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Default, Settlement, and Signalling: Lending Resumption in a Reputational Model of Sovereign Debt

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ABSTRACT

This paper develops a simple model of sovereign debt in which defaulting nations are excluded from capital markets and regain access by making partial repayments. This is consistent with the historical evidence that defaulting countries return to international loan markets soon after a settlement, but after varying periods of exclusion.

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1. Introduction

Many nations have, at some point in their history, defaulted on their foreign debt and as a result lost access to international credit markets. In this paper we focus on nineteenth century bond defaults and subsequent resumptions. We provide historical evidence that the defaulting nations typically regained access after reaching settlements with their creditors. We develop a reputational model of sovereign debt that is consistent with these observations.

The histories of Latin American and U.S. state defaults and settlements in the nineteenth century have four common features. First, the settlements generally were not complete repayments; they included some debt forgiveness. Second, the countries in default were able to obtain new loans relatively soon after settling with their creditors. Third, the settlements appear to have been a prerequisite for obtaining new loans. Even after very long periods of default, in one case exceeding 50 years, countries settled old debts before obtaining new loans. Fourth, the penalty for defaulting appeared to be a cutoff of lending and not direct sanctions.

During this period creditor country courts applied sovereign immunity quite broadly (Alexander, 1987). As a result, creditors did not have the ability to seize debtor country assets or otherwise impose sanctions on defaulting nations—although creditor country governments were, in some cases, willing to intervene on behalf of creditors (Wynne, 1951). Because settlements could not be compelled, we argue that debtors agreed to them in order to signal their intent to repay future loans. To motivate the signalling, governments in our model can be one of two types, one more myopic than the other. The type of the government is assumed to follow a Markov process, and changes in a government's type are unobservable. We focus on equilibria in which the less myopic government services the debt, while the more myopic government defaults. After a default the country is excluded from international capital markets. When a country in default switches back to

the less myopic type, it signals the change by making a payment to settle the old debts. If it pays enough to distinguish itself from the myopic type, it regains access to the loan market.

We analyze perfect Bayesian equilibria: in other words, lenders' actions are supported by beliefs about the borrower's type. Our next step is to consider whether these beliefs are updated in a reasonable way in response to disequilibrium behavior by the borrower. This refinement greatly reduces the set of signalling equilibria and will frequently rule out equilibria in which the marginal product of capital is equal to the interest rate.

The extensive literature on sovereign debt has focused primarily on the incentives for sovereign borrowers to repay their debts, but has left aside the issue of how countries can regain access to international credit markets once they have defaulted. The most prominent models of sovereign debt provide little guidance for thinking about lending resumptions in the aftermath of a default. The trigger-strategy equilibria that have been examined (for example, Eaton and Gersovitz, 1981) suggest that after a predetermined period of exclusion from international capital markets, renewed access to credit is automatic. Models based on direct sanctions (for example, Bulow and Rogoff, 1989b; Fernandez and Rosenthal, 1991) suggest that exclusion should not occur because explicit defaults can be avoided through recontracting. Detragiache (1988) and Diamond (1989) consider reputation acquisition in models with unchanging types. In Detragiache's model of sovereign debt the government may be one of two possible types. In this model separation occurs in the first period, and the model becomes a standard trigger strategy model in the later periods. In Diamond's model, reputation acquisition is more complex because there is an adverse incentive problem as well as uncertainty about the type of borrowers.

The organization of the paper is as follows. In Section 2 we summarize the historical record of sovereign default and lending resumption in the nineteenth century in the U.S. and Latin America. In Section 3 we set out the model. Section 4 describes enforcement by signalling. In Section 5 we

discuss the plausibility of lenders' beliefs and draw implications for the predictions of the model. Section 6 is a brief conclusion.

2. Historical Evidence on Settlements

In this century international debt markets have become more complex because of the introduction of multilateral lenders, such as the IMF and the World Bank (Lindert and Morton, 1989; Dooley, 1991). In addition, the interpretation of sovereign immunity by creditor country courts has been narrowed since the Second World War (Bulow and Rogoff, 1989b, Appendix; Alexander, 1987). For this reason we have chosen to focus on the nineteenth century market for U.S. and Latin American debt.

A. Cases

During the nineteenth century many Latin American countries and U.S. states borrowed abroad, primarily in London, in order to fund military spending, internal improvements, and banks. In many cases, the loans were defaulted on, and the borrowers were unable to borrow additional funds for some period of time (Marichal, 1989; and McGrane, 1935). After varying intervals, defaulting states and countries reached settlements with their creditors under which they agreed to repay a portion of their defaulted debts. Soon after they resumed payments on the old debts, borrowers regained access to international credit markets. (See the cases presented in the Appendix and in English, 1991.)

Two of the most striking examples are the defaults of Honduras and Uruguay in the 1870s. Uruguay defaulted on its interest payments for a brief period between 1876 and 1878. In 1878 the arrears of interest were funded with 1.5 percent bonds, and the interest rate on the principal was reduced from 6 percent to 2.5 percent for five years. In 1883, after servicing its debt for five years, the government was able to refinance its internal and external debt in a consolidated debt at 5 percent.

Having met its obligations for an additional five years, the government was able to issue bonds between 1888 and 1890 totalling £6,235,300 at 6 percent for public works projects and the redemption of internal debt (Corporation of Foreign Bondholders, 1908).

In contrast, Honduras, which defaulted in 1872 and 1873, did not reach a settlement with its bondholders until 1926. In the settlement, Honduras agreed to pay only £1,200,000 in biannual installments over 30 years to redeem its outstanding liabilities (principal plus arrears) of over £30 million. This agreement allowed Honduras to regain access to international credit markets. In 1928 the government was able to obtain a loan of £1.5 million at 7 percent to fund its internal debt. It borrowed additional funds in 1931 and 1933. All of these loans were repaid (Corporation of Foreign Bondholders, 1928 and 1953).

For defaulting U.S. states, the sequence of events was quite similar. In the early 1840s nine U.S. states defaulted. Ultimately two states (Florida and Mississippi) completely repudiated their debts, and the others reached settlements with their creditors. As in the Latin American case, the settlements enabled states to regain access to credit markets. In Florida and Mississippi, Northern-imposed Reconstruction governments were able to borrow after the Civil War without settling their defaulted debts.

B. Interpretation

We believe that the settlement payments were signals of fiscal probity. After a default borrowers were unable to obtain loans because they were thought to be unlikely to repay. By settling their old loans, governments in default could show that they were willing to make sacrifices to repay lenders. As a result, the countries' reputations improved, and they were able to borrow again.

An alternative interpretation is that these payments were necessary, not to reestablish the debtors' reputations, but because the old creditors could have blocked new loans. It seems unlikely,

however, that the creditors were able to do so. They could have tried to block new loans either by using the courts to seize the proceeds of a new loan or repayments made on it or by forming a cartel to impose a lending moratorium. The creditors' ability to use the courts to seize assets was very limited in the nineteenth century. Until 1976 British courts applied absolute sovereign immunity and would not allow suits against foreign governments (Alexander, 1987, p. 25). In the case of U.S. state defaults, the Eleventh Amendment to the U.S. Constitution does not allow suits against states without their consent (Orth, 1987).

It is unlikely that the creditors could have coordinated to cut off credit to defaulting governments. U.S. lenders would have been quite unlikely to participate in a British-led creditors' cartel to impose sanctions on U.S. states. Even if the British lenders had been able to form a cartel, by the time of the late nineteenth century Latin American defaults there were other sources of international credit in Paris and Berlin. To have organized a cartel of many lenders in three countries would have been very difficult. In any case, the ability of Reconstruction governments in Florida and Mississippi to borrow after the Civil War suggests that the old creditors could not block new loans once the states' reputations had been restored by an observable change in regime.[1]

Bulow and Rogoff (1989a) have argued that direct sanctions are the only reasonable motivations for sovereign loan repayment. They note that if payment-in-advance insurance contracts are available, then a borrower can make itself better off by defaulting and using the payments that would have been made to its creditors to purchase such insurance contracts. We don't find their argument compelling on theoretical grounds for the reasons discussed in Cole and Kehoe (1991). On practical grounds, their model does not seem appropriate to these cases for three reasons. First, the main sources of demand for international borrowing in the nineteenth century were transportation

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[1]Ironically, when Reconstruction ended many of the new state governments—including the one in Florida—defaulted on the Reconstruction-era debts.

investments and wars, and it is unlikely that payment-in-advance insurance contracts contingent on technological advances in transportation technology or the outbreak of wars were available in the nineteenth century. Insurance contracts paying off in the event of war would suffer from obvious incentive problems and so are probably not feasible in any case.

Second, any effort by a defaulting country to finance future needs without the use of payment-in-advance insurance contracts would likely have required the accumulation of a substantial surplus by the government. Such surpluses, however, might not have been politically acceptable. For example, in the United States the accumulation of a large federal surplus in the mid-1830s was controversial. Some commentators argued that the surplus would be wasted or that it improperly increased the power of the executive branch. In the end, the surplus was distributed to the states (Bourne, 1885).[2] The states, in turn, generally did not hold the federal funds for long. Most states spent the money on ordinary state expenses or invested it in state projects such as banks or railroads. Most dramatically, six northeastern states distributed the money, entirely or in part, to counties or towns in the state. In Maine the money was distributed directly to the citizens (Bourne, 1885, chapters 6-11).

It is important to note that the federal surplus that was distributed in 1837 was relatively small compared to the surpluses that the states would have accumulated under the default strategy. The aggregate debt of the states in 1841 was over $200 million—more than seven times the federal surplus that proved politically insupportable. Moreover, heavily indebted states had debts between 10 and 40 times as large as their share of the federal surplus.

In commenting on the U.S. state defaults in the 1840s B. R. Curtis, later a U.S. Supreme Court Justice, argued that the accumulation of state surpluses was politically impossible, noting that

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[2]Strictly speaking, the funds were only deposited with the states, and they were subject to recall. Nonetheless, the states viewed the funds as a gift. See the discussion in Bourne (1885, p. 21).

"The . . . political parties, which have ruled this country since the adoption of the Constitution, agree, that no more is to be drawn from the people than is absolutely necessary" (Curtis, 1844, p. 151). Indeed, he went on to argue that a state's reputation in credit markets was important specifically because U.S. states could not accumulate surpluses, and in an emergency they might need more resources than they could tax in a single year. Similarly, Alexander Hamilton argued for the repayment of the U.S. Revolutionary War debt on the grounds that the nation might need to borrow again in the event of a new war (see Garber, 1991, p. 81).[3]

The third problem with Bulow and Rogoff's argument, when applied to the nineteenth century cases, is that the creditors would have found it very difficult to impose direct sanctions (such as military punishments or trade restrictions). In Latin America, in contrast to the Near East, European governments were generally unwilling to intervene on behalf of the creditors (Marichal, 1989, p. 121). Moreover, when U.S. states defaulted, the British government was asked by the creditors to provide help in obtaining payment, and Lord Palmerston, the British Foreign Secretary noted that "British subjects who buy foreign securities do so at their own risk and must abide the consequences" (McGrane, 1935, p. 202). Even had the British government wanted to impose direct sanctions on the defaulting U.S. states, doing so would have been very costly. Any use of force to compel a defaulting state to repay would have required a war with the United States.[4] Similarly, to cut off trade with a state, Britain would have had to cut off trade with the United States because otherwise goods from the defaulting state could be exported through another state. Needless to say, cutting off trade with the United States would have been expensive both because the British textile industry was

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[3]This issue is discussed in more detail in English (1993). Note that if Ricardian equivalence holds, then these issues do not arise because the government can simply raise the required revenue through taxation. It is clear, however, that Ricardian equivalence did not hold at this time. Only governments had access to foreign capital markets.

[4]Some observers, including ex-President John Quincy Adams, feared that the British would go to war over the state defaults (McGrane, 1935, p. 35).

dependent on Southern cotton and because the United States provided a market for many British exports.

3. A Model of International Lending

Our model of international debt markets consists of a large number of competing banks and a country that wants to borrow from them. The model has an infinite number of periods. Following Kletzer (1984), we consider only short-term debt, so that the country borrows and invests in a project, the loan becomes due, and then there is a possibility of further borrowing.

A. The Borrower

We assume that there are two possible types of governments and that the type in power can change. One type is effectively more myopic than the other. Although the government knows its type, this information cannot be observed by potential lenders.[5] For expository purposes, we provide a simple interpretation of why time preference changes and why these changes are unobservable. In our model, foreign debt decisions are made by the government in power, but the composition of the government or the distribution of power within the government can change each period. One type of government is relatively likely to remain in power, while the other type is less likely to do so. As a result of its shorter expected stay in power, the less stable type is more myopic.

The government in power stays in power with probability p_s for a stable government and probability p_u for an unstable one ($p_s > p_u$). If a stable government loses power, the next government will be stable with probability q_s. If an unstable government loses power, 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:

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[5]An alternative assumption would be that the production functions differ across types rather than the preferences, as in Spatt (1983) and Kahn (1989).

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

We assume that the elements of M are strictly positive and the trace of M is greater than one, which means that the type of government changes relatively infrequently. If no new information is received about a country, the probability that it is stable will converge monotonically to the long-run population average. To complete the description of the process we must give the initial probability distribution of types. We assume that the initial probability of being stable is m_{11}—as if the borrower had been stable to start with.

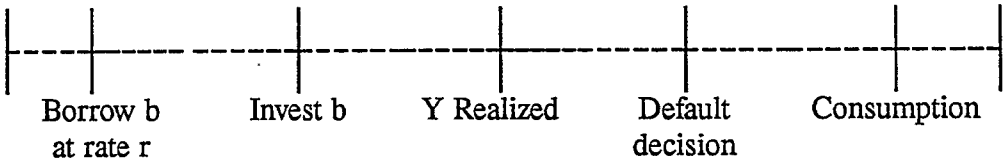
We assume that a government cares about the discounted expected utility of the representative agent only while it is in power. The preferences of the representative consumer are represented by

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t). \quad (2)$$

A government takes into account its likelihood of survival. It ceases to exist once it is replaced even if a government of the same type follows it in power. Accordingly, the stable and unstable governments have different discount factors: $p_s\beta$ and $p_u\beta$. We assume that U is increasing and concave, and we normalize $U(0) = 0$. Negative consumption is allowed. It means that the borrower is using domestic resources to repay old debts. For analytic simplicity we do not explicitly model the domestic production opportunities.

The government has available to it a technology for turning a borrowed input b (or an input purchased with borrowed funds) into output via an increasing and concave production function Y(b). The output is nonstorable: it cannot be held until the next period and consumed or reinvested. We normalize $Y(0) = 0$. At the beginning of the period, the government receives offers of loans (a loan size and an interest rate), and it decides whether or not to accept one of them. The gross interest rate,

r, is quoted in terms of the output good. If the government takes out a loan it invests the amount in a domestic project, and the output is realized later in the period. At the end of the period the government must decide whether to repay or default. The representative agent consumes the remainder. The timing within each period is thus:



The assumption that output from the investment process cannot be stored and reinvested is a strong one. Our results would not be greatly affected by the introduction of a sufficiently costly domestic storage technology. The assumption that domestic storage is not possible is intended to capture our view that exclusion from capital markets was costly for 19th century sovereign debtors, while leaving us with a simple and tractable model. In reality, we believe that the demand for credit was stochastic and resulted from wars or changes in technology (for example, the introduction of the railroad). Since, as noted above, it seems likely that borrowers were not able to purchase payment-in-advance insurance contracts contingent on these events or to accumulate large surpluses in anticipation of them, exclusion from international capital markets would constrain military spending in wartime and force governments to delay profitable investments.

B. The Lenders

Banks are risk-neutral. We assume that they cannot directly observe the type of the borrower; nor can they observe when a transition occurs. They can try to infer the borrower's type from its actions. This inference is the most important part of our model. We also assume that the banks can observe the amount the country borrows and whether or not it repays. This means that they can limit the amount borrowed, preventing the country from borrowing large amounts in order to default. The

banks' opportunity cost of funds is given by ρ, while δ denotes their estimate of the probability that the government currently in power is stable. In each period each lender chooses the amount it is willing to lend to the country and the interest rate it will charge. The amount that it offers to lend can, of course, be zero.

4. Perfect Bayesian Equilibria

In this paper we focus on stationary perfect Bayesian equilibria. These equilibria require that, at every possible state (including those that only occur out of equilibrium), agents' beliefs over the types and strategies of the other agents must be specified. These beliefs must be updated according to Bayes' rule wherever possible. Given these beliefs, each agent must choose actions that are best responses to the strategies of the other agents. In Section 5 we rule out perfect Bayesian equilibria that are based on implausible beliefs.

We also require lenders' strategies to be stationary functions from their belief, δ, about the type of the borrower to the loan size, $b(\delta)$, and the interest rate, $r(\delta)$. Clearly the set of strategies available to the lenders is larger than this, since lenders could condition their actions on any past event. We focus on these equilibria because we are most interested in separating equilibria in which borrowers are treated differently only because they are believed to be different. In these equilibria lenders try to infer borrowers' types from their actions. Similar stationarity restrictions are common in the literature on bargaining with asymmetric information (see, for example, Fudenberg et. al, 1985; Gul and Sonnenschein, 1988) and in the literature on policy games (see Ball, 1989).

A. Signalling Equilibria

We will compute a signalling equilibrium in which the unstable type always defaults, the stable type never does, and after a default and a subsequent change in type the stable type makes a

signalling payment. Such an equilibrium will consist of lending strategies ($r(\delta)$ and $b(\delta)$), the payment strategy of each type of borrower ($P_i(\delta,b,r)$, $i = s,u$), and an updating rule for δ.

In this equilibrium, a country that does not fully pay its debts is presumed to be unstable. After a default and a regime change in which an unstable government becomes stable, it signals its change in type by making a payment to the lenders. If this signal is to achieve its aim, it must be so large that the unstable type would not choose to pay it, even if by doing so it could regain its reputation, yet small enough that the stable type is willing to pay it in order to regain its reputation.[6] Since lenders believe that the stable type always pays the signal and the unstable type never does, they infer that those who do not make the payment are still unstable. In other words, if a government which has defaulted simply waits, there will be no improvement in its reputation over time.

Bayesian updating takes a particularly simple form here. If a loan was made and repaid last period, then this period's belief, δ, is m_{11}. If the loan was not repaid, δ is m_{21}. After a default δ remains m_{21} until a signalling payment of a certain minimal size is made, at which time it rises to m_{11}. We consider the plausibility of these beliefs in the next section.

The equilibrium lending strategy is to lend a fixed amount to any government that is believed to be stable with probability m_{11} and to lend nothing if the probability is m_{21}. Competition among lenders will ensure that whenever loans are extended, the lender will make zero expected profits. Given that the borrower is believed to be stable this period with probability δ and that only the stable regime repays, the expected present value of loan repayments per unit of loan is $\delta r/\rho$. If the loan is

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[6]Note that we assume that the old creditors have no bargaining power. All the debtor must do to regain access to international capital markets is pay S. As noted above, creditors' bargaining power in the nineteenth century was very limited. Changes in creditor country courts' treatment of sovereign immunity, the use of widely syndicated bank loans with sharing and cross-default clauses, and (perhaps) the greater probability of creditor government intervention have all contributed to the increased bargaining power of creditors in the 1980s. See Fernandez and Rosenthal (1991) for a bilateral bargaining model of sovereign debt in which creditors are able to extract all of the surplus from debtors.

made to an unstable government, the loan is not repaid. The lender will, however, receive a signalling payment of S/b per unit loaned when the borrower reverts to the stable type. The probability of the type switching to stability for the first time after t periods is $m_{22}^{t-1}m_{21}$. Thus, the expected discounted value of signalling payments per unit of loan, given that the loan is made to an unstable government is

$$[m_{21}(S/b)/\rho^2] \sum_{j=0}^{\infty} (m_{22}/\rho)^j. \tag{3}$$

The zero-profit interest rate as a function of the belief, δ, and the signal size, S, is therefore given by[7]

$$r(\delta) = \rho/\delta - [(1-\delta)/\delta][(m_{21}(S/b))/(\rho-m_{22})]. \tag{4}$$

In other words, the interest rate is the cost of funds, ρ, adjusted to take account of the probability of default, less a discount for the signalling payments lenders can expect to receive in the future.

The consumption level of the representative consumer in each period depends on whether or not the country defaults. Let c^n denote consumption if it does not default and c^d if it does. Then $c^n(\delta) = Y(b(\delta)) - r(\delta)b(\delta)$, while $c^d(\delta) = Y(b(\delta))$.

Let W^d be the value of the stable type's objective function if it defaults in the current period and W^n be the value if it does not default. The value function of the stable type, W, is given by $W(\delta) = \max\{W^n(\delta), W^d(\delta)\}$, where

$$W^n(\delta) = U(c^n(\delta)) + p_s\beta W(m_{11}) \tag{5}$$

and, since we have normalized $U(0) = 0$,

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[7]We assume that the signal size is constant, although in principle this need not be the case: the signal could, for example, rise over time. In the next section, however, we show that equilibria with a constant signal are more reasonable.

$$W^d(\delta) = U(c^d(\delta)) + \max\{0, p_s\beta U(-S) + (p_s\beta)^2 W(m_{11})\}. \quad (6)$$

The stable type will optimally choose to default whenever $W^d > W^n$. Similar equations apply to the unstable type, and we denote these values of the objective function by Z, Z^n, and Z^d, respectively. The only difference between the Z's and the W's is that p_s is replaced by p_u to take into account the unstable type's lower probability of surviving.

For a perfect Bayesian equilibrium with signal size S and loan size b to exist, the following four conditions must hold:

$$W^n(m_{11}) \geq W^d(m_{11}) \quad (7)$$

$$U(-S) + p_s\beta W(m_{11}) \geq 0 \quad (8)$$

$$Z^n(m_{11}) \leq Z^d(m_{11}) \quad (9)$$

$$U(-S) + p_u\beta Z(m_{11}) \leq 0. \quad (10)$$

In other words, the stable type should choose to repay loans when it gets them, and it should pay the signal if it comes to power after an earlier default. In contrast, the unstable type should choose to default when it gets a loan, and it should not pay the signal. Many loan sizes, signal sizes, and interest rates can satisfy inequalities (7)−(10).

B. Numerical Example

Here we present a simple numerical example to illustrate the wide range of signal sizes that are possible, even for a chosen loan size. The lack of sharpness with respect to the model's predictions serves to motivate the refinement that we consider in the next section.

We assume that $U(c) = \ln(c+1)$ and that $Y(b) = b^{0.33}$. The discount rate, β, is 0.96, while $p_s = 0.9$ and $p_u = 0.15$. The probability of a stable government replacing another stable government or an unstable government replacing an unstable government, q_s and q_u respectively, are both 0.5. The opportunity cost of funds to the lenders, ρ, is 1.05. There are a large number of equilibria of

this model even once the loan size has been fixed; we have chosen one in which the loan size and signal size are such as to equate the marginal product of capital to the loan interest rate.

Table 1

A Signalling Equilibrium			
r	1.089	$b(m_{11})$	0.168
S	0.062		
$W^n(m_{11})$	2.326	$W^d(m_{11})$	2.123
$Z^n(m_{11})$	0.380	$Z^d(m_{11})$	0.442

Given this loan size, other signalling equilibria exist for $S \in [0.062,0.884]$. If the signal is less than 0.062, then the unstable type will pay the signal and then default on the new loan it receives. On the other hand, if the signal is greater than 0.884, then even the stable type will not be better off paying it in order to obtain new loans.

5. Reasonable Beliefs

The signalling equilibria discussed above are perfect Bayesian equilibria: in other words, the lenders' actions in response to out-of-equilibrium moves by the borrowers are supported by the lenders' beliefs. For example, the lenders believe that any signalling payment smaller than the equilibrium signal is made by the unstable type. Are these beliefs reasonable? In this section we discuss lenders' beliefs in response to disequilibrium actions by the borrower. By requiring that these beliefs be reasonable (in a sense made precise below), we restrict the equilibrium loan and signal sizes and rule out reputation-based punishment-interval enforcement.

We rule out as implausible any equilibrium that requires a lender to believe that an out-of-equilibrium move by a borrower might have been made by a type that could not possibly benefit by

the move (given the equilibria of the subgame following the deviation). The assumption that lenders' strategies are stationary in their beliefs (both on and off the equilibrium path) allows us to use this argument to eliminate many of the perfect Bayesian equilibria. In effect the stationarity assumption limits the best responses of the lenders to be a subset of their possible best responses and so greatly reduces the number of possible equilibria in the subgame following the deviation. This refinement is in the spirit of Cho and Kreps' (1987) "intuitive criterion."

In the perfect Bayesian equilibria we consider, the stable type repays the loan and makes signalling payments. Suppose a government made a loan repayment or a signalling payment smaller than the equilibrium amount, but large enough that the unstable type would strictly prefer not to make it even if by doing so it could regain its reputation (that is, raise the lenders' belief next period to m_{11}). The argument given above implies that the lender should believe the borrower to be stable. It follows that a stable borrower would be strictly better off making the smaller payment. Thus, any equilibrium in which the unstable type is not indifferent between making and not making a payment is ruled out. Indifference of the unstable type with regard to making its loan and signalling payments implies that $Z^n(m_{11}) = Z^d(m_{11})$ and $U(-S) = -(p_u\beta)Z(m_{11})$. We can rewrite these conditions as

$$U(Y(b) - r(m_{11})b) = [1-p_u\beta]U(Y(b)) \tag{11}$$

$$U(-S) = -(p_u\beta)U(Y(b)). \tag{12}$$

These two conditions along with equation (4) determine the equilibrium interest rate, loan size, and signal. Since p_s is greater than p_u, the stable type is strictly better off repaying loans that satisfy (11) and paying signals that satisfy (12).

This refinement has three implications. First, in contrast to nonstrategic models of borrowing in which the expected marginal product of capital is equal to the real interest rate, in our refined equilibrium the marginal product of capital can be either greater or less than the interest rate. Second,

equation (12) implies that increases in the loan size, perhaps due to a decrease in the cost of funds, also increase the equilibrium signal size. This relationship holds because the signal is positively related to the anticipated level of borrowing once the government reestablishes its reputation. While this theoretical correlation is consistent with our historical examples, it is impossible in our limited sample to distinguish between this hypothesis and the effects of differences in country size. Third, equation (12) also implies that the size of the signal does not change as the length of time since default increases. Thus the signal size is independent of the amount of arrears. Here again, the historical episodes we consider are too limited to examine seriously this implication of the model.

A. Numerical Example Reconsidered

Here, we compute the signalling equilibrium of the example economy considered above that is consistent with this refinement.[8] In the refined equilibrium the loan size is smaller than in the earlier example, and the marginal product of capital is more than six times the gross interest rate.

Table 2

The Reasonable Signalling Equilibrium			
r	1.071	$b(m_{11})$	0.062
S	0.047		
$W^n(m_{11})$	2.11	$W^d(m_{11})$	1.870
$Z^n(m_{11})$	0.335	$Z^d(m_{11})$	0.335

[8]In general there can be more than one nondegenerate equilibrium of this type that satisfies our refinement. One can show that there will be only one if the curvature of the utility function is sufficiently less than that of the production function. In the example provided there is only one nondegenerate equilibrium. There are, of course, many other equilibria of the model, some of which may satisfy our refinement. We focus on this equilibrium because it appears to match the actual behavior of nineteenth century sovereign debtors.

B. Implausibility of Punishment-Interval Enforcement

Given the extensive attention that punishment-interval equilibria have received in the literature on sovereign default (for example, Eaton and Gersovitz, 1981), a natural question to ask is whether the model is also capable of generating reputation-based punishment-interval equilibria (as opposed to trigger strategy equilibria). It is. Below we briefly explain how such an equilibrium might work and why the beliefs that support it are implausible.

In such an equilibrium, the stable type repays the loan and the unstable type does not. If a government becomes stable after a default, it does not signal its type; instead, it waits until the end of a period of exclusion from the credit market. After a default, the borrower is likely to be unstable, and so lenders will not lend to it. Over time, however, the lenders' belief about the type of the borrower rises, lowering the break-even loan interest rate assuming that only the stable type will repay, ρ/δ. Over time δ rises and eventually the break-even interest rate is sufficiently low that the stable type weakly prefers to repay a loan.[9] In deciding whether or not to repay the loan, the borrower realizes that in the event of a repayment next period's belief will be m_{11}, while in the event of a default it will be m_{21}. In the latter case the punishment interval, in effect, starts over, while in the former case next period's interest rate will be lower, reflecting the country's improved reputation (for details see Cole, Dow, and English, 1989).

Our restriction on the plausibility of the beliefs supporting the equilibrium eliminates all reputational perfect Bayesian equilibria with punishment-interval enforcement. Consider the lenders' beliefs in response to a settlement payment made during the punishment interval. In the equilibrium based on punishment-interval enforcement such payments have no effect on the updating of lenders'

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[9]Since δ is governed by a first-order constant coefficient difference equation, convergence to the long-run steady state occurs if $|m_{11}-m_{21}| < 1$, which holds because the probabilities must lie between zero and one. Monotone convergence occurs if $m_{11} > m_{21}$, which is equivalent to our assumption that the trace of M is greater than one.

beliefs. This lack of effect is not plausible. Both types would like the lenders to believe that they are stable. Since they value reputations more highly, stable types are willing to make a payment during a punishment interval that is just large enough that the unstable type would not be willing to make it even if it could regain its reputation by so doing. Since such a payment demonstrates that the government is stable, making it would allow the government to regain its reputation and raise its welfare. As a result, the reputation-based punishment-interval equilibria of our model are eliminated.[10]

6. Concluding Remarks

This model provides a tractable framework for the analysis of reputation. Our exposition focuses on changes in the stability of the government as the source of changes in time preference. Indeed, the descriptions of Latin American defaults, presented in the Appendix, suggest that the two waves of defaults in the 1820s and 1870s were associated with periods of widespread political instability in the region. Nonetheless, we believe that our model should not be taken too literally. While a change in government is usually observable, changes in the collective preferences of the country, in the relative power of different interest groups, or in the internal politics of the government are more difficult to observe but may still affect the country's willingness to repay its debts. The model is intended as a simple representation of the collective preferences of the decision makers that takes into account that these preferences may change. It could even be applied to the decisions made by a single person: a person's actions may reveal information about their preferences, but old information is less precise because preferences can change over time. Examples of such actions might include participating in a political demonstration, having a drunk driving conviction, or

[10]Clearly, this argument is not relevant in standard trigger-strategy models in which there is only one type.

defaulting on a loan: in each case, the information is quite different if it relates to last week or to twenty years ago.

While partial repayment of the defaulted debt is the only type of signal that we consider here, it is only one way in which signalling could take place. It is possible to have signalling equilibria in which the government simply destroys some of the consumption good. Since these equilibria are not consistent with the historical examples we discuss and would be ruled out once we introduced small costs associated with new borrowing when a settlement with past creditors has not been achieved, we don't consider them.[11] More realistically, an austerity program could serve as an alternative type of signal. In fact, the signal need not be undesirable even without taking account of its effects on reputation. For example, stable countries may invest more domestically, perhaps as result of government tax policy. They may do so simply because they are less myopic. As long as the unstable countries do not find it worthwhile to mimic this investment level, it can serve as a signal of stability.[12]

In contrast to our model, the literature has generally focused either on models in which repayment is motivated by direct sanctions or on models with trigger-strategy equilibria in which defaulting countries are punished by intervals of exclusion from credit markets. As noted above, direct sanctions do not appear to have played a role in the cases we examine. The trigger-strategy models in the literature have a fixed (often infinite) punishment interval. One could, however, construct trigger-strategy equilibria in which the exclusion interval is random and a settlement payment is required. Beyond the fact that this particular class of equilibria is consistent with the

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[11]See Acharya and Diwan (1989) for a model in which the signalling payment (in their case it is a debt buyback) also makes the debtor more creditworthy because it reduces the investment disincentive caused by a "debt overhang."

[12]Note that if unstable types want to mimic the stable ones, then stable types can distort their investment upwards to prevent them from doing so. In that case, domestic investment could serve as a signal, but not a costless one.

historical observations, such equilibria seem no more compelling than simple punishment intervals (and perhaps less so because of their complexity). Moreover, we do not find trigger-strategy models intuitively appealing. In such models there is no direct motivation for the punishments inflicted. The preferences, the production possibilities—all the attributes of the borrower—are common knowledge and remain unchanged after a default. Exclusion from capital markets occurs due to the need to punish default in order to sustain equilibrium lending.

While it is possible to construct reputation-based equilibria in our model in which a country that defaults faces a fixed interval of exclusion, such equilibria are supported by unreasonable beliefs. Thus, among reputational equilibria, signalling equilibria appear to be the most natural. These equilibria are also supported by the history of sovereign defaults in the nineteenth century and the views of contemporary observers (see the Appendix).

Appendix

Although the history of sovereign defaults is a long one, we focus on U.S. state and Latin American defaults in the nineteenth century. These cases show that defaulting on international obligations did not permanently cut off the defaulting nation's access to international capital markets. Many countries were not only able to borrow a second time after a default, but were able to default more than once and later reenter international capital markets. Most of the countries made partial repayments on earlier loans before they were able to borrow again.

A. Latin American Defaults in the 1820s

In the 1820s, 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, the following six countries defaulted: Argentina, Chile, Mexico, Peru, Gran Colombia (which was later divided into Colombia, Ecuador, and Venezuela), and the Federation of Central America (which was later divided into Costa Rica, Guatemala, Honduras, Nicaragua, and El Salvador) (Marichal, 1989, Table 2).

These defaults reflected in part the European commercial and banking crisis in 1825–26 (Marichal, 1989, chapter 2). In addition, the political situation in Latin America following independence was very turbulent. Safford (1987, pp. 50–51) argues that

> Most Spanish American states were unable fully to re-establish the legitimacy of authority enjoyed by the Spanish crown before 1808. Formal constitutional systems were enacted.... But these formal constitutional provisions frequently proved a dead letter . . . . Opposition politicians, both civilian and military, therefore waited for, and took advantage of, moments of government weakness in order to overthrow the ruling group . . . . In few cases were the

political elites sufficiently united to enable their countries to escape frequent *coups d'état*, rebellions and civil wars.

One example of the political difficulties facing the new nations was Peru, which defaulted in 1826. Peru had six constitutions between its independence in 1821 and 1836. Furthermore, during the period between 1826 and 1836 it had eight presidents, only one of whom managed to complete his full four-year term (Bonilla, 1987, p. 248).

In all of these cases, the countries had to settle with the old bondholders before they were able to borrow again internationally. We focus here on the largest of these defaults: Gran Colombia, Mexico, and Peru. The timing of the defaults, settlements, and new loans is shown in Table A1.

Table A1

Country	Default	Settlement	New Loans
Gran Colombia	1826		
Columbia		1845	—
	1848	1861	1863
Ecuador		1856	—
Venezuela		1840	—
	1847	1859	1862
Mexico	1827	1886	1888
Peru	1826	1849	1853

Sources: Marichal (1989); Corporation of Foreign Bondholders (1908), (1928)

Peru had debt of £1,816,000 plus interest arrears at 6 percent. Peru settled its debt in 1849 by issuing £1,800,000 of new bonds at a concessional 3 percent interest rate to partially pay the arrears on the debt. The remaining arrears were canceled. Peru then succeeded in borrowing £3,000,000 in 1853 to fund its floating debt and make railway investments. In 1869–70 Peru was

able to borrow over £12,000,000 to fund railway investment (Marichal, 1989, Table 2 and Appendix A.)

The case of Gran Colombia is complicated by the fact that the federation was dissolved in 1834. The three countries in the federation divided the debt of £6,750,000 plus interest arrears as follows: Colombia, 50 percent; Ecuador, 21.5 percent; and Venezuela, 28.5 percent. Ecuador settled its share of the debt in 1855 by issuing land certificates for over £1 million of arrears and issuing new bonds to refinance the principal and £400,000 of arrears. In addition, £400,000 of arrears were canceled. Ecuador defaulted on the new bonds in 1868 without having borrowed any more funds abroad.[13]

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 additional new bonds for the arrears. These bonds would ultimately pay 3 percent and 1.5 percent, 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 Venezuela to issue an additional £2.5 million of bonds in 1862–64. Unfortunately, Venezuela defaulted on these bonds in 1864–67.

Colombia, which held the largest share of the Gran Colombia 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, Colombia borrowed an additional £200,000 in 1863, although a large offering in 1866 (£7,500,000) failed to find buyers in London.

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[13] The information in this and the following two paragraphs is from Corporation of Foreign Bondholders (1908) and (1928).

The Mexican case is too lengthy to relate here in detail (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 1860s the French, British, and Spanish succeeded in installing 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 percent in 1886, increasing by half a percent a year to 3 percent 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 £8,700,000 in 1888 and 1889 to fund railroad investment and redeem railroad subsidies.

The settlement of defaulted debts was, in many cases, associated with a higher degree of political stability. For example, of the successor states to Gran Columbia, the most stable was Venezuela (Deas, 1987, pp. 222–24), and it was the first to reach a settlement on its debts. The Venezuelan settlement came in 1840, more than 15 years in advance of those of Ecuador and Columbia, which enjoyed less political stability. Similarly, Peru achieved relative stability in the mid–1840s under Castilla, and its debts were settled in 1849 (Bonilla, 1987, p. 250).

B. U.S. States' Debts in the 1840s[14]

In the 1820s and 1830s U.S. 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 railroads.

[14]Much of the information in this section comes from English (1991).

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 Second Bank of the United States was not rechartered (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 itself (McGrane, 1935, p. 71n).

The panics of 1837 and 1839 and the failure of the United States Bank of Pennsylvania in 1841 caused financial difficulties for the states. In the early 1840s nine states (Pennsylvania, Maryland, Illinois, Indiana, Michigan, Louisiana, Mississippi, Florida, and Arkansas) defaulted at least temporarily on their bonds. Five of the states (Arkansas, Florida, Louisiana, Michigan, and Mississippi) repudiated all or part of their debts. State courts eventually decided that the Mississippi and Arkansas bonds were indeed obligations of those states (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 (Orth, 1987).

Prior to the Civil War, states were able to regain access to credit markets only by settling at least a portion of their debts. Mississippi, Florida, and Arkansas all refused to pay their creditors and did not issue new bonds again until the war. In contrast, the states that settled their debts seem to have been able to restore their reputations, and some of them borrowed additional funds before the Civil War. Pennsylvania and Maryland resumed payments on their debts in 1845 and 1847, respectively. By the early 1850s, both states' bonds were selling near par. Illinois and Indiana reached agreements with their creditors in 1846 and 1847, respectively. Under these agreements the states raised taxes to service a portion of their debts and used the completed portions of their canals

as collateral for new loans to complete the canals. Indiana actually split its debt into a half payable by the state and a half payable by a company set up to run the canal—an early debt-equity swap. Both states were able to complete their canals, and Indiana bonds were selling near par by the mid-1850s.

Michigan and Louisiana both agreed to pay a portion of their debts, and doing so seems to have improved their reputations a great deal. Michigan had issued bonds through the Morris Canal and Banking Company. The company failed after paying for only about 30 percent of the bonds that the state had turned over to it. The remaining bonds, however, had been hypothecated in London. The state ultimately agreed to pay the interest and principal on the bonds in proportion to the payments received from the bank. After this settlement the state's reputation improved; by the early 1850s, state bonds were selling above par. Louisiana had guaranteed the bonds of banks in the state. When the banks failed, the state refused to honor the guarantees. The state, however, had other debts that it continued to service. Although the other debts were small (about 10 percent of the total), the state restored its reputation by paying them, and it was able to borrow more in 1854.

Contemporary observers clearly believed that defaulting U.S. states needed to settle their obligations before they would be able to obtain new loans. In 1846 the Barings (a major British banking house) were quoted in *Niles Register* as stating that Europeans would not "purchase either old or fresh [U.S. state] securities until . . . those states which were still defaulters had shown their willingness and ability to recommence and continue the regular payment of future dividends" (quoted in McGrane, 1935, p. 268). Similarly, the *London Times* wrote in that year 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" (Dec. 3, 1846, quoted in McGrane, 1935, p. 166). Five months later, the *London Times* wrote of Indiana, "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).

These arguments were also recognized within the U.S. The *Floridian* noted that the cost of repudiating the state's debts was an inability to borrow in the future, but pointed out "What harm will it do to stop our credit? None in the world. We are now as a community heel over head in debt" (quoted in McGrane, 1935, p. 237). In contrast, in the 1850s the Arkansas *Gazette* argued that the state should resume payment on its defaulted debts in order to be able to borrow to fund railroad construction (McGrane, 1935, p. 262).

British investors seem to have believed that the state defaults provided information about the honesty of all Americans. After the state defaults of the 1840s, British investors became wary of U.S. federal 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. By the end of the decade, after five of the states had settled their debts, federal government bonds were selling above par in London (McGrane, 1935, pp. 270–71).

C. Latin American Defaults in the 1870s

After the defaults of the 1820s 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 (Marichal, 1989, Table 4 and Appendix A).

As in the earlier cases, many of the defaulting nations were unstable politically. In Central America the long period of conservative domination ended with the liberal revolution in Guatemala in 1871. The Guatemalan regime then supported similar movements in El Salvador and Honduras that destabilized those nations (Munro, 1960, pp. 413–14). Costa Rica had a liberal revolution at about the same time (Munro, 1960, p. 415). In South America Paraguay was defeated by Argentina, Brazil, and Uruguay in 1869, and suffered from frequent, though relatively small, revolts for a generation (Munro, 1960, p. 220). In Uruguay there was a civil war between 1870 and 1872, followed by a period of instability (Munro, 1960, pp. 203–204). Bolivia endured a series of short-lived governments in the 1870s (Munro, 1960, p. 271). In Peru the 1872 election was won by a civilian, Manuel Pardo, the first time in almost 40 years that the official candidate had been defeated. Pardo's term was marked by military revolts, and he accepted a general as his successor in 1876 (Munro, 1960, p. 258). Nonetheless, instability continued until the outbreak of war with Chile in 1879 (Bonilla, 1987, pp. 262–63).

In contrast, Brazil and Argentina, which did not default, enjoyed periods of relative stability. In Brazil, the rule of Emperor Pedro II provided a lengthy interval of internal stability, lasting until the fall of the Empire in 1889 (Munro, 1960, p. 330). In Argentina, there was an attempted coup in 1874, but it was defeated and its leader pardoned. Munro (1960, p. 183) claims that the national government seemed to have acquired a real stability in this period.

As in the earlier cases, the defaulting countries settled their old debts before receiving new loans. Table A2 presents the dates of defaults, settlements, and new loans for the largest Latin American defaults in this period.

Table A2

Debtor	Default	Settlement	New Loans
Costa Rica	1874	1885	—
	1895	1897	—
	1901	1911	1911
Honduras	1872--73	1926	1928
Peru	1876	1890	1922
Uruguay	1876	1878	1883

Sources: Marichal (1989); Corporation of Foreign Bondholders (1908), (1928)

By far the largest of the 1870s defaulters was Peru, which defaulted on bonds totalling almost £33 million in 1876. The settlement of this debt took place 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 access to 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 1920s (Marichal, 1989, Table 4; Foreign Bondholders Protective Council, 1945).

There were three other countries that defaulted on a substantial amount of debt: Costa Rica, £3,302,000; Honduras, £5,400,000; and Uruguay, £3,165,000. The experience of Costa Rica provides only limited 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 percent of the old bonds. Costa Rica serviced the new bonds for ten years without issuing any additional bonds. The country fell into default again in the mid-1890s. A new agreement with the bondholders 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 is possible that it was this institutional change, rather than the settling of the old debts, that allowed Costa Rica to borrow additional funds (Corporation of Foreign Bondholders, 1928). The experiences of Uruguay and Honduras were discussed in the text.

The settlements again appear to have reflected increased stability. The rapid settlement in Uruguay followed the stabilization of the country under a military dictatorship (Munro, 1960, p. 204). Similarly, Peru settled its debts in 1890, while under military rule, returning to civilian rule five years later (Munro, 1960, p. 260).

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