the case of Argentina, for example, part of the output loss during the 1980s could possibly be traced to the associated political cost of a return to democracy. This is an interesting case study because it shows an instance

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1/ Mauro Mecagni of the IMF performed some more sophisticated time series analysis on the Argentine GDP data. He was able to reduce the forecast error somewhat by exploiting the slight serial correlation of the series, but he also found that the distance between actual and forecast GDP during the 1980s exceeded two standard deviations.

where output contains information that would be difficult to take account of by means of other exogenous variables. 1/

Suppose, however, that output was manipulable within certain bounds, but, since output is a good proxy for permanent income, it is nevertheless employed by lenders and borrowers as a sufficient statistic for debt relief. Clearly, under these circumstances, the contract should make sure that an output loss is not accompanied by such a big debt relief that it induces policymakers to provoke a fall in output in order to increase social welfare. In other words, the contract must be "incentive compatible." Interestingly, these types of constraints may make some of the $(\sigma,p)$ combinations of Table 1 infeasible because not all of them do necessarily satisfy that kind of incentive compatibility; consequently, this may allow us to narrow down even further the possible set of optimal ex-ante implicit loan contracts, which, from our Sherlock Holmes perspective, is "good" news.

## IV. Conclusions

This paper is motivated by the need to understand the origin and incentives behind the debt contracts that were written during the 1970s in order to shed some light on the principles behind the granting of debt relief or the enforcement of default penalties.

We have argued that a loan contract may contain clauses that are not necessarily expressed in the written document. For example, we suggested that the existence of a positive risk premium shows that contracts may not have ruled out debt relief. The premium was undoubtedly small but still could be consistent with at least a 0.8 percent probability of (some kind of) debt relief. The relevance of these numbers was tested for Argentina. It was argued that Argentina's GDP levels for the 1980s, based on the experience for the period 1957-80, appears to be a low-probability event. In fact, the econometric exercise suggests that the probability of those events, given the track record for the period from 1957 to 1980, could be smaller than 0.7 percent. These results suggest that some countries could be in the position of someone who bought car insurance and had an accident. Everyone would agree that the car owner has the right to

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1/ It should be remembered that we are talking about contracts which, by definition, are written before the relevant events are known. Thus, although it may be relatively easy to argue after the fact that certain events have occurred (e.g., a return to democracy), the point that I am trying to make is that it may still be very difficult to account for them ex ante by means of variables other than income or some related macroeconomic measures.

collect from the insurance company. The same logic applies to debt relief. It could be argued that borrowers paid a "risk premium" in case a bad, and unlikely, event happened. Well, if one could then prove that a given country has actually been involved in an accident, it follows that, like the car owner, this country would have the right to receive some compensation. One form that the latter can take is debt relief.

The paper, however, stops short of recommending debt relief. The analysis is still too preliminary and incomplete. Its main contribution, however, is to show that one can in principle discuss thorny issues like debt relief on the basis of solid economic concepts, many of which have been in the toolbox of economists for many years. There is always going to be room for disagreement, but an effort should be made to find a common ground.

Another related issue that was focused in the paper is penalties. This is important because debt crises tend to polarize the world between problem debtors and creditors. It could, therefore, be misleading to discuss policy issues under the assumption of perfect competition in the capital market (for problem debtors, at least). Creditors and international institutions are likely to be engaged in a game where a lot of power could be exercised over problem debtors. This power could be used to threaten them with big default penalties, or to reach an agreement where less that 100 percent of the debt is repaid.

The paper contributes to understanding these issues by looking at examples where the penalty is one of the contract's variables. It is shown that although at the time of writing the contract, lenders may find it to their advantage to agree to relatively low penalties, their incentives could be quite different after the contract has been signed. If they could revise penalties they may have incentives to make them bigger. The situation is not very different from the one faced by an individual who borrows from a bank. He may be first enticed to the bank by "low rates" and by appealing commercials where the emphasis is on how well he will be treated when applying for a loan. Afterwards, however, at the slight indication of insolvency the bank might be tempted to hire a nasty private company to fill the borrower with apocalyptic terror. The paper discusses the rationale for this to happen, and, more importantly, it strongly suggests that extreme caution should be taken if one is called in to reinforce the contract's penalties.

Our analysis gives strong support to the case-by-case approach to the debt problem. According to the above discussion, its resolution hinges upon being able to understand the nature of the original loan contracts. Contracts and objective situations are clearly not identical across countries, so there is no reason to expect that all countries should be subject to the same debt relief and default penalties.

This paper represents a very tentative attempt to deal with the debt problem on the basis of standard economic theory. There is a long way to travel before we get to a reasonably interesting destination. Nevertheless, it shows that there is hope that a serious economic analysis could considerably enhance the possibilities of narrowing down the band of disagreement between borrowers and lenders. Furthermore, a resolution of the debt problem along the lines suggested here has the added attraction that it does not call for a breach of (implicit) contracts. On the contrary, a successful application of these methods should be able to implement the spirit of the original contracts, and, therefore, to cause minimal damage to the fabric of international financial relations.

There are several important issues that the paper has not covered. In particular, it has nothing to say about the possibility that debt relief may improve the welfare of <u>both</u> lenders and borrowers through coordination among creditors (see Corden (1988), Sachs (1988), Helpman (1988), Froot (1988), Krugman (1988), for example). This is so because, by definition, under optimal contracts there is no room for Pareto improvements. 1/

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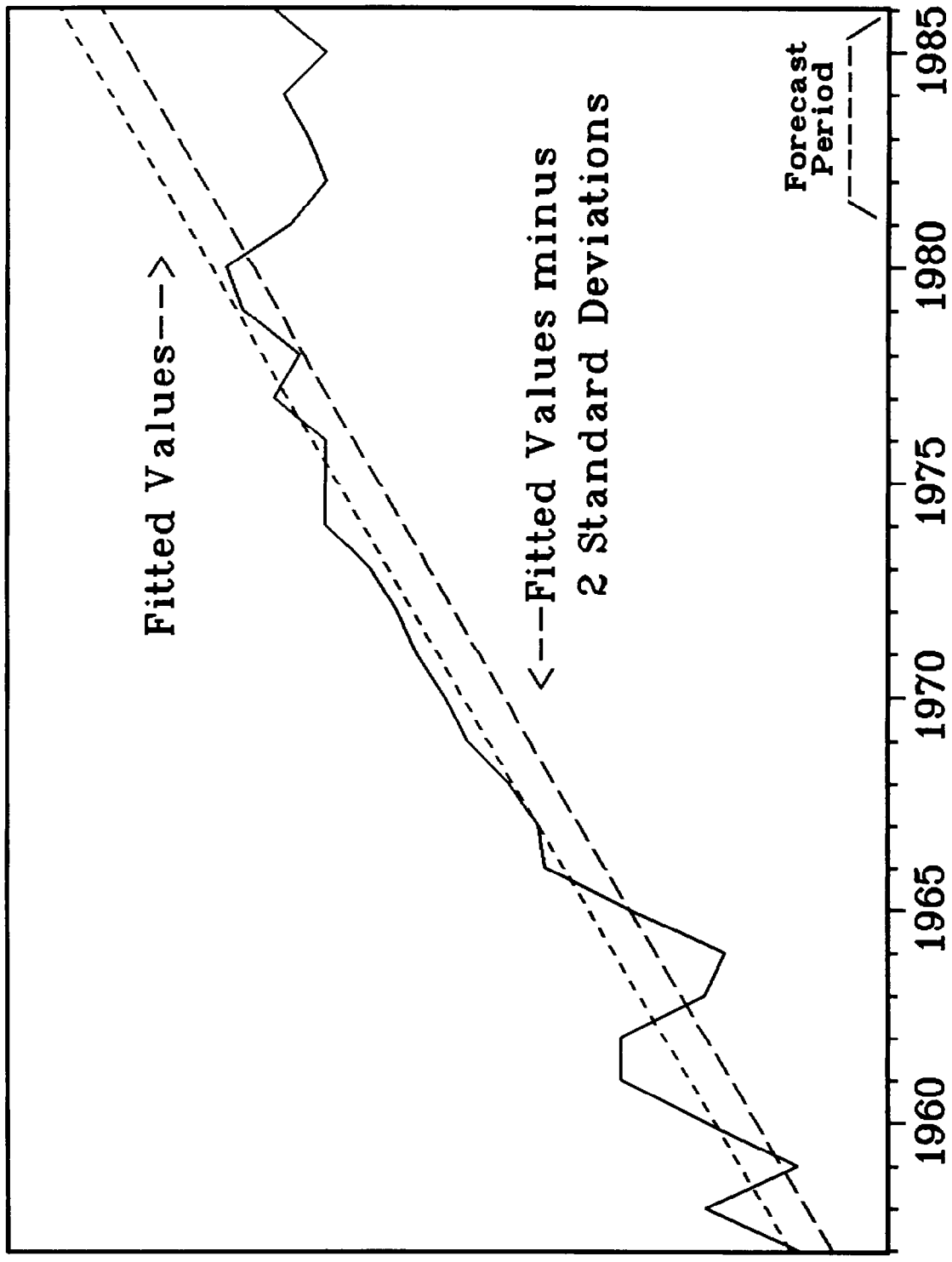
1/ This implies, of course, that our arguments for debt relief are entirely independent of the ones given by the above-mentioned literature.


ARGENTINA. GROSS DOMESTIC PRODUCT
(1980 Prices. Semi-logarithmic Scale)
Fitted Values-->
<--Fitted Values minus
2 Standard Deviations
Forecast
Period
1960
1965
1970
1975
1980
1985

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