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## Rescheduling of Sovereign Debt: <br> Forgiveness, Precommitment, and New Money

Many less developed countries in the past decade failed to meet contractual obligations on their external debt. Lenders generally responded by rescheduling these debts rather than declaring them to be in default, but further commercial lending to these sovereigns has virtually ceased. These borrowers now face an enormous debt overhang, while their lenders face substantial losses on their international loan portfolios.

Among the many proposals for addressing this crisis, the relative desirability of debt forgiveness and new lending has been the focus of considerable debate. The Baker plan of 1985 emphasized additional funding coupled with growth-oriented domestic policies rather than debt reduction. Lenders were encouraged to provide additional funds ("new money") to help the impaired and indebted economies grow their way back to creditworthiness. However, lenders were reluctant to offer new funds that would increase the sovereign's debt burden without some assurance that future repayment would be likely. With debt generally recognized as providing borrowers with a disincentive for investment, ${ }^{1}$ the emphasis has now shifted to the need for debt forgiveness on the part of the lenders and a commitment to internal adjustment by the borrowers. Both parties are viewed as benefitting by a reduction of the inherited debt, and possibly the provision of additional funds, if the sovereign borrower can commit itself to adopting policies that reduce internal consumption and

[^0]promote investment, thereby providing greater future resources for the repayment of the debt obligation. ${ }^{2}$

While the investment depressing effects of a debt overhang have been much analyzed [see, for example, Krugman (1988), Corden (1989), and Helpman (1989)], only little attention has been devoted to the effect of the debt overhang on the borrower's allocation of investment between the tradeable and nontradeable goods' sectors. We will argue that this issue may have important implications concerning the enforceability of sovereign debt contracts and the structure of debt relief programs. Related to this view is the observation of Cohen and Sachs (1986) and Diwan (1990) who argue that aggregate investment may not be as important for future debt repayment as the amount allocated to export production. This suggests that the export revenue-generating capacity of a sovereign may be positively linked to the degree of enforceability of its debt agreements. Diwan focuses on the allocation of resources to exports and import-substitutes and demonstrates that it may be optimal for lenders to offer partial debt forgiveness if it induces the sovereign to invest in export promotion (rather than in an import-competing sector) and thereby generate foreign currency for loan repayment. Our paper is related to that of Diwan in that we, too, emphasize the importance of recognizing the sovereign's incentives with respect to its choice of investment subsequent to loan rescheduling. However, our focus is on an integrated study of debt relief, new money, and contract enforcement, and their resulting incentives for the sovereign's promotion of tradeable goods production. ${ }^{3}$ Thus, we study the interrelationship within an optimal loan "package" between debt relief, new money, and the ability of the sovereign to precommit to a particular investment decision, and its effect on the allocation of resources to the tradeable and nontradeable goods' sectors. Another point of difference is that we examine also the implications for debt renegotiation if the sovereign has an informational advantage vis-à-vis the lender.

Enforcement of the renegotiated agreement is of central importance in a study of sovereign debt. Since such debt is distinguished by the absence of the usual enforcement mechanisms, the debtor's cost of repudiation is not obvious, but nevertheless must exist since debtors attempt to avoid outright default. Such costs have been rationalized in the literature as being based on the ability of creditors to "punish" defaulters, for example, to impose trade sanctions, as well as on the desire of the sovereign to maintain a "reputation for repayment." Both rationales have been criticized in the literature. More specifically, applying sanctions does not appear timeconsistent since it is difficult to see how creditors could carry out penalties to punish defaulters without inflicting losses on themselves. ${ }^{4}$ The reputation argument is prob-

[^1]lematic as well. It is unclear why a creditor would make a payment for this reason if it could repudiate its debt and subsequently participate in international trade on a "cash-in-advance" basis (see Bulow and Rogoff 1989b).

An alternative possibility for enforcing repayments is the creditors' threat to confiscate assets owned by the sovereign. However, which assets of sovereigns are able to be seized by lenders in the event of default, and consequently, the importance of this threat, remain unresolved issues. For example, Bulow and Rogoff (1989a) note that "if a country repudiates its foreign loans, it will be forced to conduct its trade in roundabout ways to avoid seizure" (p. 158), and, in commenting on the prevalence of rescheduling rather than outright repudiation, they state that "there are few cases in which countries actually have been forced to move trade underground" (p. 159). ${ }^{5}$ Thus, there is some recognition in the literature of the creditors' implicit threat to seize the sovereign's tradeable goods or, more likely, the foreign exchange reserves or other assets generated from trade. For understanding the sovereign's incentives for repayment, however, of greater importance than the specific assets at risk may be the notion that the more "open" is the debtor country's economy, the more assets it has to lose to creditors. This idea parallels the view of some economists that a country's penalty for default is increasing in the size of its tradeable goods' sector. The difference, however, is that the threat of attaching assets is credible while that of imposing penalties may not be.

Recognizing that investments differ in their ability to generate foreign exchange that can be used to repay the sovereign's debt, we make the assumption that the enforceability of a country's repayment obligation is linked to its investment in export production. The tradeable goods' sector is viewed as generating assets, for example, foreign exchange reserves, which would be at risk to some degree in the event of default. If only revenues from international trade can potentially be seized by lenders, investment choices will affect the enforceability of the debt contract. Likewise, the lenders' threat of seizure of export revenue may discourage the production of tradeable goods. We assume that the sovereign allocates its endowment as well as any additional funds that are provided by lenders between the production of goods that can only be exported (tradeables) and production of goods that are suited only for domestic consumption (nontradeables). We emphasize that the issue of enforcement motivates our focus on the choice between producing tradeable or nontradeable goods, rather than that between investment or consumption. Enforcement of the renegotiation agreement may require sanctions if repayments are not made. As discussed before, ex post efficiency implies that sanctions are imposed only if export revenue is generated. Thus, a sovereign realizes that choosing the nontradeable technology puts creditors in a position where sanctions cannot lead to repayment, and therefore, will not be imposed. ${ }^{6}$

[^2]We emphasize that the debtor country's production decision influences the severity of the creditor's reprisal for default. In other words, it is the sovereign's decision to produce tradeables that provides the necessary credibility to the creditor's (implicit) threat of seizure of assets. ${ }^{7}$ Indeed, if the country produces only nontradeables, there is no credible threat. However, given that there is value to foreign trade, producing only nontradeables cannot be costless and there must therefore be a limit to their production.

We also emphasize the importance of a precommitment by the sovereign of its subsequent production decision. The precommitment in our model can be interpreted as the transfer to the lender of control over the sovereign's production decision, or more realistically, by the sovereign's involvement of a third party such as the International Monetary Fund (IMF) that can facilitate the precommitment. ${ }^{8}$ In this context, our analysis stresses the potential role of the IMF in enabling welfareenhancing renegotiation agreements to be realized. This view is also that of Claessens and Diwan (1990); we will discuss it in more detail in the concluding section.

In our model, sovereigns with external debt outstanding have the incentive to shift production toward nontradeables. The lender recognizes this incentive and may optimally forgive part of the debt; this "write-down" of the debt obligation could be Pareto-improving. We also show that further Pareto-improvements are possible with the provision of new money by the lender for investment by the debtor. More importantly, if the sovereign surrenders control over production (explicitly or implicitly by precommitment) in exchange for new money, a Pareto-improvement relative to debt forgiveness alone is always possible. ${ }^{9}$ Finally, precommitment by sovereigns to a production decision is shown to be even more important in debt renegotiation when lenders have an informational disadvantage relative to debtors. Without such a precommitment, a pooling agreement may be the only one that is possible and new money is generally not optimal.

In the next section, we describe our model and first analyze it under the assumption of symmetrically informed agents. Subsequently, we allow sovereign debtors to have an informational advantage. The remaining section concludes our paper.

[^3]
## 1. THE MODEL

We cast our analysis in a four-date model. At date -1 , the sovereign obtains funding from a (foreign) lender. We assume that the loan is needed to "unearth" the sovereign's endowment $E$; consider this a developmental activity. For instance, we could view this as an investment in education, or more literally, as a nationalresource "unearthing" activity that precedes the country's actual production decision. The country realizes its endowment at date 0 , and subsequently (at date 1 ) it allocates the endowment between the production of tradeables and nontradeables. ${ }^{10}$ The debt contract between lender and sovereign stipulates that a repayment $D$ is due at date 2 , that is, when export revenue is realized. ${ }^{11}$ The lender faces an agency problem in that the repayment will depend on the country's subsequent production decision. Only if the production of tradeables generates sufficient export revenue can the loan be repaid. ${ }^{12}$ Investment decisions in our model can be thought of as being made by a central planner since we assume the existence of a coordination mechanism that can set aggregate levels of production of tradeable and nontradeable goods. Alternatively, we can take the view that the sovereign provides a system of taxes and subsidies to induce the desired allocation of resources. In what follows, we abstract from relative price changes since they are not crucial for our results. ${ }^{13}$

An important determinant of the sovereign's production decision is the level of its endowment. The endowment, $E$, has a two-point support, that is, $E=\underline{E}$, with probability (w.p.) $q$, and $E=E$, w.p. $(1-q)$, with $0<E<\bar{E}<\infty$. Given our structural assumptions, we will show that if the level of endowment is high $(E=\bar{E})$, there is no doubt about the country's ability to repay the loan. However, if $E=\underline{E}$, the sovereign not only has fewer resources to allocate to the production of tradeables and nontradeables, but as we will show, it also has an incentive to invest these resources in nontradeables. This decision obviously further undermines the sovereign's ability to repay its loan. Given that the country makes the investment decision at time 1 , and that this decision affects the lender's expected return on the existing loan, the lender may have an incentive at time 1 to renegotiate the existing loan. That is, the loan need not be in default to result in renegotiation at time 1 , and the possibility of renegotiation is priced in the original loan agreement, but this is of no importance to our analysis.

[^4]
## Model Formulation and Solution with Internal Financing

To facilitate our analysis, we assume that discrete technologies are used to produce both tradeable and nontradeable goods. ${ }^{14}$ We have already defined the total endowment of a country that is available for production as $E \in\{\underline{E}, \bar{E}\}$. We denote by $N$ and $T$, respectively, the quantities of nontradeables and tradeables that are produced. The country has a linear utility function that is separable in the equally weighted tradeable and nontradeable goods, and prices are unity; that is,

$$
\begin{equation*}
U=N+T \tag{1}
\end{equation*}
$$

The per unit resource costs of producing nontradeables and tradeables are $F^{N}$ and $F^{T}$, respectively, and are step functions. That is, we have

$$
F^{N}=\begin{array}{ll}
c_{1} & \text { for } N \in(0, \bar{N}]  \tag{2}\\
c_{2} & \text { for all nontradeable goods exceeding } \bar{N}
\end{array}
$$

and

$$
F^{T}=\begin{array}{ll}
d_{1} & \text { for } T \in(0, \bar{T}] \\
d_{2} & \text { for all tradeable goods exceeding } \bar{T}
\end{array}
$$

In most of our analysis, we assume that $\bar{T}$ is sufficiently high that it does not constrain $T$. The specification in (2) implies decreasing returns to scale in the production of both goods. We make two assumptions for our analysis:

$$
\begin{align*}
& c_{1}<d_{1}<c_{2}<\operatorname{Min}\left\{1, d_{2}\right\}  \tag{A1}\\
& 0<E-c_{1} \bar{N}<d_{1} \bar{T}, \text { for all } E \in\{\underline{E}, \bar{E}\} \tag{A2}
\end{align*}
$$

Assumption (A1) implies that at low production levels, the nontradeable good requires fewer resources than the tradeable good. However, (A2) guarantees that resources remain for the production of the tradeable good even if the endowment is low. We now state the sovereign's date 1 optimization program for its production decision:

$$
\begin{equation*}
\operatorname{Max}_{\{T, N\}} U=T+N \tag{3}
\end{equation*}
$$

s.t.

$$
\begin{aligned}
E \geq & \mathrm{c}_{1}[\operatorname{Min}\{N, \bar{N}\}]+c_{2}[\operatorname{Max}\{0, N-\bar{N}\}]+d_{1}[\operatorname{Min}\{T, \bar{T}\}] \\
& +d_{2}[\operatorname{Max}\{0, T-\bar{T}\}]
\end{aligned}
$$

$$
\begin{equation*}
T, N \geq 0 \tag{4}
\end{equation*}
$$

14. We could have specified the production technologies more generally (see also footnote 19) but this would have added substantial complexities without altering our conclusions qualitatively.
where $E \in\{\underline{E}, \bar{E}\}$. Given the conditions (A1) and (A2), the solution is

$$
\begin{align*}
& N^{o}=\bar{N} \\
& T^{o}=\left\{E-c_{1} \bar{N}\right\}\left[d_{1}\right]^{-1} \tag{5}
\end{align*}
$$

where the superscript ( $o$ ) denotes the optimal solution. Recall that the solution in (5) shows the sovereign's resource allocation in the absence of outstanding debt, and that our choice of production technology guarantees that the tradeable good is produced at the margin. We next take into account the impact of external debt (that is, the loan at date -1 ).

## The Effect of External Debt

We assume that the risk-free rate of interest and time discount rate equal zero. From (A1) and the utility function (1), it is evident that the sovereign optimally invests its entire endowment; that is, the "expected return" on tradeable and nontradeable goods' technologies is strictly positive. Thus, the endowment will not be used to replace the outstanding debt at the outset (that is, at date 1 ).

The existence of external debt imposes a repayment obligation on the sovereign and may reduce its incentive to produce tradeables; that is, by switching to nontradeables it may reduce its future repayments. Indeed, as is shown in the next lemma, a loan repayment obligation $D$ may alter the sovereign's production plan if its endowment is low. However, for a sufficiently high endowment, its production decision is unaffected.

Lemma 1 (Production Plan with External Debt): The sovereign continues to choose the (first best) production plan given in (5) if $\mathrm{E}>\mathrm{c}_{1} \overline{\mathrm{~N}}+\mathrm{d}_{1} \mathrm{c}_{2}\left[\mathrm{c}_{2}-\mathrm{d}_{1}\right]^{-1} \mathrm{D}$. However, whenever this inequality is reversed, the sovereign chooses

$$
\begin{align*}
& \mathrm{N}^{*}=\overline{\mathrm{N}}+\left\{\mathrm{E}-\mathrm{c}_{1} \overline{\mathrm{~N}}\right\}\left[\mathrm{c}_{2}\right]^{-1} \\
& \mathrm{~T}^{*}=0 \tag{6}
\end{align*}
$$

Proof: As before, the sovereign starts out allocating $c_{1} \bar{N}$ of its resources to the production of nontradeables. After producing $\bar{N}$ nontradeables, the sovereign chooses tradeables if

$$
\left[E-c_{1} \bar{N}\right]\left[d_{1}\right]^{-1}-D>\left[E-c_{1} \bar{N}\right]\left[c_{2}\right]^{-1} ;
$$

otherwise it continues to produce nontradeables. The results in the lemma now follow immediately. Q.E.D.

Let the repayment obligation on the loan contract be $D=D^{o}$. We will assume that for a sovereign with a high endowment realization, the inequality in the statement of Lemma 1 holds, and that it therefore follows the production plan in (5) enabling it to repay the lender. As Lemma 1 shows, a sufficiently low endowment realization will
induce defection to the production plan given in (6) and thus eliminate any repayment capacity. We make the following assumption:

$$
\begin{equation*}
\underline{E}<c_{1} \bar{N}+d_{1} c_{2}\left[c_{2}-d_{1}\right]^{-1} D^{o}<\bar{E} . \tag{A3}
\end{equation*}
$$

Condition (A3) captures the two relevant states: with a high endowment realization ( $E=\bar{E}$ ) export revenue is generated and repayment is made, and with a low endowment realization, $(E=\underline{E})$, the production decision is distorted and no repayment is forthcoming.

We can now devote our attention solely to the low endowment realization. This is the state in which, for example, a negative external economic shock has caused the endowment to be low and created a serious debt overhang problem with adverse production incentives. No such problem exists with a high endowment realization.

Propositon 1 establishes that a lender optimally grants debt forgiveness to a sovereign with a low endowment realization.

Proposition 1: In a debt renegotiation agreement that offers only debt forgiveness, the lender optimally agrees to lower the repayment obligation to $\mathrm{D}^{*}<\mathrm{D}^{\circ}$ where

$$
D^{*}=\left[c_{2}-d_{1}\right]\left[d_{1} c_{2}\right]^{-1}\left[\underline{E}-c_{1} \bar{N}\right] .
$$

Proof: From the condition $E>c_{1} \bar{N}+d_{1} c_{2}\left[c_{2}-d_{1}\right]^{-1} D$ in Lemma 1, note that for any level of $D>\left[c_{2}-d_{1}\right]\left[d_{1} c_{2}\right]^{-1}\left[\underline{E}-c_{1} \bar{N}\right]$, the sovereign chooses the production plan in (6) and the lender is not repaid. However, if the lender reduces $D$ to $D^{*}$, the sovereign is willing to adopt production plan (5) and the lender obtains $D^{*}$. Note that debt forgiveness in excess of $D^{o}-D^{*}$ will strictly reduce the lender's payoff. Q.E.D.

The intuition for Proposition 1 is straightforward. If the repayment obligation is too high, the sovereign will not produce tradeables, thereby precluding any repayment for the lender. Consequently, the lender will offer to forgive debt to the level of $D^{*}$.

It is noteworthy to emphasize that in our formulation, a lump sum repayment $D$ is identical to a proportional export revenue-related repayment obligation. ${ }^{15}$ This can be easily understood since discrete linear production technologies imply that the choice of technology depends on the total repayment obligation, rather than on the repayment obligation at the margin.

## New Money and the Sovereign's Precommitment of Production Choice

We have emphasized that the lender faces a moral hazard problem. Since a sovereign maximizes its own utility, this decision may have an adverse effect on the

[^5]lender's utility. Nevertheless, the lender might be willing to offer more than debt forgiveness; for instance, it may choose to provide additional (new) funds to augment the sovereign's endowment if this enhances the lender's expected (net) payoff. In turn, the sovereign may be willing to eliminate the moral hazard problem by credibly precommitting to a production choice simultaneous with the renegotiation agreement. The sovereign might do so if it is better off with precommitment than with only debt forgiveness. Of course, the lender must also be at least as well off with such an agreement as with one that includes only debt forgiveness. ${ }^{16}$

In this section we take the debt forgiveness solution as stated in Proposition 1 as the benchmark and analyze how new money and precommitment can improve upon this benchmark. We first identify the condition for having a lender offer additional funding in the absence of precommitment.

Proposition 2: Starting at the optimal repayment obligation after debt forgiveness, $\mathrm{D}^{*}$, a lender is willing to provide new money without obtaining the sovereign's precommitment of production if

$$
\begin{equation*}
\mathrm{c}_{2}>\mathrm{d}_{1}\left[1-\mathrm{d}_{1}\right]^{-1} \tag{9}
\end{equation*}
$$

Proof: An additional unit of (new) money adds to the sovereign's endowment $E$ and may only be beneficial to the lender if it enhances the sovereign's export revenue. Note that the tradeable good is the marginal good produced at $D=D^{*}$ (see Proposition 1) and that at that level of $D$ the sovereign is indifferent between producing tradeables or additional nontradeables. A minimum condition for a unit of new money to be allocated by the sovereign to producing tradeables is $\left[d_{1}\right]^{-1}-1>\left[c_{2}\right]$ ${ }^{-1}$. This takes into account the lender's minimum acceptable repayment obligation of $\$ 1$ (given our assumption of a zero risk-free rate of interest) on each unit of new money. We now have condition (9). If this condition is satisfied, export revenue increases by more than the minimum repayment obligation, that is, $\left[d_{1}\right]^{-1}>1$ (see A1), and thus the lender should be willing to provide new funds. Q.E.D.

Generally, the restriction (9) holds for a sufficiently efficient tradeable goods technology, that is, for small $d_{1}$. However, we can obtain a much stronger result if new money is combined with the sovereign's precommitment of its production decision.

Proposition 3: A debt renegotiation agreement can be attained that Paretodominates an agreement involving only debt-forgiveness if the sovereign can credibly precommit its production choice and if new money is included in the agreement.

[^6]Proof: We prove this result by perturbing the solution $\left(D^{*}\right)$ that involves only debt forgiveness. From Proposition 1, we note that the total repayments to the lender with debt forgiveness alone are $D^{*}=\left[c_{2}-d_{1}\right]\left[c_{2} d_{1}\right]^{-1}\left[\underline{E}-c_{1} \bar{N}\right]$. We start at this solution and introduce $\$ 1$ of new money and the sovereign's precommitment. Assume that the (mutually agreed upon) precommitment prescribes the production of tradeables at the margin. By (A1), the return on the new money is $\left[d_{1}\right]^{-1}-1=$ $\delta$, with $\delta$ strictly positive. The Pareto-optimality of new money plus commitment now follows immediately since the renegotiation agreement can specify that the return $\delta$ on each dollar of new money is shared between sovereign and lender, and the sovereign repays each dollar of new money. Both parties benefit from the agreement. Q.E.D.

The intuition for Proposition 3 is straightforward. A sovereign that switches technology from tradeables to nontradeables causes a social wealth loss; it reduces the joint wealth of sovereign and lender. If a sovereign could credibly commit not to switch technology after a debt renegotiation agreement is signed, both parties can be made better off. One might wonder if the sovereign would be willing to provide a precommitment of its production choice in the absence of new money. Generally, it would not do so. The sovereign recognizes the inability of the lender to obtain repayment if only nontradeables are produced. It can credibly threaten to switch to the nontradeable technology if the lender does not agree to the lower repayment obligation, $D^{*}$. The lender therefore optimally agrees to $D^{*}$. At $D^{*}$, production decisions are first best. Thus, precommitting to a production decision cannot improve the wealth of the sovereign, and hence, it will refuse to do so. With new money, however, the lender has a potentially powerful instrument that appeals to the sovereign and might entice it to remove the moral hazard problem by precommitment. ${ }^{17,18}$

It is useful to contrast Propositions 2 and 3. According to Proposition 2, the provision of new money can be valuable for the lender if incremental export revenue is generated that exceeds the loan. This, however, only obtains if condition (9) is not violated; otherwise, the lender cannot attain a positive return on the new money invested. We can contrast this with Proposition 3 which shows that new money combined with the precommitment of the production technology always Paretodominates a pure debt relief agreement. That is, even if condition (9) is not satisfied, new money plus precommitment will still be optimal.

If condition (9) holds, an interesting question from the lender's perspective is whether new money should be provided with or without the sovereign's precommitment. It can be shown that the lender can be made strictly better off if it obtains the sovereign's precommitment in return for the new money. The intuition for this result is readily understood. If new money is provided without the sovereign's precommit-

[^7]ment, the latter can capture a large portion of the rents earned on the new funding because the lender knows that the sovereign will otherwise be tempted to switch to the production of nontradeables. Thus, the lender may only marginally improve upon the repayment $D^{*}$ that it obtains with debt relief alone. By linking new money to precommitment, however, the flow of rents to the sovereign can be reduced. That is, $D^{*}$ can effectively be increased without offsetting the preference of the sovereign for an agreement with new money and precommitment vis-à-vis one that offers only debt relief.

The previous arguments show that a lender always prefers precommitment in a debt relief package. An interesting issue is whether a debt relief package in which the sovereign obtains new money without precommitment is a likely outcome of the renegotiation. It obviously would prefer this arrangement, and the lender would still obtain a positive return on its new funding provided that (9) holds. Part of the explanation is that the sovereign can certainly not "force" the lender to give new money without being willing to precommit. Consider the following implied bargaining position of the lender and the sovereign. The sovereign realizes that in the absence of new money and precommitment, only the benchmark pure debt relief agreement is feasible. Then, it will accept a take-it-or-leave-it offer that guarantees new money conditioned on precommitment as long as it provides a marginally higher utility than the benchmark agreement. In the next corollary (to Proposition 3), we summarize our discussion and state the features of the optimal debt renegotiation agreement.

Corollary to Proposition 3: The lender optimally chooses to include new money conditioned on a precommitted production decision in the renegotiation agreement. It will set the conditions such that the sovereign is at least as well off with the package including new money and precommitment as it is with debt forgiveness alone. The sovereign optimally accepts this renegotiation agreement.

## Debt Forgiveness, New Money, and Sovereign Precommitment under Asymmetric Information

Regardless of how much debt relief and/or new money is offered by the lender, one would expect a sovereign debtor to demand more. We have already shown that the optimal repayment obligation in the renegotiation agreement will depend, in part, on the efficiency of the sovereign's production technology. To the extent that such efficiency is unobservable to the lender, there is an incentive to misrepresent it. Alternatively, a sovereign might be privately informed about the size of its endowment. Consequently, in equilibrium, a renegotiation agreement must not provide the sovereign with an incentive for misrepresentation. In this section, we assume that a sovereign is privately informed of the efficiency of its tradeable goods' technology and examine the implications for renegotiation in this environment.

For simplicity, we assume that a sovereign can be either type $G$ (good) or type $B$ (bad). The lender knows that a sovereign is of type $G$ with probability (w.p.) $\gamma$ and type $B$ w.p. $(1-\gamma)$. Type $G$ has the superior technology for the production of the
tradeable good; therefore $d_{1}^{G}<d_{1}^{B}$. From Proposition 1, it follows immediately that $D_{G}^{*}>D_{B}^{*}$ where $D_{G}^{*}\left(D_{B}^{*}\right)$ is the repayment obligation after debt forgiveness for a sovereign of type $G(B)$. Indeed, type $G$ can produce more tradeable goods from the same level of resources; thus, it can sustain a strictly higher repayment obligation. ${ }^{19}$

The sovereign's efficiency in producing tradeables, however, is private information. This would suggest that the renegotiation loan agreement can only pool countries, either at $D_{G}^{*}$ or $D_{B}^{*} \cdot{ }^{20,21}$ Specifically, if $\gamma$ is sufficiently high, the lender optimally presumes that the sovereign is type $G$, even if it results in the sovereign's not repaying any debt if it turns out to be type $B$. However, if $\gamma$ is low, the latter consequence is too costly and the lender would choose to pool at $D=D_{B}^{*}$.

An interesting question is whether output-contingent contracts could provide an improvement. Since we have assumed export revenue to be observable, we could envision a scheme in which the lender tells the sovereign that its obligation is $D_{G}^{*}$ if export revenue is high, and $D_{B}^{*}$ if it is low. While we have excluded outputcontingent contracts, they may indeed do better. Two qualifications should be made, however. First, the output-contingent contract pair $\left\{D_{G}^{*}, D_{B}^{*}\right\}$ that lenders would choose in the absence of information distortions may not be incentive compatible under asymmetric information; a sovereign of type $G$ may optimally decrease its production of tradeables in order to mimic $B$. Thus, debt forgiveness becomes a less efficient instrument. Second, from a strictly contract-theory point of view, one could distinguish between contractability of export revenue and verifiability. By excluding output-contingent contracts, we have excluded contractability. However, we have allowed for some degree of verifiability since we assume that the sovereign repays the lender if there is export revenue.

The previous arguments emphasize that with asymmetric information, debt forgiveness becomes less efficient. In addition, it is interesting to note that under asymmetric information, new money without precommitment becomes ineffective and generally counterproductive. To understand the general argument, note that one would like to use new money to make incentive compatible a contract in which a type $G$ sovereign receives little and a type $B$ receives more debt forgiveness. One would thus offer new money to the sovereign type that needs to be induced to accept less forgiveness (that is, type $G$ ). However, at its optimal level of debt forgiveness, $D_{B}{ }^{*}$ a type $B$ is indifferent between producing tradeables and additional nontradeables. It will therefore always switch to a contract that gives new money (and then, of course, choose to produce nontradeables). Thus, new money may not enable a
19. Our discrete specification of the production technology can be reinterpreted as an approximation of a continuous production technology. (Continuously) decreasing returns to scale imply $c_{1}=\hat{c}_{1}+f(N)$ and $d_{1}=\hat{d}_{1}+g(T)$ with $\partial f / \partial N>0$ and $\partial g / \partial T>0$. Assume that an interior optimum exists, and equals $\left[N^{*}, T^{*}\right]$. Then, at the optimum $\left.\left\{\partial\left\{c_{1} N\right\} / \partial N\right\} / \partial\left\{d_{1} T\right\} / \partial T\right\}=1$. That is, given the linear (equal weight) utility function, at the optimum, the resource costs of the marginal units are equal. It follows now immediately that for $d_{1}^{G}<d_{1}^{B}$, we have $T_{G}^{*}>T_{B}^{*}$. Depending on the relative magnitudes of the substitution and income effects, nontradeable goods production may be higher or lower for the more efficient sovereign, that is, $N_{G}^{*} \gtrless N_{B}^{*}$. In our discrete specification, however, the income and substitution effects cancel out.
20. Assuming that players will announce their true types if they are indifferent between alternative announcements, there does not exist a separating equilibrium $\left\{D_{B}^{*}, D_{G}^{*}\right\}$ since both $B$ - and $G$-type sovereigns will claim to be type $B$.
21. It is straightforward to show that for the lender, $D_{B}^{*}$ is strictly better than any $D \in\left(0, D_{B}^{*}\right)$, and $D_{G}^{*}$ is strictly better than any $D \in\left(D_{B}^{*}, D_{G}^{*}\right)$ or $D \in\left(D_{G}^{*}, D^{o}\right)$.
lender to distinguish between types. As an illustration, the next lemma shows this with noncontingent contracts.

Lemma 2: Assume that (9) holds for country G but not for country B. ${ }^{22}$ An agreement involving repayment obligations, $\mathrm{D}_{\mathrm{G}}^{*}$ and $\mathrm{D}_{\mathrm{B}}^{*}$, and new money, $\mathrm{M}_{\mathrm{G}}>0$, for country G , cannot be a separating equilibrium.

Proof: Note that if $D_{G}^{*}$ and $D_{B}^{*}$ are offered simultaneously, $B$ is indifferent between them while $G$ strictly prefers $D_{B}^{*}$. Hence, $D_{B}^{*}$ is not incentive compatible since sovereign $G$ will mimic $B$. If offered new money, $M_{G}$, sovereign $G$ may no longer prefer $D_{B}^{*}$ to $\left\{D_{G}^{*}, M_{G}\right\}$, for some $M_{G}>0$. But now, $\left\{D_{G}^{*}, M_{G}\right\}$ is not incentive compatible. That is, since $B$ is indifferent between $D_{B}^{*}$ and $D_{G}^{*}$, it will strictly prefer $\left\{D_{G}^{*}\right.$, $\left.M_{G}\right\}$ to $D_{B}^{*}$. The statement in the lemma now follows immediately. Q.E.D.

Lemma 2 indicates that more than debt forgiveness and new money is needed to get truthful revelation. Generally, the renegotiation agreement may have to include the sovereign's removal of the moral hazard problem by precommitment. Under asymmetric information, this is particularly valuable because new money invested in tradeables is more valuable to a type $G$. This type is therefore willing to accept less debt forgiveness in return than a type $B$ would demand. Indeed, a type $B$ may choose not to commit because its inefficient tradeable goods' technology makes new money less valuable and the commitment more costly.

## 2. CONCLUSION

We have analyzed a debt renegotiation agreement between a lender and sovereign borrower. Our focus was on the moral hazard effect from the debt overhang on a sovereign's production decision that is made after the debt obligation is renegotiated. Central to our analysis is the interaction of debt relief, new money, and the sovereign's precommitment of its production decision within an optimal renegotiation agreement. The moral hazard element that we explicitly recognize is the sovereign's choice between producing tradeable and nontradeable goods. The export revenue arising from the production and sale of tradeables and the lender's ability to "seize" a fraction of these export receipts is assumed to allow at least limited enforcement by the lender of a debt (renegotiation) agreement. This imposes an implicit cost upon the production of tradeable goods. We have shown that, as a consequence, a sovereign may reduce its production of these goods which in turn reduces export revenue and its repayment capacity and consequently the lender's ability to enforce the agreement.

We have examined the problem in an evironment where both parties are identically informed, as well as in one where the country is endowed with relevant private information. Our analysis shows that under symmetric information, a renegotiation agreement involving some debt forgiveness, new money, and the precommitment by the sovereign of the allocation of resources in production is favored by the lender; in
22. This is not essential; condition (9) may hold for both countries as well. If (9) does not hold for either country, the lender may always abstain from offering new money.
addition, the agreement can be designed so that it always Pareto-dominates pure debt relief. In the absence of such precommitment, an agreement with new money may Pareto-dominate one with debt relief alone.

Allowing the sovereign debtor to have private information concerning the efficiency of its production technology makes the removal of the moral hazard element in production an even more important feature of the renegotiation. Without the precommitment, the only agreement that may be feasible is one that does not recognize the differences in technologies; that is, only a "pooling" agreement may be possible. In addition, providing new money without precommiting the production decision is generally not optimal when there is private information. Precommitment may facilitate the design of an agreement that is specific to the sovereign borrower.

While we recognize that our model is stylized, we believe that it demonstrates the importance of recognizing the interrelationship of the multiple contract features that typically have been analyzed in isolation in the literature. Furthermore, it stresses the necessity of a mechanism to enable the sovereign to precommit its future allocation of resources in production. We view the IMF and the World Bank as agencies that potentially can facilitate such a precommitment. The involvement by lenders of an international agency in the renegotiation of their sovereign debt may be useful in terms of promoting credibility (see also Claessens and Diwan 1990). However, the important issue is why the debtor's precommitted production decision is potentially more credible when the IMF is a party to the agreement. To the extent that a sovereign views precommitment as a valuable contract feature, ex post deviations can be credibly punished by the IMF and the World Bank by exclusion of such features from future renegotiations with any lenders. An individual lender may be incapable of enforcing the sovereign's precommitment, and consequently, it may not be credible; an agency that is a party to all renegotiations can provide the necessary credibility. This appears to us to be a more appealing role for these institutions than that of providing funding for debt and debt-service reductions as envisioned under the Brady initiative. Certainly, the observed unwillingness of many banks to provide further credit unless the subject countries adopt IMF proposals for reform, including particular allocations of resources among different sectors, is suggestive of our view. ${ }^{23}$

Finally, we emphasize the distinction between tradeable and nontradeable goods for its implications for the credibility of the enforcement mechanism as well as the design of the debt renegotiation agreement itself. Our analysis would predict that countries that have defaulted and have been unable to reschedule their debts will be observed to shift resources toward the production of domestically consumed goods. It could help explain why, historically, some countries have pursued export-oriented production strategies, and others have not.
23. An international agency may also promote efficiency. For example, the IMF may operate as a "delegated monitor" that specializes in a monitoring technology that can be used on many debtors simultaneously and intertemporally, thereby being potentially less costly than individual monitoring by lenders.

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[^0]:    The authors express their appreciation for valuable comments to two anonymous referees.

    1. Myers (1977) was the first to note the distortion of investment choice due to existing firm leverage, while Jensen and Meckling (1976) emphasized the adverse incentive effects when insiders (the sovereign in our case) issue claims to outside investors.

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[^1]:    2. This is the basic idea of the so-called "Brady initiative." See also Sachs (1988); Krugman (1988); Giammarino and Nosal (1988); Froot, Scharfstein, and Stein (1989).
    3. Diwan (1990) focuses on the sovereign's terms of trade, the choice between domestic consumption and investment in either exports or import-substitutes, and on the effects of different types of shocks that result in default and possible renegotiation. In contrast, we take aggregate investment as fixed at the time of renegotiation. Cohen and Sachs (1986) are mainly concerned with the intertemporal pattern of growth of a sovereign borrower and do not deal with the allocation of resources to exports and importsubstitutes.
    4. See Hellwig (1986), for example, for a discussion of the time inconsistency of applying sanctions.
[^2]:    5. Eaton (1990) also recognizes the possibility of lenders seizing sovereign-owned assets that are located abroad and reviews the various issues involved with enforcing loan contracts with sovereigns.
    6. The lender's threat of seizure of the defaulting country's (tradeable) goods in our model is analogous to the threat described in the literature of rationing the country form the world capital markets. For credibility, both threats must not be capable of being circumvented by the sovereign's use of its private
[^3]:    sector for trade or borrowing. For our purposes, however, the key distinction between the two "penalties" is that the creditor's seizure of tradeable goods is certainly time consistent while exclusion from the credit markets may not be.
    7. It should be noted again that our discussion of the seizure of exports is meant to be a stylized way of capturing the idea that a country's production (and sale) of tradeable goods gives rise to assets abroad that have some risk of being seized.
    8. The idea that precommitment can be used to eliminate moral hazard is well known in the sovereign debt literature. Cohen and Sachs (1986) recognize the moral hazard when the sovereign makes the production decision after the loan is granted. Therefore, they assume that both the sovereign's borrowing and investment decisions are made simultaneously; this method would be equivalent to a precommitment on the investment decision. The precommitment in our model, however, is part of an optimal rescheduling agreement. Examples of the use of precommitments that deal with sovereign debt issues are Aizenman (1988) and Claessens and Diwan (1990).
    9. Froot (1989) also shows that a combination of debt relief and new money may dominate pure debt relief. However, he does not consider precommitment and focuses on the "traditional" distinction between consumption and investment.

[^4]:    10. Implicitly, we assume here that directly allocating the (initial) loan to the production of tradeables and nontradeables is suboptimal. That is, "unearthing" the endowment first is strictly (expected) value enhancing.
    11. We assume that a simple debt contract is employed. We could envision a more complex, or comprehensive contract with repayment obligations based on the endowment realization, $E$. The incomplete contracting literature (see, for example, Williamson 1975 and Allen and Gale 1992) has given a variety of reasons why we observe missing contingencies in contracts. Possible explanations involve transactions costs as well as agency costs associated with partially observable events. For a discussion of why sovereign financing is likely to be in the form of bank loans, see Hellwig (1986).
    12. The debt is therefore risky and thus the face value includes an amount to account for a default premium.
    13. Note, however, that unless a central planner dictates resource allocation, relative prices need to adjust to enable the growth of the export sector and enable the transfer to creditors. See Diwan (1990).
[^5]:    15. We can interpret a lump-sum repayment as price indexation and distinguish it from schemes that are like output indexation. Since the exogenous parameters are constant, the lump-sum payment is a constant as well. Previous studies have established that with (continuous) decreasing returns to scale, a
[^6]:    lump-sum repayment obligation is better than output indexation because an additional marginal unit of production is not taxed with a lump-sum payment, but is taxed with a proportional obligation (like output indexation). Under asymmetric information, output and price'indexation are difficult to compare.
    16. The situation we have in mind is one in which new money plus precommitment of production is only included in the debt renegotiation agreement if it is mutually beneficial to make it an integral part of the agreement. If "new money" could have been negotiated separately (independently from the existing debt) with identical implications for both parties, then we do not consider it part of the renegotiation agreement.

[^7]:    17. In Diwan (1990), producing tradeables reduces default risk thereby raising the sovereign's credit ceiling and therefore the availability of funds. In our paper, it is the new money, possibly with a precommitment, that provides the incentive to produce tradeables.
    18. Diwan and Kletzer (1990) give an alternative rationale for a menu or package approach to debt relief. Such an approach may facilitate the optimality of debt buybacks by effectively imposing a tax on the capital gains on remaining debt.
