Resumption of Lending in a Reputational Model of Sovereign Debt[1]

by

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May 1989
Revised July 1989

ABSTRACT

We consider a model of international sovereign debt where repayment is enforced because defaulting nations lose their reputation and consequently, are excluded from international capital markets. Underlying the analysis of reputation is the hypothesis that borrowing countries have different, unobservable, attitudes towards the future. Some regimes are relatively myopic, while others are willing to make sacrifices to preserve their access to debt markets. Nations' preferences, while unobservable, are not fixed but evolve over time according to a Markov process. We make two main points. First we argue that in models of sovereign debt the length of the punishment interval that follows a default should be based on economic factors rather than being chosen arbitrarily. In our model, the length of the most natural punishment interval depends primarily on the preference parameters. Second, we point out that there is a more direct way for governments to regain their reputation. By offering to partially repay loans in default, a government can signal its reliability. This type of signaling can cause punishment interval equilibria to break down. We examine the historical record on lending resumption to argue that in almost all cases, some kind of partial repayment was made.

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1. Introduction

Since the seminal paper by Eaton and Gersovitz (1983), economists have become used to viewing international debt as a reputation game. Eaton and Gersovitz noted that there is no legal compulsion to repay a sovereign debt. They pointed out that sovereign loans could still be made--and repaid--based on a reputational argument. In this view countries repay because failure to do so will destroy their reputation as a good borrower, and they will not be able to borrow in the future.[2]

Although the model that they develop is able to explain many of the stylized facts of international lending, it abstracts from one of the important features of lending. In the Eaton and Gersovitz model, the tastes of the borrower are known with certainty by the lender. Moreover, after a default, the tastes of the borrower are still known, and have not changed. Thus the cut-off of lending that occurs after a default is due to the need to punish default in equilibrium rather than new information which lenders learn about the borrowers when they default. In practice, however, it seems likely that this sort of learning is quite important. In particular, defaulting may signal that defaulting countries have tastes that make them unreliable and additional loans should not be made.

In addition, the Eaton and Gersovitz model has two implausible implications. First, once a sovereign debtor defaults it will never again make payments on the defaulted debt. Second, the length of time before a country can resume borrowing after a default is arbitrary (above some lower limit) and independent of the borrowers behavior after default. In practice, however, permanent, complete, defaults are rare. Generally defaulters make at least a partial repayment on a loan, although in some cases after a very long period of not servicing their debts. Defaulters often make these partial payments as a condition for receiving new loans.

There are two straightforward ways to extend the Eaton-Gersovitz analysis to explain when defaulting countries may later be able to borrow. First, one could try to determine the punishment interval via the renegotiable-proof equilibrium concept of Pearce (1987), which provides a theoretically appealing

punishment interval in complete-information two player games. Second, one could assume that the lending game is restarted from time to time, perhaps after revolutions or major political upheavals.

Neither of these alternatives is very satisfactory. The punishment interval has varied too much in length, from a few years to several decades, for the renegotiable-proof equilibrium concept unless there are differences in the defaulters which make the intervals differ for different countries. As for restarting the game, there are examples in which the new loans were made to governments quite similar to those which defaulted. For example, some of the states in the United States defaulted in the nineteenth century but restored their reputation in international capital markets within a decade. In addition, neither of these additions to the model would help to explain why countries which have defaulted on loans would be willing to make partial payments on those loans at a later date.

The basic framework of Eaton and Gersovitz could be extended to explain partial repayments of debts. One could allow for more complicated history dependent strategies than they considered. We could allow the resumption of lending to depend on both the time since the last default and the a partial repayment of the debt. This approach seems to us unlikely to explain the high variablitiy of the length of time prior to the resumption of lending or the size of the partial repayments that have in fact taken place.

There are two alternitive approaches in the literature which generate partial repayments. Bulow and Rogoff (1989b) suggest that partial defaults could result from an explicit bargaining problem between borrowers and lenders after a shock is realized. If such is the case, however, the renegotiation should take place very rapidly, and there is no reason for credit to be denied a borrower after a default. In a similar vein, but without the explicit bargaining problem, Atkenson (1988) notes that the partial payments could be the result of an implicit contract between borrowers and lenders allowing state contingent payments in bad states of nature. The problem with this approach is that it is no longer clear observationally what a "default" is. A violation of the terms of the loan agreement may or may not be a default depending on the implicit con-tract. In addition, Atkenson derives a contract which borrowers will not choose to violate, suggesting that all of the defaults which seem to have occurred

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should be seen as the results of the implicit contracts.

At a more fundamental level we find reputation models of lending in which there is no asymmetric information unappealling. It seems strange for a borrower to be treated differently over time as a function of his histroy (as he must be if there is to be an equilibrium), even though his enviroment may be time stationary and thus his history signals nothing about him.

In this paper we take a new approach to these two issues. We start with a reputation model similar to that in Kletzer (1984), and introduce uncertainty about the borrowers' attributes. In our model borrowers can be one of two types: one relatively myopic, and the other relatively forward-looking. Lenders cannot observe the type of potential borrowers. This sort of complication has been considered in the credit rationing literature (see Jaffee and Russell (1976), and Stiglitz and Weiss (1981)), but has generally been ignored in the sovereign debt literature. An exception is the work of Detragiache (1989), which initially suggested this approach to us. Unlike Detragiache, we allow for the type of the borrower to change over time. (See Spatt (1983) for a related approach.) Thus lenders must try to infer borrowers' types from their behavior. It is this inference problem that can generate finite punishment intervals with partial repayments of debts.

We consider two possible equilibria of the model. First, we look at punishment interval equilibria. In these equilibria when a borrower defaults lenders know that it is myopic. Defaulting countries will not be able to borrow again for a time. As time passes, however, a defaulter's type can change back to being far-sighted. When enough time has passed to make the borrower sufficiently unlikely to be myopic, it will be able to borrow again. We suggest a natural duration for such punishment intervals.

Second, we consider signalling equilibria. When an honest government follows a dishonest one, it may find that it is unable to borrow due to the default of the previous government. By making a partial repayment on the previously defaulted loan, however, it is able to signal its type. As a result, it will make the partial payment and then be able to borrow again the following period.

We find that the possibility of paying a signal allows us to make a refinement argument which implies that the punishment interval equilibria can

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breakdown. Thus we might expect to see equilibria of the signalling sort. In Section 6 we look at some examples of real world defaults and find a number of cases that provide support for the model.

2. A Model of International Lending

Our model of international debt markets consists of two groups of agents: a large number of competing banks, and a country which wants to borrow from them. It makes no difference to our analysis whether there is one or many borrowers, and so we will assume that there is only one. The model has an infinite number of periods but we consider only short-term debt, so that the country borrows, invests in a project, the loan becomes due and then there is a possibility of further borrowing.

The principal hypothesis we make in this paper concerns our representation of the borrower's preferences. We assume that there are two possible types of preference: one type is effectively more myopic than the other. The most straightforward interpretation of our model is to suppose that foreign debt decisions are made by the government in power, but that the government changes in a random fashion. We assume that a government cares about the discounted expected utility of the representative agent only while it is in power, and that it takes into account its likelihood of survival in weighing the representative agent's future welfare. There are two types of governments, stable and unstable: the government in power can be deposed with probability p_s for the stable government and probability p_u for the unstable ($p_s > p_u$.) Given that a stable government has been deposed, the next government will be stable with probability q_s. If an unstable government is deposed, the probability that the next government will also be unstable is q_u. Thus the type of the government in power follows a Markov process with transition probabilities:

$$M = (m_{ij}) = \begin{bmatrix} p_s + (1-p_s)q_s & (1-p_s)(1-q_s) \\ (1-p_u)(1-q_u) & p_u + (1-p_u)q_u \end{bmatrix}$$

We assume that all of the elements of M are strictly positive and that the trace of M is greater than one.

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We assume that a regime ceases to exist once it is replaced. If a regime of the same type returns to power, it has a completely new identity, and consequently a regime cares only about the representative agent's consumption during its period in power. Accordingly, the stable and unstable regimes will have different effective discount rates: $p_s\beta$ and $p_u\beta$.

This model provides a tractable framework for the analysis of reputation. However, it is not intended to be interpreted literally as a representation of different governments. Rather, it forms a simple model of the 'character' of the group of decision makers which takes into account the fact that this character will tend to change over time. Indeed, it could be applied to analyze the decisions taken by a single person, although such semi-rational behavior is not commonly used in economic analysis of single-person decisions. Notice that in our model the transition to a new regime is unobservable.

In order to complete our description of the model we must give the initial probability distribution of types in the first period. We assume that this initial distribution is the same as the long-run steady-state level δ_{LR}, which is given by

$$\delta_{LR} = m_{21} / (1 - m_{11} + m_{21}). \tag{1}$$

At the beginning of the period, the government decides how much to borrow. This amount b of a nonstorable good is invested in a domestic production process. The output of the process, realized later in the period, is given by $f: R^+ \rightarrow R^+$. This output is also nonstorable. Notice that, for analytical convenience, we do not allow the borrower to consume the loan directly.[3] We assume that $f' > 0$ and $f'' < 0$ on an interval $(0, B)$, and $f(x) = f(B)$ on $[B, \infty)$. We also require that $f(0) = 0$ and $f'(0)_+ = \infty$. The purpose of assuming satiation at B is that a country which intends to default will borrow a finite amount B. The bound B is meant to capture the idea that there is only a finite amount that can be borrowed before the lenders realize that it is borrowing "excessively" (i.e. with no intention of repaying) although, as we explain below, a country's total borrowing cannot be observed directly by the lenders. The government must then decide whether or not to repay the loan plus interest that is owed the lender. The representative agent consumes the remainder.

The timing within each period is thus:

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|- - - - - - - - - - - - -|- - - - - - - - - - - - -|- - - - - - - - - - - - -|- - - - - - - - - - - -|
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choose b   Invest b   f(b) realized   default   consumption
given r   decision

This timing is convenient because a government cannot become myopic between
the time the loan is made and when it is repaid. Without this assumption we
would have to consider whether a myopic government would choose to default when
it came into power, or would repay the loan of the previous government in order
to default on a larger loan one period later.

The preferences of the representative consumer are given by:

$$\Sigma^{\infty}_{t=0} \ \beta^t \ U(c_t) \qquad\qquad\qquad\qquad (2)$$

We assume that U is strictly concave and C^2. For analytic simplicity we do not
explicitly model the other production opportunities, but we allow for negative
consumption, which means that the borrower is reducing consumption below the
level obtainable solely with domestic resources. This reduced consumption could
be used to pay old loans in default - a possibility which we consider below when
we discuss signalling equilibria.

Note that for simplicity we assume that the output from the investment
process is perishable; it cannot be held until the next period and consumed or
reinvested.

We make three assumptions about what the banks can observe and what
conditions they can make on the loan. First, we assume that they can observe
defaults. This assumption is uncontroversial. It implies that repaying a loan
could be incentive-compatible for a sovereign nation, because of the possibility
of being excluded from credit markets in the future. Second, we assume lenders
cannot monitor whether a country they make a loan to is also borrowing from other
banks. Thus, they cannot observe the amount borrowed. This assumption is
introduced primarily for reasons of tractability: it means that a bank decides
whether to lend and if so at what interest rate, but cannot impose credit
rationing. While the main thrust of our analysis does not depend on this
assumption, it greatly simplifies the range of possible strategies open to the
lenders. Third, we assume that lenders cannot directly observe the type of the
borrower, nor can they observe when a transition occurs. They can of course try

to infer the type from the lender's actions. This inference is the most important part of our model.

Let ρ be the lenders' opportunity cost of funds, and let the belief δ be their estimate of the probability that the government currently in power is stable. In each period a lender must first choose whether it is willing to lend to the country at all, and, if does lend, the interest rate it will charge. We restrict the lenders' strategies to be a stationary mapping from the belief to an indicator function as to intention to lend, ℓ, and an interest rate, r. Clearly, the set of strategies actually available to lenders is larger than this since they could condition their actions on any past events. Throughout this paper, punishment intervals should be viewed as being implemented via the lenders beliefs. Lenders assume that a borrower which defaults is unstable, and their belief gradually reverts to δ_{LR} according to the Markov process. After the belief rises above a given level, they are willing to lend again: this structure can be used to implement any punishment interval. While it seems natural to restrict the lenders strategy to be a stationary mapping from his prior in the separating equilibrium, there does not seem to be a compelling reason to do so in the case of the no default and no lending equilibria since the lender is not engaged in an inference problem here. The reason for restricting the lenders' strategies in this way is that in this paper we are primarily concerned with separating equilibria in which the lenders attempt to infer the borrower's type.

We observe certain notational conventions throughout. First, time subscripts are typically suppressed for the current period. Thus r denotes the value of the variable r at time t. The value of r at time t+1 is denoted r_{+1}, the value at time t+T by r_{+T}, and so on. Second, interest rates are written as gross rates, e.g. a 10% interest rate is written r = 1.1, not r = 0.1.

3. Punishment Interval Equilibria

The consumption level of the representative consumer in a period depends on whether or not the government chooses to default. Let c^n denote consumption if the government does not default, and c^d if it does. Then, $c^n = f(b) - rb$, while $c^d = f(b)$. The prevailing interest rate determines the optimal level of

borrowing which maximizes consumption given that the government is going to repay. This is given by the level of borrowing b* such that

$$f'(b*) = r \qquad (3)$$

Thus, a non-defaulting government's loan demand schedule is given by

$$b* = (f')^{-1}(r). \qquad (4)$$

The size of the loan in turn determines the representative agent's consumption level as a function of the prevailing interest rate:

$$c^n(r) = f(b*) - rb*. \qquad (5)$$

Note that since f is strictly concave on $[0,B]$ with $f'(0) = \infty$, the loan demand of a non-defaulting borrower is strictly decreasing in r. Since the interest payments for any given level of b are strictly increasing in r, it follows that the optimal level of consumption, $c^n(r)$, must be strictly decreasing in r.

If a government is going to default, it cannot raise the level of current consumption above $f(B)$. We assume that governments which intend to default borrow exactly B.

A. The Default Decision

The value of a stable regime's objective function if it does not default this period is given by

$$W^n(r) = U(c^n(r)) + p_s\beta W(r_{+1}), \qquad (6)$$

where

$$W(r) = \max \{W^n(r), W^d\}, \qquad (7)$$

and where W^d is the value of its objective function if it chooses to default next period. The value of W^d depends upon the response of the lenders. For example, in a trigger strategy equilibrium, it depends upon the length of the punishment interval. Say the interval is T-1. Following a default, the country will be excluded from borrowing in the international credit market until the T'th period after. In this equilibrium, the value of the stable regime's objective function if it chooses to default in the current period is given by:

$$W^d = U(f(B)) + (p_s\beta)^T W(r_{+T}). \qquad (8)$$

These equations define the alternative levels of welfare for the stable type. The unstable regime's possible levels of welfare are similar, and are denoted Z. In other words, Z is the unstable type's value function, Z^n is the

value of the objective if it chooses not to default and Z^d is the value if it does default. The difference between Z^n or Z^d and W^n or W^d is that p_s is replaced by p_u to take into account the lower probability of surviving for the unstable borrowers.

The stable (and the unstable) regime will optimally choose to default whenever $W^d > W^n$ $(Z^d > Z^n)$. Under weak conditions, which will be satisfied in equilibrium, the unstable type will default in any situation in which the stable type defaults. First notice by our use of the notation $W(r)$ we implicitly assume that future interest rates are a function only of today's rate. If we further suppose that r is constant, then the stable regime will optimally choose to default whenever:

$$U(f(B)) - U(c^n(r)) > p_s\beta[1-(p_s\beta)^{T-1}]W(r), \tag{9}$$

where, as defined in (7) above,

$$W(r) = \max \{[\Sigma^\infty_{t=0} (p_s\beta)^t U(c^n(r_{+t}))], [\Sigma^\infty_{t=0} (p_s\beta)^{Tt} U(f(B))]\}. \tag{10}$$

The stationarity of the regime's problem implies that for a fixed interest rate it will choose either to always default or to never default, depending on which of the terms in (9) is larger. A similar condition holds for the unstable regime, with p_s replaced by p_u. The difference in utility for a stable regime between never defaulting and always defaulting is given by the difference between the two elements of the set in equation (10). We can write this difference as

$$\Sigma^\infty_{j=0} (p_s \beta)^{Tj} \{\Sigma^{T-1}_{i=0} (p_s \beta)^i U(c^n(r_{+i+j})) - U(f(B)) \}. \tag{11}$$

From equation (11), it follows that a regime is more likely to choose not to default as its probability of staying in power increases since the expression in brackets is increasing in p_s. This implies that in any situation, if the stable regime chooses the strategy of always defaulting then the unstable regime will also (in fact, since c^n is decreasing in r while the amount of consumption associated with default is independent of r, for sufficiently high r a government will always default.)

Clearly, if interest rates are not constant it will still be true that whenever the stable type defaults, the unstable type will too, so long as there is no 'reward' in the future for defaulting. We consider only equilibria where default does not lead to lower interest rates in the future. While there may be equilibria in which default leads to lower interest rates this could not plausibly happen when the lenders' strategies depend only on their beliefs about

the type of borrower.

Thus, there are three types of possible equilibria in the model: (1) Default never occurs, (2) the stable regime repays loans, while the unstable regime always defaults, and (3) both regimes would default if given the chance, but no lending actually takes place.

B. No Default Equilibrium

The assumption that the lending market is competitive implies that the market interest rate will equal ρ if loans are always repaid. There will exist a trigger strategy equilibrium of the model with punishment interval T, in which neither the stable or unstable regimes ever default, whenever at interest rate ρ, the unstable regime is willing to repay the loan. In other words, we must have:

$$\Sigma^{\infty}_{i=0} \ (p_u\beta)^i \ U(c^n(\rho)) \ - \ U(f(B)) \geq 0. \tag{12}$$

This inequality simply says that even if the borrower were known to be unstable, there would be a trigger strategy equilibrium with lending.

C. No Lending Equilibrium

The model always has a no-lending equilibrium in which banks do not lend because they believe borrowers would not repay, and countries would default if they were given loans because they think they will not be given further loans in the future regardless of their behavior today. However, if both types are sufficiently myopic this is the only equilibrium of the model.

Clearly if the stable type is so myopic that even if the borrower were known to be stable there would be no lending, then we cannot have lending in equilibrium. However, this is not a necessary condition for no lending to be the only equilibrium. It could be that the negative externality imposed by the unstable borrowers makes equilibrium with lending impossible. This case is discussed in our analysis of separating equilibria.

D. Separating Equilibrium

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In a separating equilibrium, the stable borrowers repay loans while the unstable borrowers default. Repayment is incentive-compatible for the stable types because of a punishment interval during which a borrower in default has no access to international loan markets, but for the more myopic unstable types this is an insufficient deterrent. When a borrower defaults, the banks infer that it has become unstable. During the punishment interval the lenders' belief that the regime is unstable gradually reverts towards the population mean so that, at the end of the interval, it is quite likely that the country is stable.

Since a strategy for a lender is a function from this belief to a lending decision and an interest rate. (See Section 2 above.) When the belief that the type is stable is sufficiently strong, the bank will start to be willing to lend at an interest rate reflecting the beliefs.

The evolution of beliefs in this type of equilibrium is as follows. The potential borrower either has an outstanding loan to repay, in which case the repayment decision will provide information about the type, or the borrower was excluded from capital markets and no new information has been received, in which case the beliefs will be updated according to the Markov process.

Recall that δ is the belief the type is stable. On the one hand, if the country borrowed last period and repaid the loan, then $\delta = m_{11}$. On the other hand, if the country defaulted last period, $\delta = m_{21}$. In these two cases, the bank has received information about the regime and updates accordingly.

If the country was not borrowing last period, because it was excluded from international capital markets, then no new information has been received. The belief is updated according to the Markov process governing the evolution of the regime:

$$\delta_{+1} = m_{11}\delta + m_{21}(1-\delta) = (m_{11} - m_{21})\delta + m_{21}. \tag{13}$$

Our assumptions on M ensure that this belief will converge monotonically to the long-run steady state, δ_{LR}. Since this is a first-order constant coefficient difference equation, convergence to the long-run steady state occurs when $|m_{11}-m_{21}| < 1$, which follows from our assumption that all the elements of M are positive. Monotone convergence occurs because $m_{11} > m_{21}$, which is equivalent to our assumption that the trace of M is greater than one.

Whenever lending takes place, competition among the banks will ensure that they make zero profits. When a bank makes a loan, therefore, the present value

of the amount of money to be repaid, multiplied by the chance of repayment, must equal the amount of the loan. Normalizing the size of the loan to one dollar we have

$$\rho = r\pi(\delta) \tag{14}$$

where $\pi(\delta)$ is the chance of repayment. Notice that $\pi(\delta) < \delta$. $\pi(\delta)$ is given by the beliefs over types and the fact that the stable type repays while the unstable type defaults, correcting for the extra amount of money borrowed by defaulters. Stable regimes borrow $b*(r)$ while unstable ones borrow a larger amount B, so that the proportion of funds borrowed by the unstable ones is larger than their frequency in the population:

$$\pi(\delta) = \delta b*(r) / [\delta b*(r) + (1-\delta)B] \tag{15}$$

It follows that the equilibrium interest rate in a period where lending does take place is a decreasing function of the belief that the borrower is stable. The greater the chance it is stable, the more likely it is to repay and hence the lower the interest that needs to be charged. In separating equilibrium, we write $r(\delta)$ to denote this equilibrium interest rate. For given δ, $r(\delta)$ is defined by the unique solution to equations (14) and (15).

When lending first resumes after a punishment interval, this rate is therefore $r(\delta_{+T})$. If the loan is repaid, then in subsequent periods, the rate falls to $r(m_{11})$. The fall in the rate is caused by the jump in the borrower's reputation due to repayment of the loan. Loosely speaking, a newly reinstated borrower must at first pay a premium interest rate before it regains its former reputation. Since our model has only two types, the reputation is regained in just one period.

Thus, our model, like that of Detragiache (1989), captures the commonly observed phenomenon that interest rates depend on past performance. In our model, however, this effect does not occur only in the initial two periods, and it is possible for a country to restore its reputation.

Given these interest rates, we can compute the value to the borrower of defaulting versus not defaulting. With this time-profile of interest rates, the regime will choose either to default until it is replaced, or to repay until it is replaced. We write W^D and W^N for the utilities of these strategies. Note that these are special versions of the value functions defined above, W^d and W^n, which were the values of defaulting and not defaulting, respectively, for one

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period only and then taking whatever actions were optimal from then on.

The reason for restricting our attention to W^D and W^N is that in our environment the interest rate after a resumption is always the same, and the interest rate after a loan is repaid is always the same. As a result, if it is optimal to default once at a given interest rate, it is always optimal to default, and visa versa. Thus the optimal level of utility for the country will be either W^D or W^N.

Making the appropriate substitutions, one obtains:

$$W^N(r(\delta_{LR})) = U(c^n(r(\delta_{LR}))) + \Sigma^{\infty}_{t=1} (\beta p_s)^t U(c^n(r(m_{11}))) \qquad (16)$$

in the first period of the model, and

$$W^N(r(\delta_{+T})) = U(c^n(r(\delta_{+T}))) + \Sigma^{\infty}_{t=1} (\beta p_s)^t U(c^n(r(m_{11}))) \qquad (17)$$

after an interval of no lending, and

$$W^N(r(m_{11})) = \Sigma^{\infty}_{t=0} (\beta p_s)^t U(c^n(r(m_{11}))) \qquad (18)$$

during a period of lending. Notice that W^D depends on T but not on r:

$$W^D(T) = \Sigma^{\infty}_{t=0} (\beta p_s)^{Tt} U(f(B)) \qquad (19)$$

Similarly, we define Z^D and Z^N for the unstable type.

For fixed punishment interval T, there are four possible types of equilibrium. (Of course, if some of the expressions below hold as equalities rather than inequalities, then more than one type of equilibria exists.)

<u>Case (i)</u>: $W^N(r(\delta_{LR})) > W^D(T)$ and $Z^N(r(\delta_{LR})) > Z^D(T)$.

In this case we cannot have a separating equilibrium, because both types would choose to repay at the interest rate compatible with that type of equilibrium. No default is the only equilibrium for the given punishment interval. The equilibrium interest rate will be ρ, and both types will pool and repay the loan.

Notice that the second condition is stronger than

$$Z^N(\rho) > Z^D(T), \qquad (20)$$

which says that a no-default equilibrium is possible, but not necessarily the only equilibrium.

<u>Case (ii)</u>: $W^N(r(\delta_{LR})) > W^D(T)$ but $Z^N(r(m_{11})) < Z^D(T)$.

Here it is possible to have separating equilibrium initially. After default occurs, the condition for separating equilibrium to resume T periods later is

(iia) $\qquad W^N(r(\delta_{+T})) > W^D(T)$

In this case we have a separating equilibrium. However, it is possible that

(iib) $W^N(r(\delta_{+T})) < W^D(T)$

in which case we have initial separation, but lending cannot resume after the first default. The problem is that T periods after a default, the borrower is still not likely enough to be a stable type. As a result, the interest rate which would be charged would not be low enough for a stable borrower to be willing to repay. Thus lenders will not choose to lend again after T periods, and there will be no separating equilibrium. As discussed below, however, there would be a separating equilibrium for large enough T.

Case (iii): $W^N(r(\delta_{LR})) > W^D(T)$ but $Z^N(r(\delta_{LR})) < Z^D(T) < Z^N(r(m_{11}))$.

Here an unstable regime would choose to default in the initial period, but would not choose to do so if it followed a stable regime. We have the same two subcases as in case (ii). If the inequality of (iia) holds then we asymptotically have no default, but there would be default in the first period. In the subcase in (iib), however, those countries which default in the first period would never repay in the resumption after T periods, and so the separating equilibrium would again break down. As in case (iib), for T large enough there would be a separating equilibrium.

Case (iv): $W^N(r(\delta_{LR})) < W^D(T)$

Here even the stable type wants to default, so we cannot have a separating equilibrium. In this case, if there were a separating equilibrium the banks would believe that if they made a loan, they would have to charge $r(\delta_{LR})$ because the unstable types would default - but then even the stable types would default.

Notice that this case is independent of the inequality

$Z^N(\rho) > Z^D(T)$,   (21)

which states that a no-default equilibrium is possible. If it holds, then there is a no-default equilibrium, in which the banks believe that both types would repay, which would allow them to charge a lower interest rate ρ at which both types would repay. If on the other hand

$Z^N(\rho) < Z^D(T)$ (22)

no lending is the only equilibrium. Notice that this sub-case includes, but does not imply, that

$W^N(\rho) < W^D(T)$ (23)

which says that at the cost of capital, even the stable types would default. Thus, it may be that lending even to the stable types is impossible in

equilibrium, because of the externality imposed on them by the unstable types.

We turn next to analysis of the equilibria as T varies. As T becomes longer, the utility of a default strategy falls, so the right hand sides of the above inequalities fall. In addition, δ_{+T} rises towards δ_{LR} so the interest rate after a punishment interval falls. Thus, as noted above, in cases (ii) and (iii) there are separating equilibria for large enough T. It may also happen that as T tends to infinity, the separating equilibrium disappears and is replaced by no-default equilibrium.

In summary, the model will typically have multiple equilibria, depending on the length of the punishment interval, and may also have multiple equilibria for a given punishment interval. Our focus in this paper is separating equilibria. We argue that among the separating equilibria, the equilibrium with the shortest interval consistent with asymptotic separation is the salient equilibrium for economic analysis. We denote this interval T_{min}.

Although longer punishment intervals cannot be ruled out, the most reasonable equilibrium is clearly that with a punishment interval of T_{min}. In order to show that shorter intervals cannot be ruled out, consider a separating equilibrium where the punishment interval T is longer than T_{min}. Since the lender's strategy is defined as a stationary mapping from the prior, this means not extending a loan if the prior is below δ_{+T}. Assume that a lender deviates and makes a loan in period $T_{min}+1$ of the punishment interval. In our punishment interval equilibrium, both types of borrowers should borrow and then default. The stable regieme will prefer to default even if not doing so would signal that he was stable, so long as the number of periods remaining until he can borrow is not greater than T_{min}. Since in this case lenders gets no information from the loan, there is no effect on the prior. As a result, the borrowers must wait until the end of the T periods to get additional loans. Note that this does rule out punishment intervals longer than $2*(T_{min}-1)$.

In contrast, on a heuristic level it seems possible that by extending a loan after $T_{min}+1$ periods, a lender might indicate to borrowers a move to a new equilibrium with a shorter punishment interval. Moreover, if communication between borrowers and lenders were possible, then one would expect them to agree on a punishment interval of T_{min}.

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4. Signalling Equilibria

Above we have considered equilibria where repayment is incentive-compatible for the stable regime because of a punishment interval during which a defaulting borrower has no access to international capital markets. During this interval, the beliefs of potential lenders evolve so that, at the end of the interval, they consider it sufficiently likely that the country has now reverted to a stable type that they are willing to resume lending.

This suggests that a country which reverts to a stable type during the punishment interval should want to signal this fact to lenders and thereby regain access to loans before the interval expires. Furthermore, there is an obvious way for countries to try to do this. They can pay an amount of money-- interpreted as partial repayment of the previously defaulted loans--in order to be able to obtain loans again the following period. If this amount of money is large enough, then unstable regimes will be unwilling to pay it even if by doing so they can regain their reputation. If the signal is small enough, however, stable regimes will be willing to pay it to regain their reputation. In this section we show that such equilibria exist for certain values of the exogenous parameters of the model.

In practice, it may not always be possible for this type of signaling to occur, because countries differ in their availability of foreign currency reserves. In some cases, a country may not be able to raise enough foreign currency to make the signal. This fact may explain why in practice countries make such signals over several periods (see Section 6). An additional problem is that although a stable regime might be able to raise the cash, it may be easier for another, unstable, country with more export goods available, to make the signal. Thus we should expect the size of the signal required to depend on the characteristics of the country's economy.

While partial repayment is the only type of signal which we consider in our model, it is only one way in which such signaling could take place. One could consider models in which an austerity program, or other activity which imposes an immediate cost on the country, could serve the role of signal. The important characteristic is that the signal should impose an immediate cost on

the country while the benefit, access to credit markets, should be delayed. It is not important that the immediate cost to the country should also be a benefit to the (previous) lenders. In the case of a partial repayment signal considered here, we must take account of the partial repayments in our calculations of the rate of return to lenders.

Moreover, it is possible that the signal, while costly initially, could be costless overall. For example, stable countries may invest more domestically, perhaps as result of government tax policy. They would do this simply because they are less myopic. So long as the unstable countries do not find it worthwhile to mimic this investment level, the first-best (from the point of view of the government, which is more myopic than individuals) investment level can serve as a signal of stability. If the unstable regimes would want to mimic the stable ones, the stable regimes can distort their investment upwards to prevent that. In that case, domestic investment could serve as a signal, but not a costless one. A similar case arises in Aizenman (1987) in which countries shift investment into the expert sector in order to allow lenders to impose a larger cost on them if they default. The difference between our approach and Aizenman's is that we view the investment distortion as a signal, whereas in Aizenman's view it is a bond for good behavior.

A. The Equilibrium

In the signalling equilibrium we consider, failure to repay a loan leads lenders to think that a country is governed by an unstable government. Having defaulted on a debt, the only way to lead the lenders to believe that a government is stable is for it to make a partial repayment S of the outstanding debt. We assume that S is constant, although in principle this need not be the case. S could, for example, rise to a ceiling level over the periods after a default. However, we will argue below that equilibria with a constant signal are more reasonable.

In this equilibrium, governments in default which revert to stability pay the signalling cost to regain their reputation for being stable, and then repay the loans they are offered. In contrast, the unstable governments in default prefer not to make the partial repayment, and if they have stable reputations

when they come to power, they will borrow the maximum amount and then default.

In the signalling equilibrium, there is no way to regain access to the loan market without making a partial repayment. If a country simply waits for its reputation to improve, as in the punishment interval model considered above, it will find that there is no improvement in its reputation over time. This is because in signaling equilibrium the stable types always pay the signal, while the unstable types never do. Therefore the lenders believe that those who do not make the payment must be unstable, and refuse to lend to them.

We start by analyzing the lenders' behavior. As before, lenders know that borrowers who repay are stable, and so remain stable until the next period with probability m_{11}. In the signalling equilibrium, lenders also know that governments which make a partial repayment S are stable. They too will remain stable with probability m_{11}. Thus, when lending a dollar to a government with a stable reputation, the probability of complete repayment is the same as in the punishment interval equilibrium. In the signalling equilibrium, however, the lender also gets partial payments in later periods from governments which become unstable, default, and later revert to stability. We assume that when a partial repayment is made, it is divided equally among the lenders of the last loan made. Then the present discounted value of the expected repayments on a loan of one dollar is:

$$[\delta b*/(\delta b*+(1-\delta)B)][r/\rho]+[(1-\delta)B/(\delta b*+(1-\delta)B)][m_{21}(S/B)/(\rho(\rho-m_{22}))] \quad (24)$$

where b* and B have the same interpretation as before. The detailed derivation is given in the Appendix. Solving this expression for the loan interest rate, $r_s(\delta)$, yields:

$$r_s(\delta) = \rho + [(1-\delta)B/\delta b*] [\rho - (m_{21}(S/B))/(\rho-m_{22})] \quad (25)$$

Thus the interest rate is the cost of funds, ρ, plus a risk premium to take account of the probability of default in the next period, less a discount for the partial repayments lenders can expect to receive in the future.

As in the punishment interval equilibrium, we can solve equation (25) and the equation giving the stable borrowers' optimal loan size:

$$f'(b*) = r$$

to obtain the equilibrium loan size b* and the equilibrium interest rate $r_s(m_{11})$. As before the unstable borrowers will borrow the maximum amount B.

We turn now to the borrower's behavior. In the signaling equilibrium, two incentive-compatibility conditions must be satisfied by the unstable government. First, it must be the case that an unstable type, which comes to power after a government which had access to international credit markets, chooses to default rather than carry on borrowing and repaying:

$$U(f(B)) \geq [1/(1-p_u\beta)] \; U(c^n(r_s(m_{11}))) \tag{26}$$

Second, we must also consider the possibility that an unstable government chooses to pay the signal, in order to borrow a large amount and then immediately default. Thus the unstable type must prefer to remain in default rather than adopt a pay-default strategy, which requires:

$$[1/(1-(p_u\beta)^2)] \; [U(-S) + p_u\beta \; U(f(B))] \leq 0 \tag{27}$$

Note that the S such that the above l.h.s. expression is equal to zero is increasing in p_u. If p_u is small, so unstable borrowers are very myopic, then S can be very small. On the other hand, if $p_u\beta$ is near one, hence the myopic government is not very myopic, then S would be about the same size as B.

In contrast, the stable government must choose both to repay loans when it borrows, and also to pay the signal to regain its reputation. Thus:

$$[1/(1-p_s\beta)]U(c^n(r_s(m_{11}))) \geq$$
$$\mathrm{Max}\{[1/(1-(p_s\beta)^2)][U(f(B))+p_s\beta U(-S)], \; U(f(B))\} \tag{28}$$

and

$$U(-S) + [p^s\beta/(1-p_s\beta)] \; U(c^n(r_s(m_{11}))) \geq 0. \tag{29}$$

Using the inequality in (29) it is straightforward to show that the larger of the two elements of the set on the right-hand side of (28) is the former, and so (28) can be rewritten as:

$$[1/(1-p_s\beta)]U(c^n(r_s(m_{11}))) \geq [1/(1-(p_s\beta)^2)][U(f(B)) + p_s\beta U(-S)] \tag{30}$$

The above inequalities define three important values for the signal (there would be a fourth, but the inequality in (26) is independent of S). First, S must be higher than the maximum amount which the unstable government would be willing to pay in order to be able to borrow (and default) again. If this condition does not hold, then the unstable governments will pay the signal, and the lenders will get no information from it. We call this level of the signal S_1. It is simply the level of the signal which makes the inequality in (27) hold with equality. Second, S must also be larger than the minimum level of S which makes the stable government choose to repay rather than play pay-default. If

this condition were not satisfied, then the stable types would pay the signal, but would not repay their loans. In such a case even if the lenders knew that those who paid the signal were stable, they would still be unwilling to lend to them. This level of the signal, S_2, is the one which makes the inequality in (30) hold with equality. Finally, the signal must be below the amount which would make the stable government unwilling to pay it. If S were larger than this, even stable governments would be unwilling to pay it, and so lending would never be resumed after a default. This upper bound, S_3, is the level of S which makes the inequality in (29) hold with equality.

Any S in the interval [Max{S_1,S_2}, S_3] can serve as the signal in a Nash equilibrium. If this interval is empty--i.e. either S_1 or S_2 is larger than S_3--then no signalling equilibrium of this type is possible.

So far we have not discussed how the signaling equilibrium is initiated. One possibility is that in the first period stable governments must pay the signal in order to be able to borrow in the second period. In this case, however, the payment cannot be interpreted as partial repayment on an earlier default.

Alternatively, we could assume that lenders' initially offer loans at interest rate $r_s(\delta_{LR})$. Because the long run probability of a government being stable is below the probability of it remaining good for a period, this loan interest rate is higher than the rate that will prevail for borrowers in later periods. Thus unstable governments will surely choose to default in period one:

$$U(f(B)) > U(c^n(r_s(\delta_{LR}))) + [p_u\beta/(1-p_u\beta)] \, U(c^n(r_s(m_{11}))) \tag{31}$$

where the inequality follows from (26). For the same reason, however, the stable government may choose to default in this first period. Stable governments will not default if:

$$U(c^n(r_s(\delta_{LR}))) + [p_s\beta/(1-p_s\beta)] \, U(c^n(r_s(m_{11}))) \cdot$$
$$\geq U(f(B)) + p_s\beta U(-S) + [(p_s\beta^2)/(1-p_s\beta)] \, U(c^n(r_s(m_{11}))) \tag{32}$$

or,

$$U(c^n(r_s(\delta_{LR}))) + p_s\beta U(c^n(r_s(m_{11}))) \geq U(f(B)) + p_s\beta U(-S) \tag{33}$$

If the inequality in (33) does not hold, then lenders know that any loan they make in the first period will be defaulted on. As a result, they make no loans. If no loans are made in the first period, however, then the situation in the second period is the same as in the first, and so loans are never made.

This case is discussed in more detail below when we compare signaling equilibria with punishment-interval equilibria.

B. A Refinement

The intuitive criterion, developed in Cho and Kreps (1987), is a refinement of the Nash equilibria of signalling games. A signalling game is a one-shot game in which an informed player moves prior to an uninformed player who can observe the move of the informed player and from it try to infer his information. The intuitive criterion provides a method for ruling out equilibria based on implausible out-of-equilibrium beliefs.

To see if an equilibrium satisfies the intuitive criterion, one chooses an out of equilibrium move, or deviation, for the informed agent. Given this deviation, one then calculates the best responses of the uninformed player for each possible set of beliefs about the type of the informed player, and the payoffs for each type of informed player under each possible best response. One then partitions the types of informed players into two groups, one being those types which are strictly better off making the equilibrium move, and the other being the agents who could conceivably be made better off by deviating. Since it is clear that the deviation would not be made by a type in the first group, one recalculates the best responses of the uninformed player for each set of beliefs putting zero weight on the types which would be worse off making the deviation. One then calculates the payoffs to the remaining types given these possible best responses. The equilibrium fails the intuitive criterion if there is a type with an equilibrium payoff strictly less than the payoffs resulting from the deviation.

In determining the plausible sub-game perfect Nash equilibria of our model we extend the intuitive criterion to repeated games of the type we consider, which are not signalling games. The force of the intuitive criterion still applies, however. We rule out as implausible any Nash equilibrium which requires a lender to believe that an out-of-equilibrium move by a borrower might have been made by a type of borrower who could not possibly benefit by making such a move, given the best responses of the lender to his move. Our assumption that the lenders strategies are a stationary mapping from his prior, which is a

restriction both on and off the equilibrium path, allows the intuitive criterion to be effective in our model. In effect our stationarity assumption limits the best responses of the lender to be a subset of his possible best responses.

In general, the intuitive criterion is not compatible with stationarity, because the intuitive criteria in effect, argues that a sub-game cannot be viewed in isolation, but that the beliefs at that sub-game must be compatible with the context of the sub-game. However, we are imposing stationarity with respect to the lenders prior. The lenders prior takes into account the context of the sub-game. In this case, there is no conflict between stationarity and the intuitive criterion.

The above discussion of signalling equilibria identifies an interval of possible signal values which are consistent with the existence of an equilibrium. Any value of the signal larger than S_1, however, can be ruled out by appeal to our extension of the intuitive criterion. Consider a signalling equilibrium in which there is initial lending and the signal is greater than or equal to S_1. Now consider possible out-of-equilibrium moves by a stable government which succeeds an unstable government in default on a loan. If the government makes a partial repayment which is smaller than the equilibrium payment, but larger than S_1, then the payment should still signal that the government is stable. The reason is that, so long as the payment is larger than S_1, an unstable government could not be better off making the payment even if by doing so it could completely rehabilitate its reputation. Given that the payment could not have been made by an unstable government, however, lenders know that the government is stable. The stationarity assumption means that since the lenders were willing to lend to a borrower when their prior was m_{11}, then they are willing to do so again. Thus the stable type is strictly better off making the signal if it can thereby show that it is stable, and the equilibrium with a signal larger that S_1 fails our extension of the intuitive criterion.

Strictly speaking, this argument would not be correct if we did not assume that the lenders' strategy was a function only of their beliefs about the type of the borrower. For example, if the lenders believe that a stable regime which paid less than the equilibrium signal, S, was planning to default, they would optimally choose to not lend until they received a signal of S. Given that a stable regime expects to receive no future loans until they pay S, they would

optimally choose to default in the current period if they receive a loan. In
other words, since the no lending equilibrium always exits, it is always possible
in any proper sub-game off the equilibrium path.[4] Also, if the lenders'
strategies were not only functions of the beliefs then there would be some
conceivable situations where an unstable borrower could hope to benefit from the
signal, for example if the borrower thought that lenders always lend to any
country which pays a signal of $5 in 1975. This type of belief seems
implausible, especially in a separating equilibrium where the emphasis is on
distinguishing between the types. Hence, our restriction that strategies depend
only on δ, combined with our application of the intuitive criterion, may be
viewed as a way of dismissing such implausible beliefs.

It may seem surprising that the equilibrium signal is constant, rather than
rising over time after a default occurs. In effect this result means that the
borrower must repay a fixed fraction of the principal, rather than a fixed
fraction of the principal plus accumulated interest, in order to regain access
to the international credit market. The reason for this result is that in every
period - regardless of the time since default - the stable type of government
needs to pay only an amount sufficient to separate itself from the unstable type.

5. Signaling or Punishment Interval?

We have discussed two types of equilibrium for the model: the punishment
interval equilibrium and the signalling equilibrium. Our extension of the
intuitive criterion, however, allows us to eliminate the punishment interval
equilibria so long as a signalling equilibrium exists. Consider a punishment
interval equilibrium, with a punishment interval of T-1. In the last period of
the punishment interval, a stable government would like to signal that it is
good, if by doing so it could get an interest rate of $r(m_{11})$ in period T rather
than a rate of $r(\delta_{+T})$. On the other hand, since $Z^D(T) > Z^N(r(m_{11}))$, an unstable
government would not care, because it will default in period T if given loans
at either interest rate. Thus any payment at period T-1 would only be made by
the stable government. In that case, however, lenders should believe that the

signalling government is stable, and lend to it at the lower interest rate in period T. Thus the stable government would strictly prefer to make an infinitesimal payment at T-1, and the punishment interval equilibrium will break down.

On the other hand, there are values of the parameters for which there is no signalling equilibrium, but for which there is a punishment interval equilibrium. The above argument would still seem to imply that the punishment interval equilibrium is implausible. However, in this case, the signal would now not indicate that the borrower was going to repay a loan even if he was stable. Thus extending a loan would not be a best response on the part of the lenders. In this case the stationarity restriction off the equilibrium path seems unreasonable, and the punishment interval equilibrium seems to be the plausible equilibrium.

In order to find such an example, we must start by assuming that a punishment interval equilibrium exists. Thus it must be the case that if there is an infinite punishment interval, then the stable government would choose not to default in the first period. Thus:

$$U(c^n(r(\delta_{LR}))) + [\beta p_s/(1-\beta p_s)] \, U(c^n(r(m_{11}))) > U(f(B)) \tag{34}$$

There will be no signalling equilibrium, however, if one of the inequalities in (28), (29) or (32) is reversed.

First, note that the left-hand-sides of (32) and (34) are nearly equal if the size of the signal is sufficiently small. On the other hand, it is straightforward to show that the right-hand-side of the inequality in (32) is larger. The difference between the right-hand-side of (32) and the right-hand-side of (34) is

$$p_s\beta U(-S) + [(p_s\beta^2)/(1-p_s\beta)] \, U(c^n(r_s(m_{11}))) \tag{35}$$

But (29) implies that this is positive. Thus 'it is possible for (34) to be satisfied with (32) not satisfied. In this case, there would be a punishment interval equilibrium, but it would be impossible to start a signalling equilibrium with loans at time zero. This case would be particularly likely if the unstable government is very unstable because in that case the signal required to differentiate stable governments from unstable ones would be quite small.

This result could be overcome if we considered a signalling equilibrium in which there were no loans in the first period, but stable governments paid

the signal in order to be able to borrow in the second period. Even in this case, however, there can be cases in which no signalling equilibrium is possible, but there is a punishment interval equilibrium. For example, again assume that (34) holds, it does not follow that (28) will hold--i.e. that stable governments will not choose to play pay-default. To show this, rewrite (28) as:

$$[1/(1-p_s\beta)] \; U(c^n(r_s(m_{11}))) >$$
$$U(f(B)) + [p_s\beta/(1-(p_s\beta)^2)] \; [U(f(B)) + p_s\beta U(-S)] \qquad (36)$$

Given the argument above, the level of S is the signal that makes unstable governments indifferent about playing pay-default (i.e. S_1). Using this fact, we can write (36) as:

$$[1/(1-p_s\beta)]U(c^n(r_s(m_{11}))) >$$
$$U(f(B)) + [p_s\beta/(1-(p_s\beta)^2)][(p_s-p_u)\beta U(f(B))] \qquad (37)$$

Note that the last term on the right-hand side is positive. Now rewrite (34) as:

$$[1/(1-p_s\beta)] \; U(c^n(r(m_{11}))) >$$
$$U(f(B) + [U(c^n(r(m_{11}))) - U(c^n(r(\delta_{LR})))] \qquad (38)$$

Again consider the case in which the unstable government is very unstable, and so the signal is very small. In such a case $r(m_{11})$ and $r_s(m_{11})$ will be quite close, and the left-hand sides of (37) and (38) will be almost equal. For a sufficiently large value of B, however, the right hand side of (37) will be larger than the left-hand side. Thus we would again find that there was no signalling equilibrium. The problem here is that with a very small signal, and a large amount to be gained by defaulting, the stable government chooses to play pay-default rather than repay its loans. Thus the payment of a signal shows that the government is good, but not that it will not default.

6. Case Histories

In practice, defaulting on international obligations does not appear to irremediably ruin a nation's access to international capital markets. Many countries have not only been allowed to borrow a second time after a default, but have been able to default more than once and still reenter international

capital markets at a later date. As one would expect from the discussion of the signalling equilibria above, most countries made partial repayments on earlier loans before they were able to borrow again.

Three complications arise when one looks at real-world resumptions of lending. The first is that borrowers may not be able to pay a large enough signal in a single year to show that they are not myopic. The reason for the complication is clear: there is a limit to the country's export earnings, and the money for the signal clearly cannot be borrowed. There is no particular reason, however, for the signal to be paid in only one year. For example, a signal might consist of a small payment each year for several years, after which lending would be resumed.[5] In practice, countries which have defaulted are generally forced to resume service on some portion of the old debt and perhaps make some payments on the accumulated arrears of interest. Only after service has continued for some period does lending resume.

The second complication which may arise is that there may be more that two types. In particular, it seems to be the case that when lending resumes the loan interest rate is high for a time. This may reflect the lenders' residual uncertainty about the type of the borrower. Over time, if the borrower repays, this uncertainty should fade, and interest rates should fall.

Finally, in practice lenders have more information about the country's stability than we have allowed for in our model. For example, if a civil war is in progress, then lenders may believe the government is quite unstable, even if it has serviced its debts. Similarly, changes in the government--due perhaps to a revolution--may be observable in some cases, even though they are not in our model.

In this section we discuss a number of sovereign defaults and resumptions. Although the history of sovereign defaults is a long one, we will focus on Latin American and North American defaults in the nineteenth and twentieth centuries.

A. Latin American Defaults in the 1820's

In the 1820's, soon after they became independent of Spain, many Latin American countries borrowed abroad both for internal improvements and to cover government deficits necessitated by their high levels of military spending. In

the period 1826-28, eight of these countries defaulted: Argentina, Chile, Mexico, Peru, Gran Columbia (which would later become Columbia, Ecuador, and Venezuela), Costa Rica, Guatemala, Honduras, Nicaragua, and El Salvador. (See Marichal (1989), Table 2)

In all of these cases, the countries had to settle with the old bondholders before they were able to borrow again internationally. We will focus here on the largest of these defaults: Gran Columbia, Mexico, and Peru. The timing of the defaults, settlements and new loans are shown in Table 1.

Country	Default	Settlement	New Loans
Gran Columbia	1826		
Columbia		1861	1863
Ecuador		1856	1904
Venezuela		1859	1864
Mexico	1827	1888	1889
Peru	1826	1849	1853

Source: Marichal (1989)

Table 1

Peru had a debt of L1,816,000 plus interest arrears at 6%. Peru settled its debt in 1849 by issuing L1,800,000 of new bonds at a concessional 3% interest rate to partially pay the arrears on the debt. The remaining arrears were cancelled. Peru then succeeded in borrowing L3,000,000 in 1853 to fund its floating debt and make railway investments. In 1869-70 Peru was able to borrow over L12,000,000 to fund railway investment. (Marichal (1989), Tables 2 and Appendix A)

The case of Gran Columbia is complicated by the fact that the federation was dissolved after 1834. The three countries in the federation divided the federation's debt of L6,750,000 plus interest arrears as follows: Columbia, 50%; Ecuador, 21.5%; and Venezuela, 28.5%. Ecuador settled its share of the debt in 1855 by issuing land certificates for over L1 million of arrears, and issuing new bonds to refinance the principal and L400,000 of arrears. In addition, L400,000 of arrears were cancelled. Ecuador defaulted on the new bonds in 1868 without having borrowed any more funds abroad. Venezuela made a first attempt

at a settlement in 1840, but it defaulted on this agreement in 1847. A new settlement was reached in 1859 under which Venezuela issued new bonds to cover the original principal and other new bonds for the arrears. These bonds would ultimately pay 3% and 1.5% respectively, although they had even lower rates for the first year. New bonds had to be issued in 1862 to fund arrears of interest on the 1859 bonds. Nonetheless, this agreement allowed Ecuador to issue an additional L2.5 million of bonds in 1862-4. Unfortunately, Ecuador defaulted on these bonds in 1864-7. Columbia, which held the largest share of the Gran Columbia debt, followed a path similar to that of Ecuador. Its initial agreement was reached in 1845, and it was defaulted on in 1848. In 1861 a new agreement was reached with the bondholders. The agreement funded the debt at lower interest rates and supplied land as part of the package. Having reached an agreement on its old debts, Columbia borrowed an additional L200,000 in 1863, although a large offering in 1866 (L7,500,000) failed to find buyers in London. (Information on these debts comes from corporation of Foreign Bondholders (1928); the information in Marichal, Table 2, appears to be incomplete.)

The Mexican case is far too lengthy to relate here. (See Marichal (1989) and Turlington (1930) for a discussion.) In brief, the Mexicans made several preliminary attempts to pay at least part of the debt, but were unable to do so. In the 1860's the French, British, and Spanish succeeded in putting Emperor Maximilian in power. Maximilian's government serviced the debts in part, but when he was deposed the debts again lapsed. Finally, an agreement was reached in 1886 under which new bonds were issued to refinance the outstanding debt and part of the interest arrears with new bonds paying 1% in 1886, increasing by half a percent a year to 3% in 1890 and thereafter. In 1888 Mexico issued new bonds abroad to refinance its floating debt and buy back at a discount the bonds issued under the agreement of 1886. Having satisfied its old creditors, Mexico then borrowed L8,700,000 in 1888 and 1889 to fund railroad investment and redeem railroad subsidies.

B. United States States' Debts in the 1840's and 1850's

In the 1820's and 1830's American states increased their debt by more than thirteen times. These debts were primarily for two purposes. First, the success

of the Erie Canal had shown that state investment in internal improvements could be productive and profitable. Other states, primarily those in the North, attempted to emulate New York's success by building their own canals and, somewhat later, railroads. In contrast, southern states borrowed primarily to obtain the capital for banks. The southern states felt that their banking systems were insufficient, especially after the United States Bank was not rechartered. (See McGrane (1935), Chapter 1.)

Many of the bonds issued by these states were sold in London or Amsterdam. For example, the par value of the bonds of Pennsylvania--one of the most heavily indebted states--was $34.5 million in 1842. Of this, over $20 million was held in England, and an additional $1.8 million in Holland. Even France, which held $570,000 of Pennsylvania bonds, held more than any state other than Pennsylvania herself. (See McGrane (1935), p.71, footnote)

Unfortunately, the panic of 1837 and the failure of the United States Bank of Pennsylvania in 1839 caused great financial difficulties for the states. In the early 1840's nine states (Pennsylvania, Maryland, Illinois, Indiana, Michigan, Louisiana, Mississippi, Florida, and Arkansas) defaulted at least temporarily on their bonds. In the 1850's another state, Minnesota, was added to the list. All of these states but Florida and Mississippi eventually made some provision for their debts, although in many cases the debts were not paid off in full.[6] In addition, Arkansas failed to provide for payments on its bonds until after the Civil War. Florida, Mississippi, and Arkansas claimed that all or part of their bonds had been issued improperly and were not legal obligations of the state. The courts eventually decided that the Mississippi and Arkansas debts were indeed obligations of those states--the Florida bonds were not tested in court. (See McGrane (1935), Chapters 10-12.) However, the Eleventh Amendment to the Federal Constitution--which precludes suing a state without its consent--prevented the bondholders from forcing the states to pay. (See Scott (1893), Chapter 1.)

After the defaults of the 1840's, British investors became much more wary about American Securities. In 1842, when nine states were in default, the Federal government, which had never defaulted on its obligations, attempted to issue bonds in London, but was unable to find buyers. It was not until the mid to late 1840's that six of the defaulting states reached settlements with their

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bondholders. These settlements, however, quickly improved the reputation of both the states and the Federal government. By mid-1849, Pennsylvania bonds were selling in London at 80, up from a price of 33 a decade earlier. At the same time, Federal government bonds were selling above par. (See McGrane (1935), pp. 270-71)

The London Times' description of the defaults suggests the validity of the signalling model presented above. In 1846 the Times argued that the defaulting states would eventually choose to pay their debts because they "will deem it a not disadvantageous transaction to lay out ten or twenty millions...in purchasing a restoration of their forfeited respectability." (December 3, 1846, quoted in McGrane (1935), p. 166) Five months later, the Times noted that, "Sooner or later the people of Indiana will find themselves rich enough to buy a character and wise enough to know that it is worth the price." (April 29, 1847, quoted in McGrane (1935), p. 141)

It is clear from these quotations that the Times believed that by providing for their old debts these states could quickly rebuild their reputations and would then be able to borrow again. This seems to have been the case. For example, Minnesota borrowed to build railroads in 1858. In 1859 the railroads were unable to make the interest payments due on the bonds sold on their behalf. In 1860 the Legislature chose to default on the bonds and a constitutional amendment was passed to bar the state from ever making payments on the bonds without a vote of the people of the state. After the Civil War the state attempted to settle the debts, but either the bondholders or the people rejected the settlements offered them. In 1881 the State Supreme Court ruled the 1860 · Amendment to the state constitution in violation of the Federal Constitution. As a result, the governor and legislature were able to make an agreement with the bondholders to pay off the debt and accumulated interest at fifty cents on the dollar. In spite of this lukewarm evidence on the character of the people in the state, Minnesota was able to issue new bonds within less than a year. (See McGrane, Chapter 14, and Scott, Chapter 5)

It is interesting to note in these cases, that the--primarily British-- lenders had very little ability to impose costs on individual American states. In the first case, it is not at all clear what costs could have been imposed by Britain. Cutting off trade with individual states would have been virtually

impossible given that goods could be shipped through another state. New York never defaulted, and trade with the western states could easily be shipped through New York and then West via the Erie canal. In any case, the British government showed no interest in trying to force the American states to pay (in contrast to later interventions in Mexico, Egypt, and the Ottoman Empire). Lord Palmerston, the British Foreign Secretary stated when asked to send a memorial to Mississippi through the British Minister to the United States, "British subjects who buy foreign securities do so at their own risk and must abide by the consequences." (McGrane (1935), p. 202)

Thus, if Bulow and Rogoff (1989a) are correct, there should have been no repayments by the U.S. states. As we have seen however, seven of the nine defaulters eventually reached a settlement with their bondholders. It appears that the British lenders had only one weapon at there disposal: to deny the American defaulters further loans. Fortunately for the lenders this proved to be sufficient in most cases.

C. Latin American Defaults in the 1870's

After the defaults of the 1820's had been settled, foreign lending in Latin America resumed. The financial crisis of 1873, however, brought on a second wave of defaults. Between 1873 and 1876 eight Latin American countries defaulted on foreign bonds: Bolivia, Costa Rica, Guatemala, Honduras, Paraguay, Peru, Santo Domingo (now the Dominican Republic), and Uruguay. The defaulting countries were mostly relatively small debtors. Of the four largest Latin American debtors, only the largest, Peru, defaulted. Two others, Brazil and Argentina did not default, while Mexico still had not reached a permanent settlement on its earlier default. (See Marichal (1989), Table 4 and Appendix A)

By far the largest of the 1870's defaulters was Peru, which defaulted on bonds totalling almost L33 million in 1876. The settlement of this debt occurred in 1890 when the old debt and arrears were exchanged for stock in the Peruvian Corporation, a holding company owning the state railways, mining concessions and other state property. It is not clear what effect this exchange had on Peru's reputation in international debt markets. The City of Lima was able to issue bonds in London in 1911, but the country did not borrow abroad again until the

1920's. (See Marichal (1989), Table 4; Foreign Bondholders Protective Council (1945).)

There were three other countries which defaulted on a substantial amount of bonds: Costa Rica, L3,302,000; Honduras, L5,400,000; and Uruguay, L3,165,000. The experience of Costa Rica does not provide support for the signalling model presented here. Costa Rica defaulted in 1874. The debt was settled initially in 1885 by the exchange of the old bonds for new bonds equal to 50% of the old bonds. Costa Rica serviced the new bonds for ten years without issuing any new bonds. The country fell into default again in the mid-1890's. A new agreement with the bond holders was reached in 1897, but the government defaulted a third time in 1901. The debt was finally settled, and additional loans made, in 1911. The settlement included the right of a representative appointed by the bankers who floated the loan to collect the customs duties of the country in the event of a default. It seems likely that it was this institutional change, rather than the settling of the old debts, which allowed Costa Rica to borrow additional funds. (See Corporation of Foreign Bondholders, 1928)

The resumptions of Uruguay, which defaulted only briefly, and of Honduras, which remained in default for over 50 years, are more supportive of our signalling model. Uruguay defaulted on its interest payments for just two years, 1876-8. In 1878 the arrears of interest were funded with 1.5% bonds and the interest rate on the principal was reduced from 6% to 2.5% for five years. In 1883 the government refinanced the internal and external debt in a consolidated debt at 5%. Having met its obligations for an additional five years, the government was able to issue bonds totalling L6,235,300 at 6% for public works projects and redemption of internal debt between 1888 and 1890. Uruguay was unable to pay the interest on its bonds in 1891, but a new settlement was quickly reached with the bondholders. In 1896 the government was again able to obtain funds by issuing bonds in London. (See Corporation of Foreign Bondholders, 1908)

In contrast, Honduras, which defaulted in 1872 and 1873, did not reach an agreement with its bondholders until 1926. In this agreement, Honduras agreed to pay L1,200,000 in biannual installments over 30 years to redeem its outstanding liabilities (principal plus interest) of over L30 million. This agreement appeared to improve Honduras' reputation in international credit markets. In 1928 the government was able to obtain a loan of $1.5 million at

7% to fund its internal debt. It borrowed additional funds in 1931 and 1933.
All of these loans were repaid. (See Corporation of Foreign Bondholders, 1928
and 1953)

D. Latin American Defaults in the 1930's

During the Great Depression most Latin American countries defaulted, at
least in part, on their foreign debts. Haiti, Honduras, and Nicaragua all made
regular payments on their debts. Argentina avoided default by issuing interest
bearing certificates for part of the interest payments, and then subsequently
redeeming the certificates. Venezuela had no foreign debt on which to default
(Marichal (1989), Table 8; Foreign Bondholders Protective Council (1945)).

The countries that defaulted reached agreements with their creditors in
the 1940's and 1950's. (See Marichal (1989), Table 8; Foreign Bondholders
Protective Council (1967) indicates that settlements for Bolivia and Ecuador,
not shown in Marichal, were reached in 1958 and 1955 respectively.) It does not
appear that the settlements provided these countries with renewed access to
international credit markets. One reason for the lack of private borrowing may
be the substantial amounts of bilateral (especially Export-Import Bank) and
multilateral (IMF and World Bank) lending available to these countries after
World War Two. If this is the case, however, then it is hard to understand why
the countries agreed to any settlement at all, since the bilateral and
multilateral lending began before many of the countries had reached settlements
with their bondholders. It may be that the agreements with their old lenders
allowed them increased borrowing under the new lending regime.

7. Concluding Remarks

We believe that reputation models of international lending in which no
learning takes place are incomplete. By adding uncertainty about the attributes
of borrowers to the model we are able to explain an important characteristic of
real-world defaults which is otherwise hard to explain: the existence of partial
repayments prior to the resumption of lending after defaults. The partial

payment on old debts is a signal that the borrower is of a desirable type, and the resumption of lending is a response to that signal. The historical record prior to the 1930's supports our view that the settlement of old debts is a prerequisite to obtaining new loans. In some cases the settlements occurred a generation or more after the original default, but they were still made before additional international credit was obtained.

Appendix

A. Break-even Interest Rate

Here we derive the break-even loan rate in the signalling equilibrium, where S is the level of signalling payment. First note that $\delta b*(r) + (1-\delta)B$ is the expected amount borrowed given the lender's prior δ that the government is stable. As before we normalize the size of the loan to $1. Then the probability that loan went to a stable government, multiplied by the return in that case is:

(A1) $[\delta b*/(\delta b* + (1-\delta)B)] \, r/\rho$.

If the loan was made to an unstable government the loan is not repaid at the time, but the lender will receive a signalling payment of S/B when the borrower reverts to a stable type. The probability of this occurring after one period is m_{21}. The probability of the government in power first becoming stable after t periods is $m_{22}^{t-1}m_{21}$. Thus, the expected return to the lender, given that the loan was made to an unstable government is:

(A2) $[m_{21}(S/B)/\rho^2] \, \Sigma_{j=0}^{\infty} \, (m_{22}/\rho)^j$

Thus, the expected return to the lender from the one dollar loan is:

(A3) $[\delta b*/(\delta b* + (1-\delta)B)] \, [r/\rho] + [(1-\delta)B/(\delta b*+(1-\delta)B)] \, [m_{21}(S/B)/(\rho(\rho-m_{22}))]$

We can therefore write the loan rate as:

(A4) $r = \rho + [(1-\delta)B/\delta b*] \, [\rho - (m_{21}(S/B))/(\rho-m_{22})]$

The loan rate is lower in the signalling model than the punishment interval model by the present value of the expected signalling payment.

To complete the derivation of $r_s(\delta)$, we must also solve (A4) simultaneously with the equation that determines b*,

$b* = (f)^{-1}(r)$.

B. Derivation of Equations

1. Derivation of (30)

Equation (28) implies:

(A5) $[1/(1-p_s\beta)] \, U(c^n) \geq [1/(1-(p_s\beta)^2)] \, [U(f(B)) + p_s\beta U(-S)]$

which can be written as

(A6) $[1/(1-p_s\beta)] \, U(c^n) \geq [1/(1-(p_s\beta)^2)] \, U(f(B)) - [p_s\beta/(1-(p_s\beta)^2)] \, [-U(-S)]$

Equation (29) implies:

(A7) $-u(-S_1) < [p_s\beta/(1-p_s\beta)] \, U(C^n)$

(A8) $[1/(1-p_s\beta)] \, U(c^n) \geq [1/(1-(ps\beta)^2)] \, U(f(B)) - [p_s\beta^2/(1-(p_s\beta)^2)] \, \{[1/(1-p_s\beta)] \, U(c^n)\}$

Now, collecting terms

(A9) $U(c^n) \geq [1/(1-(p_s\beta)^2)] \, U(f(B)) > U(f(B))$

2. Derivation of (33)

(A10) $U(c^n(r(\delta_{LR}))) + [\beta p_s/(1-\beta p_s)] \, U(c^n(r(m_{11})))$

        $< U(f(B)) + \beta p_s U(-S) + [\beta p_s^2/(1-\beta P_s)] \, U(c^n(r(m_{11})))$

which implies:

(A11) $U(c^n(r(\delta_{LR}))) + \beta p_s U(c^n(r(m_{11})))$

                $< U(f(B)) + \beta p_s U(-S)$

3. Derivation of (35)

    $U(c^n(r(\delta_{LR}))) + [\beta p_s/(1-\beta p_s)] \, U(c^n(r(m_{11}))) > U(f(B))$

The inequality (A10) implies no SE.

    LHS in each case depends on βp_s. We want cases in which:

    $\beta p_s U(-S) + [\beta p_s^2/(1-\beta p_s)] \, U(c^n(r(m_{11})))$

        $> U(-S) + [\beta p_s^2/(1-\beta p_s)] \, U(c^n(r(m_{11})))$

            > 0

which is exactly (29).

Notes

1. We thank Andrew Foster, Timothy Guinnane, and especially George Mailath for helpful conversations. This paper was written in large part while Cole and English were staying at the London Business School. They thank the LBS for its hospitality.

2. Recently Bulow and Rogoff (1989a) have suggested that reputation may not be enough to justify international debts. They argue that payment-in-advance insurance contracts would always be preferable to repaying outstanding loans. We assume that such insurance contracts are not available in our model.
     See the discussion at the end of Section 6, part B, below.

3. Atkeson (1988) considers the lender's problem when they cannot observe what fraction of the loan is consumed.

4. In terms of the intuitive criterion, the stable government is not sure to be better off paying the signal in every equilibrium that could result. This post-signal equilibrium seems implausible to us for two reasons outside of the formal model. First, since the economy was in an equilibrium with lending before the signal, it seems unlikely to move to a no lending equilibrium after it. Second, the negotiations over the partial repayment of the earlier debts provide a way for the borrowers and lenders to communicate about the post-signal equilibrium.

5. Such an arrangement would have a side benefit if the probability of remaining good were not known. If the probability were low then the good government might not survive, and so the lenders would learn about the probability of remaining good. Note that there may also be equilibria in which there is a mixture of punishment interval and signal.

6. Mississippi is still listed as in default by the Corporation of Foreign Bondholders.

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