

# Debt Maturity and the International Financial Architecture\*

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## Abstract

This paper presents a theory of the maturity of international sovereign debt and derives its implications for the debate on reforming the international financial architecture. I present a model in which short-term debt dissuades countries from deviating from good policies, but makes them vulnerable to unwarranted self-fulfilling rollover crises. I discuss the impact on global welfare of a number of institutions or measures that have been discussed in recent debates, such as an international lender of last resort, an international bankruptcy court, renegotiation-friendly clauses in debt contracts, or capital controls.

**Key words:** Short-term debt, foreign debt, international financial architecture, liquidity crisis, lending-in-last resort, capital controls, international bankruptcy court.

JEL Classification Numbers: F32, F33 and F34.

# 1 Introduction

The international financial crises of the 1990s have generated a sense that the global financial system, left to itself, tends to give rise to dangerous forms of finance. Mexico in 1994, Indonesia, Korea, Malaysia and Thailand in 1997, and Russia in 1998; all these countries had to roll over large amounts of short-term external debt. This made these countries vulnerable to external debt *rollover crises* that were all the more difficult to deal with that debt was held by a large number of uncoordinated foreign creditors.

These crises have generated a debate on the reform of the "international financial architecture", in which a number of proposals—such as the establishment of an international lender of last resort, or of an international bankruptcy court for sovereigns—attempt to deal with the problems posed by external rollover crises (see Eichengreen 1999 or Kenen 2001 for reviews). It is difficult to assess the relative merits of the proposed reforms, however, without understanding the underlying reasons why maturity mismatches arise in the balance sheet of emerging countries. While it is often taken for granted that international capital is "hot", there must be some reasons why investors and borrowers engage in short-term contracts that turn out to be costly for both sides in the event of a crisis. And it seems important to understand these reasons in order to predict how changes in the institutional and regulatory framework of international finance will affect the lending structure that arises in equilibrium, as well as the welfare of lenders and borrowers.

This paper attempts to make some progress in the normative analysis of the international financial architecture. It presents a model in which the maturity structure of countries' external sovereign debt and the degree of coordination between creditors are endogenous. Short-term debt held by uncoordinated creditors has better incentive properties, and so is made available on better terms than long-term debt. On the other hand, short-term debt can make countries vulnerable to rollover crises caused by expectational shocks—as opposed to bad policies. There is a tension, thus, between the benefits of short-term debt in terms of incentives and the risk of unwarranted rollover crises.

The model has countries with different wealth levels and predicts an endogenous division of countries between two groups: a capital-abundant and safe core, and a capital-scarce and risky periphery. While some countries

inside the core may borrow externally, the structure of their debt does not make them vulnerable to rollover crises. By contrast, credit flows from the core to the periphery are short-term and involve the risk of rollover crises, putting the welfare of countries in the periphery below the first-best level. The welfare inequality between rich and poor countries is thus aggravated by the risk of external rollover crises.

The importance of endogenizing the maturity of debt becomes clear when assessing the optimality of public intervention. Although *laissez-faire* is inefficient in my model for the reason that many “international financial architects” have in mind—the possibility of self-fulfilling liquidity crises—I find that the measures that have been advocated yield ambiguous welfare results, and can easily be welfare-decreasing. The reason is that in my model, short-term debt is not just a source of risk; it also brings benefits to lenders and borrowers. It is not easy to design mechanisms that remove the risks of short-term finance without sacrificing its benefits.

First, I find that the efficiency of an international lender of last resort is hampered by a “large lender curse”. The lender of last resort is called upon to intervene when an incentives problem induces—or forces—the government to roll over short-term debt with a large number of uncoordinated creditors. However, because it is a large agent, the lender of last resort is unable to provide the government with the same incentives as a large group of small uncoordinated creditors. If the lender of last resort applies the classical rule of lending only to “illiquid but solvent” borrowers, then it lends only to countries in the core, which does not increase welfare.

Similarly, it is Pareto-suboptimal to take measures that make it automatically easier for countries to coordinate their creditors (for example by imposing the use of renegotiation-friendly clauses in sovereign debt contracts, or by creating a bankruptcy court for sovereigns with unrestricted access<sup>1</sup>). These measures reduce the cost of crises *ex post*, but make external finance more difficult to obtain *ex ante*. In equilibrium, countries in the periphery suffer more from the reduced access to external credit than from the lower

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<sup>1</sup>The idea of an international bankruptcy court dealing with sovereign default was popularized in the 1990s by Sachs (1995) and others—see Rogoff and Zettelmeyer (2002). The concept was recently endorsed by the IMF with its proposal to create a Sovereign Debt Restructuring Mechanism (SDRM) that would apply bankruptcy reorganization principles to the resolution of sovereign debt crises (Krueger, 2001).

cost of crises.

Creditor coordination can be optimal, however, if it can be made contingent on the nature of the crisis. For example, an international bankruptcy court that can reject some defaulting countries puts welfare at the first-best level if it chooses to deal only with true self-fulfilling rollover crises. Public intervention is optimal in this case because it achieves outcomes that are not attainable on a contractual basis.

The model is completely real: there are no currencies and no exchange rates. One way to interpret this simplifying assumption is that debt is denominated in foreign currency. Thus I assume away one part of the problem (the currency composition of debt) to better focus on the other part (its maturity structure). The focus on sovereign debt also implies that the analysis is more directly applicable to crises that primarily involved sovereign debt, such as the 1994 Mexican or 1998 Russian crises, than to the Asian crisis, where fragility arose primarily in the corporate and banking sectors. I discuss the extent to which my results can be extended to private debt at the end of the paper.

The results in this paper resonate with a number of themes in the literature on the debt structure of firms. The idea that short-term debt has better incentive properties than long-term debt is a classical one in the corporate finance literature. Moreover, the idea that the disciplining power of short-term debt depends on the easiness with which it can be restructured *ex post* (and in particular the coordination between creditors) has also been studied more recently in the corporate finance literature (Berglöf and von Thadden, 1994; Bolton and Scharfstein, 1996; Dewatripont and Tirole, 1994).

The incentive effects of debt structures have also been studied in the closed economy literature on government debt as well as the literature on external sovereign debt motivated by the debt crisis of the 1980s. That the emergence of short-term debt might be the symptom of commitment problems is noted for example by Sachs (1984) and Krugman (1985). Sachs and Cohen (1982) and Cohen (1991) discuss the benefits of making sovereign debt difficult to restructure *ex post*. More recently, the maturity of external sovereign debt is studied in Detragiache and Spilimbergo (2002), Rodrik and Velasco (1999).

The more recent theoretical literature on international financial crises has

been influenced by the fact that the recent crises often involved bank debt. Chang and Velasco (1999) and Goldfajn and Valdes (1999) have endogenized the structure of countries' external liabilities as bank deposits a la Diamond-Dybvig (see also Chui, Gai and Haldane, 2000). An important question is whether the insights gained in frameworks derived from the Diamond-Dybvig model are robust to other approaches to endogenizing the structure of emerging countries' external liabilities. The model in this paper suggests a negative answer: my normative results are strongly driven by the fact that short-term debt provides incentives to the borrower, and not the sort of liquidity that is provided to depositors in the Diamond-Dybvig model.<sup>2</sup>

The paper is structured as follows. Section 2 presents the assumptions of the model. Section 3 solves for the equilibrium. Section 4 analyses the welfare effects of different reforms of the international financial architecture, and section 5 concludes.

## 2 Assumptions

The model relies on the basic assumptions of the sovereign debt literature: there is a willingness-to-pay problem and countries repay their external debts to avoid some default costs. In addition, the international debt market suffers from the agency problem as in Gertler and Rogoff (1990). Countries cannot commit to take a policy action that enhances their external solvency when they borrow abroad. It is assumed that countries can decide two aspects of their debt structure: its maturity and how easy it will be to coordinate creditors. In the next section the debt structure will be endogenized as the solution to the willingness-to-pay and agency problems.

I consider a world with one good and three-periods ( $t = 0, 1, 2$ ). The good is invested in period 0 and consumed in period 2. The world is populated by

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<sup>2</sup>The difference between my results and those derived from open economy versions of the Diamond-Dybvig model do not come from the fact that I consider sovereign (instead of bank) liabilities. Although this question remains to be explored, the models that explain the short maturity of bank liabilities by the need to discipline bankers (Calomiris and Kahn, 1991 and Diamond and Rajan, 2000, 2001) should have normative implications close to those in this paper.

a continuum of atomistic individuals living in different countries  $j = 1, \dots, n$ . The population of each country is normalized to 1. Individuals are identical in a given country but differ across countries by their levels of wealth. Countries are run by benevolent social planners who maximize the utility of the representative resident, equal to his expected period 2 consumption

$$U_t^j \equiv E_t(c_2^j). \quad (1)$$

Countries have the opportunity to build up an indivisible public infrastructure that increases domestic output: for example, a transportation infrastructure that reduces transportation costs, a schooling or health care system that enhances the productivity of domestic workers, etc. I focus on the subset of countries  $j = 1, \dots, m$  that are capital-scarce, i.e. whose aggregate wealth  $\omega^j$  is lower than the cost of the infrastructure,  $\kappa$ . These countries must borrow from residents in capital-rich countries  $j = m+1, \dots, n$  to finance the infrastructure.

Domestic output is a stochastic flow of good,  $y^j$ , that is received by the representative resident of country  $j$  in period 2. For simplicity, I assume that output can take two levels, a high level  $y^j = \bar{y}$  and a low level  $y^j = \underline{y}$ . The probability of high output is assessed in period 1 on the basis of two pieces of information: first, whether the country has built up the infrastructure and second, the quality of its policies. Output is low with certainty if the country does not build up the infrastructure.

Conditional on the infrastructure, expected output depends on the quality of the country's policies which can be "good" or "bad".<sup>3</sup> The bad policy can be interpreted as an action that shifts resources away from foreign creditors towards residents: for example, diverting some of the funds earmarked for the infrastructure to finance a social transfer, or a failure to implement a fiscal adjustment or other measures that increase domestic productivity. Domestic output is high with certainty if the infrastructure is complemented by good policy. By contrast, bad policy reduces the probability of high output from 1 to  $1 - a$ , and increases the utility of the representative resident by  $b\Delta y$ , where  $\Delta y \equiv \bar{y} - \underline{y}$ . I assume that building up the infrastructure is socially efficient, but only conditional on a good policy ( $(1 - a + b)\Delta y < \kappa < \Delta y$ ). The government cannot commit to its policy action at the time it borrows.

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<sup>3</sup>The policy is good or bad from the point of view of foreign creditors. These policies could be called "investor-friendly" and "investor-unfriendly".

The infrastructure can be fully or partially financed by a tax on residents's wealth. Individuals can invest their after-tax wealth in the international debt market or in a zero-return storage technology. I assume that taxation is the preferred source of finance, i.e. capital-abundant countries fully finance the infrastructure with the tax, while capital-scarce countries tax one hundred percent of domestic wealth.<sup>4</sup> Government in capital-scarce countries cover their financing gap  $\kappa - \omega^j$  by selling debt to the residents of capital-abundant countries. Capital is mobile internationally, and the international financial market is perfectly competitive. As a result the riskless interest rate is equal to zero in equilibrium.<sup>5</sup>

The sovereign debt contracts that can be written and enforced are limited by severe enforcement and incompleteness problems. It is very difficult for creditors to seize collateral, and the contracts cannot be made contingent on the sovereign's policy actions. Countries repay to avoid a default cost equal to a fraction  $\gamma$  of output.<sup>6</sup> Like in Bulow and Rogoff, the default cost is interpreted as a sanction that the creditors may impose on the country (litigation, trade sanctions, etc.).<sup>7</sup>

I consider debt structures that differ along two dimensions: maturity, and creditor coordination. First, let me look at maturity. The country can issue a mixture of long-term debt (a promise to repay  $D$  in period 2) and short-term debt (a promise to repay  $d$  in period 1). Short-term debt has to be rolled over in period 1 since there is no fiscal revenue in this period. The

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<sup>4</sup>This assumption simplifies the notations without restriction of generality. If it were relaxed, capital-scarce countries would endogenously choose this financing strategy in order to minimize the agency cost of external debt. It could also be assumed that domestic wealth is tapped through the domestic financial market rather than taxation.

<sup>5</sup>There is enough wealth in the world to finance the infrastructure in all countries, i.e.  $\sum \omega_j > n\kappa$ . Hence the equilibrium world interest rate is pinned down by the zero-return technology.

<sup>6</sup>This assumption was pioneered by Sachs and Cohen (1982). See Obstfeld and Rogoff (1996), chapter 6.

<sup>7</sup>Sovereign default may also involve costs that creditors cannot easily waive, such as reputational costs, the real or financial disruption induced by the default, etc. (see Eaton and Fernandez, 1995, for a discussion of default costs). It is not difficult to extend the model to the case where the default cost has an "automatic" component that creditors cannot waive.

government rolls over its debt by getting short-term creditors to accept in period 1 a promise to repay  $d'$  in period 2 in payment of their claims.

The second aspect of debt structure relates to creditor coordination. The debt contract may or not include a *coordination clause* that gives the government the option to deal with its creditors in a centralized way. If debt does not have a coordination clause (or if the government chooses not to exercise it), each individual creditor decides to accept or reject the government's offer taking actions of other creditors as given. By contrast, if the government exercises the coordination clause, creditors delegate their decision to a representative that negotiates with the government on their behalf. The government can exercise the option in period 1 or 2 (see Figure 1).

The rules of engagement between the government and its creditors are as follows. If creditors are *uncoordinated* (because the coordination clause has not been exercised) the government makes an offer to each creditor who then decides to accept the offer or litigate. The offer is  $d'$  to each short-term creditor in period 1 and some repayment  $\rho$  to all creditors in period 2. Creditors have the right to litigate unless they are offered the full repayment to which they are entitled in cash.<sup>8</sup> Litigation by one creditor (or more) triggers a default in which the country loses a fraction  $\gamma$  of its output and the creditors that litigate get repaid with a small  $\varepsilon$  (representing the little collateral that can be seized). Each litigating creditor receives the face value of his claim if  $\varepsilon$  is sufficient to repay them. If not,  $\varepsilon$  is shared between the litigating creditors. The creditors that do not litigate receive nothing. The value of collateral  $\varepsilon$  is infinitesimal and will be omitted from the equations in the following.

If the government exercises the coordination clause, the terms of the rollover or the repayment are negotiated with an agent that represents all creditors—a creditor committee, say. The negotiation leads to a Nash-bargain in which each side receives one half of the negotiation surplus. The reservation values of the government and its creditors are determined by the assumption that if the negotiation fails, creditors litigate and the country defaults.

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<sup>8</sup>Since in period 1 the government cannot offer cash, each short-term creditor has the right to litigate. By contrast, in period 2 the government can avoid litigation by repaying  $D + d'$  in cash.

These assumptions capture in a stark way the idea that sovereigns can structure their debts in ways that make it more or less difficult to renegotiate. The real world is more subtle and continuous in this regard than the model. In the literature of the 1980s creditor coordination was identified with syndicated bank loans and lack of coordination with bond finance (Sachs and Cohen, 1982). More recently there have been discussions of how bondholders can be coordinated with Collective Action Clauses or bondholder committees (see e.g. Eichengreen and Portes, 1995). I assume that the option to coordinate creditors is a feature that the sovereign can put in the debt contract *ex ante*.

It is easy to see that the uncoordinated game between the sovereign and its creditors can give rise to self-fulfilling rollover crises in period 1. Even if the government makes an offer  $d'$  that all creditors could accept in equilibrium, if one creditor litigates the government defaults, which makes its offers to the other creditors worthless (the government will not repay anything in period 2 once the default cost is sunk). Thus if one creditor litigates, all creditors are better off litigating too.

This raises the question of how the rollover equilibrium is selected if the government does not exercise the coordination clause. For simplicity, I assume that creditors coordinate on the panic equilibrium depending on the realization of a country-specific sunspot variable that gives the signal of a panic with probability  $\mu$ .<sup>9</sup> The realization of the sunspot variable is observed by governments before they choose to exercise the coordination clause.

The sequence of events is as follows. First, in period 0, countries announce the terms on which they borrow,  $(d^j, D^j, s^j)$  where  $s = c, u$  says whether a coordination clause is included or not, and auction the claims in the international financial market. Each country that has successfully financed the infrastructure then decides its policy action  $a^j$  (equal to 1 if policy is good and to zero otherwise). In period 1 the sunspot shocks are observed; the governments that have the option decide to use the coordination clause or not, and the rollover game takes place. In period 2, output is realized, international payments are made (again following the use of the clause or not), and the residents of capital-scarce countries and foreign investors consume

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<sup>9</sup>See Morris and Shin (1999) for a model of debt crisis with heterogeneous information in which the equilibrium is uniquely defined.

their final net income, given by

$$c_2^j = y^j - \rho^j + (1 - a^j)b\Delta y \quad (2)$$

where  $\rho^j$  is the repayment to foreign creditors. I consider a perfect Bayesian equilibrium of the world economy in which each individuals maximize her welfare and the government maximizes the welfare of its representative resident. For simplicity I normalize the low realization of output to zero ( $\underline{y} = 0$ ). This implies that a costly default can occur only if is a rollover crisis at  $t = 1$ .

### 3 Equilibrium

The logic behind the equilibrium is as follows. Other things equal, a country prefers not to issue short-term debt without coordination clause because this makes it vulnerable to output-reducing rollover crises. At the same time, the debt structure must be incentive-compatible in the sense of inducing the country to take the right policy action  $a = 1$ , and of repaying its debt. Countries cannot increase their welfare by issuing debt that is not incentive-compatible since the social value of the infrastructure is negative conditional on bad policy. Short-term uncoordinated debt arises in equilibrium because it is the only incentive-compatible form of finance for some countries.

Let me define the country's *pledgeable output* as the maximum expected repayment that can be credibly promised to foreign lenders with incentive-compatible debt. Table 1 below gives the country's pledgeable output conditional on the four possible debt structures: coordinated long-term, uncoordinated long-term, coordinated mixed (i.e., with a mixture of short-term and long-term debt), and uncoordinated mixed. I now derive the expression in each cell.

**Table 1. Pledgeable output.**

	coordinated	uncoordinated
long	$V^{lc} = \bar{D}$	$V^{lu} = \bar{D}$
mixed	$V^{mc} = \bar{D} + (1 - a) \left( \frac{\gamma}{2} \bar{y} - \bar{D} \right)$	$V^{mu} = \bar{D} + (1 - a)(\gamma \bar{y} - \bar{D}) - \mu \gamma \bar{y}$

(3)

I solve for the equilibrium by proceeding backwards in time. First consider the problem in period 2. If there is no coordination clause, the government has the choice between repaying its debt fully and losing  $\gamma y$ . Creditors do not accept a debt reduction in equilibrium, since if they did, each creditor would be better off litigating alone (and receive full repayment with the collateral, which although infinitesimal is sufficient to repay one atomistic creditor). By contrast, the government can reduce its repayment to  $\gamma y/2$  by using the coordination clause. Hence, the repayment that the country can credibly pledge to foreign creditors in period 2 is reduced from  $\gamma y$  to  $\gamma y/2$  by the coordination clause.

Similarly, in period 1 a government that does not coordinate its short-term creditors must offer them new claims worth at least  $d$  in order to successfully roll over its debt (any lower offer will trigger litigation and a default). Conditional on its policy action (and the resulting probability of high output  $p$ ) the country must offer at least  $d' = d/p$ , and this offer can be accepted only if the country is actually willing to repay  $D + d'$  in period 2. This is the case iff

$$D + \frac{d}{p} \leq \frac{\gamma \bar{y}}{2} \quad (4)$$

if there is a coordination clause, and

$$D + \frac{d}{p} \leq \gamma \bar{y} \quad (5)$$

if there is no such clause.

If the government offers  $d' = d/p$  and the willingness-to-pay constraint is satisfied, there is an equilibrium in which all short-term creditors agree to roll over their claims. As mentioned in section 2, this good equilibrium coexists with a bad equilibrium in which all creditors reject the government's offer and litigate. In the absence of coordination clause, there is no way the government can avoid the panic.

The government exercises the coordination clause if it knows that a decentralized rollover is going to fail, which occurs in two cases: if condition (4) is not satisfied or if the sunspot variable gives the signal of a panic. Conversely, if condition (4) is satisfied and there is no panic, the government does not exercise the clause (since this would increase the final repayment from  $D + d/p$  to  $\gamma/2\bar{y}$ ).

Now consider the government's choice of policy between period 0 and period 1. Consider first the case where the government has issued long-term debt only. Once  $D$  is issued, the country implements a good policy if and only if this increases domestic welfare

$$\bar{y} - D \geq (1 - a)(\bar{y} - D) + b\bar{y} \quad (6)$$

that is

$$D \leq \bar{D} \equiv \left(1 - \frac{b}{a}\right) \bar{y} \quad (7)$$

For the government to implement the good policy, long-term debt must not be too high. The intuition is familiar from the debt overhang literature—long-term debt acts as a tax on domestic effort. For simplicity, I assume in the following that  $\bar{D} \leq \frac{\gamma}{2}\bar{y}$ , i.e.  $\frac{b}{a} + \frac{\gamma}{2} \geq 1$ . Hence the government can issue up to  $\bar{D}$  with or without a coordination clause. It results that the country's pledgeable output under long-term debt is given by  $\bar{D}$  independently of the presence coordination clause, as indicated in the upper cells of Table 1.

The case with short-term debt is slightly more complicated because of the rollover problem. First, consider the case with a coordination clause. The debt structure must be incentive-compatible in the sense of inducing the country to implement the good (investor-friendly) policy. Let us assume that the bad policy does not trigger a rollover crisis, i.e. condition (4) is satisfied for  $p = 1 - a$  (this is without restriction of generality).<sup>10</sup> Then the incentive condition becomes

$$E(U_2|a = 1) \geq E(U_2|a = 0)$$

where

$$E(U_2|a = 1) = (1 - \mu)(\bar{y} - D - d) + \mu \left(1 - \frac{\gamma}{2}\right) \bar{y} \quad (8)$$

$$E(U_2|a = 0) = (1 - \mu)(1 - a) \left(\bar{y} - D - \frac{d}{1 - a}\right) + \mu(1 - a) \left(1 - \frac{\gamma}{2}\right) \bar{y} + (1 - \mu)a\bar{y}$$

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<sup>10</sup>Punishing a deviating country by a rollover crisis does raise its pledgeable output. To see this, assume that the rollover condition is satisfied for  $p = 1$  but not for  $p = 1 - a$ . Then a simple computation shows that the incentive condition implies the same level of pledgeable output as in Table 1.

since the coordination clause is exercised with probability  $\mu$ . This implies

$$(1 - \mu)a(\bar{y} - D) + \mu a \left(1 - \frac{\gamma}{2}\right) \bar{y} \geq b\bar{y} \quad (10)$$

Interestingly the level of short-term debt does not appear in condition (10), i.e. it does not constrain the incentives. The reason is that a short-term-indebted country fully internalizes the consequences of its policy actions through the interest rate at which debt is rolled over. It is rewarded for a good policy by a low interest rate and punished for a bad policy by a high interest rate. This point is important since it explains why countries borrow short in this model.

With mixed coordinated debt creditors receive  $D + d$  with probability  $1 - \mu$  and  $\gamma/2\bar{y}$  with probability  $\mu$ . Thus country's pledgeable output,  $V^{cm}$ , is the solution to the following problem

$$\begin{cases} \max(1 - \mu)(D + d) + \mu\gamma/2\bar{y} \\ \text{subject to (10) and} \\ d \leq (1 - a) \left(\frac{\gamma}{2}\bar{y} - D\right) \end{cases} \quad (11)$$

The first constraint guarantees the quality of the country's policy and the second one ensures that the country is willing to repay. The solution is obtained by satiating the two constraints, and it is given in the lower-left cell of table 1.

Without the coordination clause, the country's welfare conditional on policy is given by

$$E(U_2|a = 1) = (1 - \mu)(\bar{y} - D - d) + \mu(1 - \gamma)\bar{y} \quad (12)$$

$$E(U_2|a = 0) = (1 - \mu)(1 - a) \left(\bar{y} - D - \frac{d}{1 - a}\right) + \mu(1 - a)(1 - \gamma)\bar{y} + (1 - a)b\bar{y} \quad (13)$$

implying that the incentive condition becomes

$$(1 - \mu)D \leq \bar{D} - \mu\gamma\bar{y}. \quad (14)$$

The country's pledgeable output  $V^{um}$  is solution to

$$\begin{cases} \max(1 - \mu)(D + d) \\ (1 - \mu)D \leq \bar{D} - \mu\gamma\bar{y} \\ d \leq (1 - a) (\gamma\bar{y} - D) \end{cases} \quad (15)$$

which yields the expression given in the lower-right cell of table 1.

What is the impact of the coordination clause on the country's pledgeable output? One has

$$V^{mu} = V^{mc} + \left(\frac{1}{2} - \mu\right) \gamma \bar{y}. \quad (16)$$

Removing the option to coordinate creditors has two effects on the country's pledgeable output (with mixed debt). On the one hand, making debt non-renegotiable increases pledgeable output by  $\gamma/2\bar{y}$ . On the other hand, the risk of a self-fulfilling liquidity crisis reduces pledgeable output by  $\mu\gamma\bar{y}$ . I assume that  $\mu$  is small enough that the first effect dominates.

We are now ready to characterize the financing decisions of capital-scarce countries. The maximum amount that a country can levy on the international debt market without incurring the risk of an output-reducing liquidity crisis is  $V^{mc}$ . Thus countries can finance the infrastructure without making themselves vulnerable to liquidity crises if their net wealth plus  $V^{mc}$  is larger than the cost of the infrastructure,  $\omega^j + V^{mc} \geq \kappa$ . Countries such that  $\omega^j + V^{mu} \geq \kappa \geq \omega^j + V^{mc}$  must sell short-term debt to uncoordinated creditors in order to finance the infrastructure. And those such that  $\omega^j + V^{mu} < \kappa$  cannot finance the infrastructure. Let us denote  $\omega^* = \kappa - V^{mc}$ . Our results so far can be summarized as follows.

**Proposition 1** . *There is critical wealth threshold  $\omega^*$  above which countries are not vulnerable to output-reducing rollover crises, and below which countries make themselves vulnerable to output-reducing rollover crises by issuing short-term external debt without coordination clause.*

Proposition 1 describes a two-tiered international financial system with a safe core and a risky periphery. There are capital flows inside the core, which includes not only capital-abundant countries but also some capital-scarce countries (because  $\omega^* < \kappa$ ). The difference between the core and the periphery is that international credit flows inside the core are long-term and safe, while credit flows from the core to the periphery are “fickle”, in the sense that they involve the risk of liquidity crises. As figure 2 illustrates, the welfare inequality between rich and poor countries is aggravated under

laissez-faire by the financial friction, which reduces credit flows to periphery countries and submits them to the risk of output-reducing liquidity crises.<sup>11</sup>

**Remark 1.** One could assume that countries may accumulate cash reserves at time 0 in order to deal with a liquidity crisis at time 1. It is possible to show that this is inefficient, however. The reserves have to be financed by short-term debt bearing a strictly positive interest rate, so that the gap between short-term obligations and reserves at period 1 is in fact increasing with the amount of reserves.

## 4 International Financial Architecture

Laissez-faire is inefficient in this model because of the risk of self-fulfilling rollover crisis resulting from coordination failure. A great deal of recent debates on reforming the international financial architecture focus on this question, and proceeds by analogy with the banking literature, in which coordination failures are typically dealt with in one of two ways: by the public provision of liquidity (lending in last resort) or by the coordination of creditors in crises (suspension of payments). I study in this section the welfare impact of such measures.

### 4.1 Lender of last resort

The international community has responded to the international financial crises of the 1990s with bailouts of unprecedented size. The supporters of large bailouts have often presented them as a transposition of lending in last resort to the international level (Fischer, 1999), while their opponents have criticized them for generating moral hazard (Chari and Kehoe, 1998; Meltzer, 1998). I present below another objection against the concept of lending in last resort that to my knowledge has not been made in the previous literature, one related to the sovereigns' willingness to repay the lender of last resort.

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<sup>11</sup>Figure 2 shows domestic welfare as a function of domestic wealth. The line labeled first-best corresponds to the case where countries can commit to implement the good policy and to repay.

Let us assume that the international community creates a lender of last resort (LOLR) in period 0. The LOLR stands ready to lend to governments the short-term debt that is not rolled over by private creditors in period 1. Governments repay their debt to the LOLR in period 2. I assume that in accordance with the classical doctrine, the LOLR lends only to "illiquid but solvent" governments at an actuarially fair interest rate that reflects the default risk of borrowing countries. Thus, lending-in-last-resort does not involve any international subsidy or transfer. To keep the LOLR's task relatively easy, I assume that it clearly sees the difference between solvency and liquidity crises, for example because it observes the sunspot variable. Finally, I assume that the size of the LOLR is such that it can rescue all countries hit by a liquidity crisis with probability one.

Although I have (somewhat unrealistically) endowed the LOLR with all the attributes that should allow it to function ideally, one problem remains: the LOLR is a large lender. As a result, creditors should be able to negotiate with the LOLR in the same way as with coordinated private lenders. In period 2 the LOLR cannot give governments the same incentives to repay as uncoordinated private creditors. Whether it maximizes welfare or its a function of its own profits, a threat by the LOLR to put the government in default unless it fully repays is not credible.

If its claims are renegotiable, the LOLR is never repaid more than  $\gamma y/2$  in period 2. This implies that the LOLR cannot lend at an actuarially fair interest rate to countries hit by a self-fulfilling crisis in period 1. By construction, these countries are not solvent in period 1 conditional on a pledgeable output of  $\gamma y/2$ ; otherwise they would have been able to include a coordination clause in their debt and would not be vulnerable to a liquidity crisis. Thus, the only countries to which the LOLR might lend in equilibrium are those in the core. These countries may stop putting a coordination clause in their debt, knowing that they can rely on the LOLR instead. Hence we have the following irrelevance result for lending in last resort.

**Proposition 2 .** *The LOLR lends only to countries in the core. It does not lend to countries in the periphery, so that liquidity crises remain possible there. The LOLR has no impact on capital flows, debt structure or welfare.*

The rule that the LOLR should lend only to "illiquid but solvent borrowers" is ambiguous in this model, because solvency itself is conditional on the lender. A country can be solvent vis a vis uncoordinated creditors but insolvent vis a vis a large lender like the LOLR. In fact, the LOLR will be called to intervene precisely in such cases, since the reason that countries hit by liquidity crises are vulnerable is that they cannot borrow from coordinated lenders or a large lender. Thus the feature that allows the LOLR to solve the coordination failure also implies that its lending must be a loss-making activity, in contradiction with the classical doctrine.

There are ways the LOLR could function in spite of being a large lender. For example, the LOLR could have a better ability to extract repayment than coordinated private creditors because it can impose higher default costs, or because it has a better ability to monitor or influence policies in crisis countries. In other words, the LOLR needs more than an ability to solve coordination problems in order to function effectively.

## 4.2 Coordinating creditors

A number of economists and official reports take the view that the best way to deal with rollover crises is by coordinating creditors in crises.<sup>12</sup> Different measures have been suggested to achieve this objective: imposing the use of Collective Action Clauses or bondholder committees in international bonds (Eichengreen and Portes, 1995), allowing the international community to impose a standstill following a rollover crisis, or putting the debt restructuring process under the jurisdiction of a newly-created international bankruptcy court for sovereigns (Krueger, 2001).

The optimality of such measures is dubious in my model, since the lack of coordination results from an explicit design of the debt contracts for countries that cannot borrow otherwise. It is easy to see that giving all countries the option to coordinate creditors, by forcing them to include a coordination clause or by creating a bankruptcy court, is Pareto-suboptimal in my model.

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<sup>12</sup>See G-10 (1996), G-22 (1998), Eichengreen, (1999), Eichengreen and Portes (1995); Chui et al (2000), Ghosal and Miller, 2003. This approach is called "private sector involvement" (PSI) in the official literature.

Countries in the core are not affected (since they could issue debt with unconditional coordination anyway) but the countries in the periphery are cut off of the international debt market. Short-term uncoordinated debt is the only way that these countries could borrow abroad in equilibrium.

However, public intervention could be optimal if it can be made conditional on the nature of the debt crisis—on whether it is a self-fulfilling or a solvency crisis. This would be the case for example if coordination took place under the jurisdiction of a bankruptcy court that may reject the application/filing of countries on a case by case basis. If the bankruptcy court observes the sunspot and accepts only countries with liquidity crises, global welfare is unambiguously increased. Creditors will lend in the knowledge that countries will use the coordination mechanism only to deal with self-fulfilling crises, not to reduce their debts opportunistically.

**Proposition 3** *Forcing countries to include coordination clause in their debts ex ante, or allowing them to coordinate their creditors unconditionally ex post in a bankruptcy mechanism, is Pareto-suboptimal. This does not affect countries in the core and hurts countries in the periphery by preventing them from borrowing. By contrast, a bankruptcy mechanism that coordinate creditors conditionally on a liquidity crisis is Pareto-optimal. This increases credit flows to the periphery and puts the welfare of borrowing countries at the first-best level.*

Unconditional coordination is suboptimal because it forces countries to do something which they already had the option to do under laissez-faire (by including a coordination clause in their debts). Since the model has no externality or other cause of distortion of ex ante decisions, Coasian efficiency applies and there is little room for ex ante regulation. By the same logic, it can be shown that capital controls on short-term credit flows (a tax on short-term debt, or a quantity control restricting the level of short-term debt) are welfare-decreasing.

By contrast, conditional coordination improves welfare because it addresses the main source of inefficiency, which is the incompleteness of debt contracts. Conditional coordination has the same effect as making the debt contracts contingent on the sunspot realization.

**Remark 2.** Results would be different if coordination were impossible on a contractual basis (an argument that is sometimes used to justify a statutory approach to debt restructuring). Then unconditional creditor coordination would increase the welfare of some countries (those that retain access to the international debt market) and decrease that of others (the countries that can no longer borrow).

## 5 Concluding Comments

This paper has presented a model of external debt rollover crises which, although stylized, is versatile enough to lend itself to the analysis of a number of questions that have been discussed in the recent debates on the international financial architecture. The essential message is that to the extent that the problems caused by short-term debt with uncoordinated lenders can be dealt with on a contractual basis, there is little room left for public intervention. Public intervention can play a useful role only to the extent that it fills a void in the contractual approach to solving crises, for example by making creditor coordination conditional on the nature of the crisis.

This model focused exclusively on the disciplining role of short-term debt and so abstracted from a number of issues that may be quite relevant in the real world. In particular, it abstracted from financial contagion. One can think of a number of channels of contagion between private debtors, between the private sector and the public sector or between countries. For example, a capital outflow from the domestic private sector would depress output and fiscal receipts (other things equal), thus inducing a run on the public debt. Conversely, a run on the public debt could induce capital outflows from the domestic private sector by reducing domestic productivity. Integrating contagion to the analysis may lead to substantial changes in the results (for example, ex ante regulation could become optimal) but the logic of the results will survive to some extent. This paper drew the logical implications of a simple and pure case, which should be useful in thinking about more complex situations.

One question is how the arguments developed in this paper can be transposed to private debt. As emphasized by Tirole (2002), the disciplining effect of debt maturity on countries' policy still exists if the government is

concerned by rollover crises in the private sector, but it is complicated by an externality. Each private borrower fully internalizes the risks associated with his own short-term debt, but does not fully internalize the effect it has on government policies. As a result of this dual agency problem, there might be *too little* short-term debt in the private sector in equilibrium. This result can be overturned if short-term debt entails a negative externality, for example because of financial contagion.

Finally, the analysis should be extended to take domestic political agency problems into consideration. Because all countries were assumed to be endowed with benevolent governments it was unambiguously optimal to relax the credit constraints in the international debt markets. The welfare analysis would be very different if decisions were taken by self-interested policymakers who do not maximize domestic welfare.

## REFERENCES

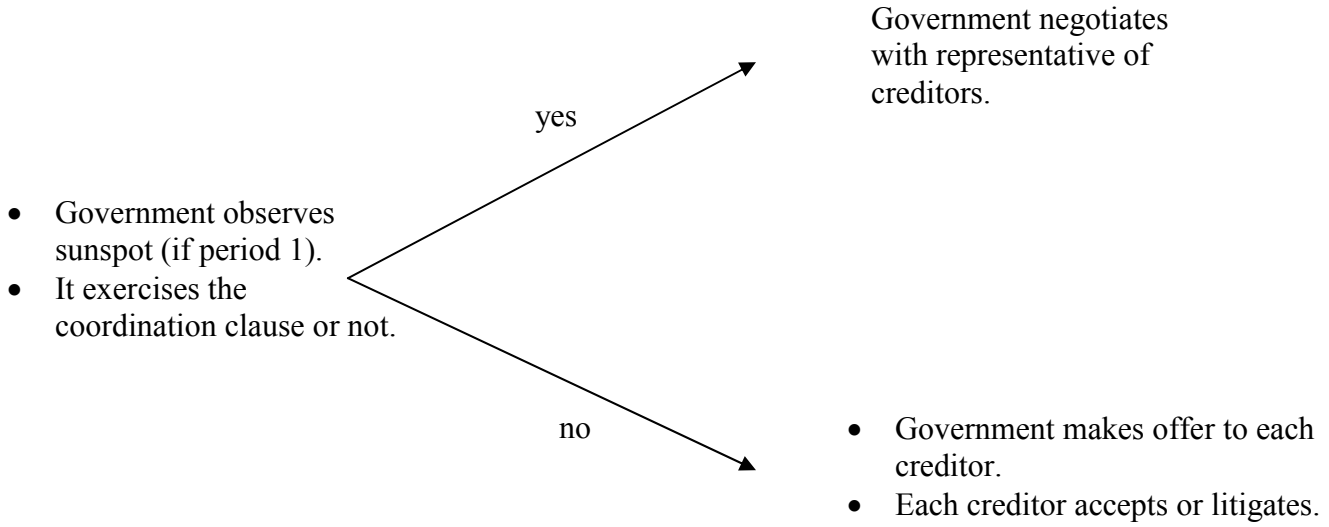
- Berglöf , Erik and Ernst-Ludwig von Thadden, 1994, Short-term Versus Long-term Interests: Capital Structure With Multiple Investors, *Quarterly Journal of Economics* 109, 1055-1084.
- Bolton, Patrick, 2002, Towards a Statutory Approach to Sovereign Debt Restructuring: Lessons from Corporate Bankruptcy around the World, mimeo.
- Bolton, Patrick, and David S. Scharfstein, 1996, Optimal Debt Structure, *Journal of Political Economy* 104, 1-25.
- Bulow, Jeremy, and Ken Rogoff, 1989, A Constant Recontracting Model of Sovereign Debt, *Journal of Political Economy* 97(1), pp. 155-78.
- Calomiris, Charles W., and Charles M. Kahn, 1991, The Role of Demandable Debt in Structuring Optimal Banking Arrangements, *American Economic Review* 81, 497-513.
- Calvo, Guillermo, 1990, Indexation and Maturity of Government Bonds: An Exploratory Model, in R. Dornbusch and M. Draghi eds., *Capital Markets and Debt Management*, 52-82, Cambridge University Press.
- Chang, Roberto and Andrés Velasco, 1999, Liquidity Crises in Emerging Markets: Theory and Policy, in NBER MacroAnnual, Ben Bernanke and Julio Rotemberg eds., Cambridge: MIT Press.
- Chari, V.V. and Patrick J. Kehoe, 1998, Asking the Right Questions About the IMF, Federal Reserve Bank of Minneapolis.
- Chui, Michael, Gai, Prasanna, and Andrew Haldane, 2000, Sovereign Liquidity Crises: Analytics and Implications for Public Policy, Bank of England, processed.
- Cohen, Daniel, 1991, *Private Lending to Sovereign States: A Theoretical Autopsy*, MIT Press (Cambridge MA).

- Cole, Harold R, and Timothy J. Kehoe, 2000, Self-fulfilling Debt Crises, *Review of Economic Studies* 67, 91-116.
- Detragiache, Enrica and Antonio Spilimbergo, 2002, Empirical Models of Short-Term Debt and Crises: Do They Test the Creditor Run Hypothesis?, mimeo, IMF.
- Dewatripont, Mathias, and Jean Tirole, 1994, A Theory of Debt and Equity: Diversity of Securities and Manager-Shareholder Congruence, *Quarterly Journal of Economics* ?, 1027-1054.
- Diamond, Douglas W. and Radhuraam G. Rajan, 2001, Banks, Short Term Debt and Financial Crises: Theory, Policy Implications and Applications, *Journal of Monetary Economics*, Proceedings of the Carnegie Rochester Conference on Public Policy 54, 37-71.
- Diamond, Douglas W., and Raghuram G. Rajan, 2000, A Theory of Bank Capital, University of Chicago, processed
- Dooley, Michael, 2000, Can Output Losses Following International Financial Crises Be Avoided?, NBER Working Paper No. 7531.
- Eaton, Jonathan, and Raquel fernandez, 1995, Sovereign Debt, in *Handbook of International Economics* vol.3, G. Grossman and K. Rogoff, eds., Elsevier Science, 2031-2077.
- Eichengreen, Barry, 1999, *Toward a New International Financial Architecture*, Institute For International Economics (Washington, DC).
- Eichengreen B., and R. Portes, 1995, *Crisis? What Crisis? Orderly Workouts for Sovereign Debtors*, CEPR, London.
- Fischer, Stanley, 1999, On the need for an international lender of last resort, *Journal of Economic Perspectives* 13, 85-104.
- Gertler, Mark, and Kenneth Rogoff, 1990, North-South Lending and Endogenous Domestic Capital Market Inefficiencies, *Journal of Monetary Economics* 26, 245-266.

- Ghosal, Sayantan and Marcus Miller, 2003, Coordination Failure, Moral Hazard and Sovereign Bankruptcy Procedures, CEPR Discussion Paper No.3729.
- Group of 10 (G-10), 1996, *Resolving Sovereign Liquidity Crises*, Washington, G-10.
- Group of 22 (G-22), 1998, *Three Reports On International Financial Architecture Reform* (October 1998).
- Goldfajn, Ilan, and Rodrigo O. Valdes, 1999, Liquidity crises and the international financial architecture, Central Bank of Chile, processed.
- Jeanne, Olivier, and Jeromin Zettelmeyer, 2001, International Bailouts, Moral Hazard and Conditionality, *Economic Policy* 33, 409-32.
- Kenen, Peter, 2001. The International Financial Architecture, What's new? What's missing?, Institute for International Economics (Washington D.C.).
- Krueger, Anne, 2001, International Financial Architecture for 2002: A New Approach to Sovereign Debt Restructuring, available at <http://www.imf.org/external/np/spe>
- Krugman, Paul, 1985, International Debt Strategies in an Uncertain World, in *International Debt and the Developing Countries*, G.W. Smith and J.T. Cuddington, eds., World Bank (Washington D.C.), 79-100.
- Kumar, Manmohan, Masson, Paul and Marcus Miller, 1999, Global Financial Crises: Mechanisms and Incentives, IMF, processed.
- Meltzer, Allan H., 1998, Asian Problems and the IMF, *The Cato Journal* 17, 267-274.
- Morris, Stephen, and Hyun Song Shin, 1999, Coordination Risk and the Price of Debt, mimeo.
- Obstfeld, Maurice, and Ken Rogoff, 1996, *Foundations of International Macroeconomics*, MIT Press.
- Rodrik, Dani, and Andrés Velasco, 1999, Short-term Capital Flows, NBER Working Paper 7364.

- Rogoff, Ken, 1999, International Institutions for Reducing Global Financial Instability, *Journal of Economic Perspectives* 13, 21-42.
- Rogoff, Ken, and Jeromin Zettelmeyer, 2002, Bankruptcy Procedures for Sovereigns: A History of Ideas, 1976-2001, IMF Working Paper 02/133.
- Roubini, Nouriel, 2002, Do We Need a New International Bankruptcy Regime?, *Brookings Papers on Economic Activity* 1, forthcoming.
- Sachs, Jeffrey, 1984, *Theoretical Issues in International Borrowing*, Princeton Studies in International Finance 54, International Finance Section, Department of Economics, Princeton University.
- Sachs, Jeffrey, 1995, Do We Need an International Lender of Last Resort?, Frank D. Graham Lecture at Princeton University, available at <http://www.ksg.harvard.edu/cid/ciddirector/publicat.html> Working
- Sachs, Jeffrey, and Daniel Cohen, 1982, LDC Borrowing With Default Risk, NBER Working Paper No.925.
- Sachs and coauthor, on the Asian crisis.
- Stiglitz, Joseph and Andrew Weiss, 1983, Incentive Effects of Termination: Applications to the Credit and Labor Markets, *American Economic Review* 73, 912-27.
- Tirole, Jean, 2002, *Financial Crises, Liquidity Provision and the International Monetary System*, Princeton University Press (Princeton, NJ).
- Vives, Xavier, 2002, External Discipline and Financial Stability, *European Economic Review* 46, 821-828.

**Figure 1. Sequence of events in period 1 and 2.**



**Figure 2. Domestic wealth and welfare**

