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 reform of the international financial architecture. The analysis is based on a model in which the need to roll over external debt disciplines the policies of debtor countries, but makes them vulnerable to unwarranted debt crises due to bad shocks. The paper presents a welfare analysis of several measures that have been discussed in recent debates, such as international lending-in-last-resort or the establishment of a mechanisms for suspending payments on the external debt of crisis countries.

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, Thailand and Russia in 1997-98; all these countries had to roll over large amounts of short-term external debt. This made these countries vulnerable to debt roll-over crises, whose resolution was complicated by the fact that debt was held by a large number of uncoordinated creditors.

A number of proposals in the debate on reforming the international financial architecture attempt to deal with external debt roll-over crises. However, it seems difficult to assess the relative merits of these reforms without understanding the underlying determinants of debt structures. While it is often taken for granted that international capital is "hot", there must be some reasons that investors and borrowers engage in short-term contracts that turn out to be costly for both sides in the event of a crisis.

This paper presents an analysis of international financial architecture reform in the context of a model in which the structure of the external debt of nations is endogenous. The structure of the external debt is endogenized as a solution to a commitment problem. A dangerous external liability structure keeps the country under a "short leash" and ensures that the debtor country implement

investor-friendly policies. But it also makes the country vulnerable to crises caused by bad shocks. There is a tension, thus, between the benefits of dangerous debt in terms of incentives and the risk of unwarranted crises.

The short maturity of debt and the coordination failure between creditors are not, in my model, the basic source of inefficiency, but the reflection of the incompleteness of international debt contracts (the impossibility of making these contracts contingent on the quality of the debtor countries' policies). It is not obvious, from that point of view, that solving the coordination failures between creditors is optimal. Indeed, I find that some well-intentioned policies may have an effect that is the opposite of the one intended—because of the endogeneity of debt structures.[1]

The reforms that improve welfare in my model do so by bringing the economy closer to the first-best equilibrium with complete contracts. One example is a debt restructuring mechanism allowing the coordination of the creditors of debtor countries with good policies. From this perspective, reforming the international financial architecture should be viewed as an effort to expand the set of verifiable states on which international financial contracts can be made contingent. The desirable degree of contract completeness may not be achieved through a spontaneous process of decentralized financial innovation because of collective action problems (Franks and Sussman, 2005). Completing the contracts may require an investment in new judicial institutions and legal regimes.

This paper is related to several strands of literature. First, the results in this paper resonate with a number of themes in the finance literature on the structure of firms' or banks' liabilities. Berglöf and von Thadden (1994), Bolton and Scharfstein (1996), Dewatripont and Tirole (1994) have analyzed the role of multiple uncoordinated creditors in "toughening up" the capital structure of a firm. A similar argument has been developed in the theory of banking to explain demandable deposits with a sequential service constraint (Calomiris and Kahn, 1991; Diamond and Rajan, 2001a).

The incentive effects of debt structures have also been studied in the literature on external debt that followed the sovereign debt crisis of the 1980s and the private debt crises of the 1990s. Gertler and Rogoff (1990) show how agency problems may reduce the volume of debt flows from advanced countries to developing countries. That the emergence of short-term sovereign debt might be the symptom of commitment problems is noted by Sachs (1984), Krugman (1985) and Calvo

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[1]For example, Chui, Gai and Haldane (2002) find, in a model where the structure of debt is exogenous, that unconditionally coordinating creditors or lengthening the maturity of debt is welfare-improving. The opposite is true here.

and Guidotti (1990), and more recently by Rodrik and Velasco (2000).[2]

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) have endogenized the structure of countries' external liabilities as bank deposits a la Diamond and Dybvig (1983). 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 markets 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. Similar themes were developed by Diamond and Rajan (2001b) and Tirole (2002, 2003).

The paper is structured as follows. Section I presents the model. Section II analyses the welfare effects of different forms of public intervention, and section III concludes.

I Model

I consider a small open economy, composed of the private sector and of the government. The timing of the main events and actions is presented in Figure 1. There are three-periods ($t = 0, 1, 2$). The private sector invests in period 0 and consumes in period 2. The investment is financed by a loan from foreign investors. Between period 0 and 1 the domestic government takes a policy action that affects the return to foreign investors. In period 1, the foreign investors observe the policy action and receive some information about the return on the domestic investment. A fraction of the investment may be liquidated in period 1 on the basis of this information. Finally, in period 2 domestic output is divided between the domestic private sector and the foreign creditors, and consumption takes place.

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[2]There is also a large literature looking at the incentive effects of government debt structures in a domestic context (see, e.g., Lucas and Stokey, 1983).

I.A   Private sector

For simplicity, the domestic private sector is represented by a single entrepreneur-consumer.[3] The entrepreneur consumes in period 2, and maximizes the expected level of his consumption:

$$U_t = E_t(c). \tag{1}$$

The entrepreneur is endowed with a indivisible project requiring an investment in period 0 and yielding a payoff in period 2. The size of the initial investment is normalized to 1. The return on the project (which is also the country's output) is given by,

$$y = \theta k, \tag{2}$$

where θ is the domestic level of productivity and k is the level of productive capital in period 2. The level of productive capital is lower than 1 if a fraction of the initial investment is liquidated in period 1. Domestic productivity is stochastic, and distributed with a continuous probability distribution function $f(\cdot)$ in the domain $[\underline{\theta}, \overline{\theta}]$. All agents in the economy receive a public signal about θ in period 1. I assume, for simplicity, that the signal is perfectly informative, i.e., θ is observed in period 1.[4]

Liquidating the project in period 1 yields λ unit of good per unit of liquidated capital. I assume that the investment is profitable ex ante, and that liquidation is inefficient even if productivity is at its lowest possible level, i.e.,

$$E(\theta) > 1, \tag{3}$$

$$\lambda < \underline{\theta}. \tag{4}$$

The domestic entrepreneur has no funds in period 0 and finances the investment by selling debt to foreign investors (the case of equity and other financial contracts will be discussed in section

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[3] This assumption simplifies the analysis by ensuring that the entrepreneur internalizes the impact of his actions on domestic policy. With a large number of entrepreneurs this may no longer be the case—because of the common agency problem emphasized by Tirole (2003). However, the results can be generalized to an arbitrarily large number of entrepreneurs if there are nonconvexities in the debt structure of an individual entrepreneur. The details are available upon request to the author.

[4] Assuming that the signal is not perfectly informative slightly complicates the analysis without yielding interesting extra insights. The details are available unpon request to the author.

I.D).[5] Foreign investors are atomistic, risk-neutral and supply an indefinite amount of funds at a zero interest rate. There is perfect competition between lenders so that the domestic entrepreneur extracts all the surplus of the lending relationship. The entrepreneur sells debt to a continuum of mass 1 of foreign lenders.

I assume that the debt is demandable in the sense of Diamond and Dybvig (1983): debt contracts give each creditor a choice between an early repayment of d_1 in period 1, or a late repayment of d_2 in period 2. The choice between early and late repayment is exclusive—a given creditor can receive only one payment—but different creditors can make different choices. The creditors who opt for an early repayment are repaid, in period 1, with the proceeds of the liquidation of the investment. There is the same sequential service constraint as in the Diamond-Dybvig model: the creditors asking for early repayment are randomly allocated in a "line", and repaid on a "first-come first-served" basis.

For simplicity, I assume that the entrepreneur sells the same debt contract (d_1, d_2) to all lenders, so that the private sector's entire debt structure is characterized by the pair (d_1, d_2).[6] Long-term debt is a special case corresponding to $d_1 = 0$. Demandable debt is obviously more dangerous than long-term debt for the entrepreneur. If $d_1 > \lambda$, the domestic private sector is vulnerable to a self-fulfilling run on its external debt (a self-fulfilling "capital flight"), since in this case there is a bad equilibrium in which all the creditors are better off asking for early repayment rather than letting the investment being liquidated for the benefit of others. I shall abstract from self-fulfilling debt runs in the following, as they raise complications that are interesting but not essential to establish the main points of this paper.

I.B   Government

I assume that there is a constraint on the level of domestic output that the country can pledge in repayment to foreign investors. Each foreign creditor will be able to appropriate at most r, the *pledgeable* return on the investment. This variable captures the strength of the creditor rights, as they are determined by the domestic legal system. The rights of foreign creditors are determined

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[5]One could assume that part of the investment is financed by the entrepreneur's wealth. The exogenous level of entrepreneurial wealth would then be a determinant of the structure of debt in equilibrium. The analysis presented here would hold if the entrepreneur's wealth is low.

[6]This is without substantial loss of generality. If the debt structure is heterogeneous then it is optimal to make only a fraction of debt demandable, but the essence of the analysis is unchanged. The details are available upon request to the author.

by domestic courts because of domestic *sovereign immunity.*

There is a large literature documenting how the strength of creditor rights and the quality of their enforcement vary across countries (see, e.g., La Porta et al, 1998). For simplicity, I assume here that r can take two values: r_H (high level of creditor rights) or $r_L < r_H$ (low level of creditor rights).[7] The level of creditor rights results from policy actions that are taken by the domestic government, for example reforming bankruptcy laws or the governance of domestic courts. Although these actions might be costly in reality, they will be assumed to be costless in the model for the sake of simplicity.

One key concern, for foreign lenders, is the extent to which the domestic government commits to enforce their rights. A plausible assumption, for many developing and emerging market countries, is that of *limited commitment*: the government can commit to enforce creditor rights to some extent, but the credibility of this commitment is more limited than in advanced countries.[8] For example, after a reform has established some measure of independence for domestic courts, this independence cannot be completely reversed overnight. Some measure of commitment can also be achieved by delegating policy decisions to a "conservative" policymaker who is determined to enforce creditor rights. But this commitment may be reversed after a period of time, especially if the country has no strong domestic constituencies backing the rule of law and private property rights.

In the model, this notion of limited commitment is captured in a simple way by assuming that the domestic government can commit to creditor rights only one period ahead. That is, a certain degree commitment is possible, but the "political horizon" at which a developing country can commit to enforce the rights of foreign investors (one period) is shorter than the "economic horizon" at which foreign investors must commit their funds to the country (two periods).

To put it more formally, I assume that in period 0, the government can commit to enforce all the contracts in period 1 (and in particular the liquidation rights of foreign investors), but cannot commit to the level of r that will be enforced in period 2. The level of r is determined through policy actions that are taken after the domestic private sector has invested. Consistent with my assumption that commitment is possible one period ahead, the level of creditor rights observed in period 1 will be enforced in period 2: the government cannot change r "between" period 1 and period 2. I assume that the domestic government sets the level of creditor right r before the level

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[7]The strength of creditor rights could be different for domestic and foreign creditors. This difference does not play any role here since all creditors are assumed to be foreign.

[8]By contrast, the literature on the "willingness-to-pay" problem in sovereign debt generally assumes that there is no commitment at all, i.e., that even a limited commitment is impossible.

of productivity θ is observed.[9]

The foreign creditors are not fully repaid in period 2 if either the pledgeable return r or the realized return y is too low. If domestic output is not sufficient to repay the debt, it is shared between the creditors on a *pro rata* basis. Thus, the period-2 repayment to a creditor who has not asked for early repayment is given by

$$\min\left(d_2, r, \frac{y}{1-\ell}\right),$$

where ℓ is the number of creditors who have opted for early repayment.

I assume that a high level of creditor rights is both necessary and sufficient for lenders to break even (conditional on no liquidation),

$$(5) \qquad \int_{\underline{\theta}}^{\overline{\theta}} \min(\theta, r_L) f(\theta) d\theta < 1 < \int_{\underline{\theta}}^{\overline{\theta}} \min(\theta, r_H) f(\theta) d\theta.$$

This implies that the domestic private sector will be able to borrow from foreign investors if and only if the government is expected to enforce a high level of creditor rights with a sufficiently high probability.

Finally, the government is assumed to be benevolent: it sets r so as to maximize the welfare of the private sector, given by (1).

I.C Equilibrium

I look for perfect Bayesian equilibria of the game between the foreign lenders, the domestic entrepreneur, and the domestic government. An equilibrium consists of: (1) a private debt structure (d_1, d_2); (2) a policy decision by the government $r = r_H$ or r_L; and (3) a set of decisions on the time of repayment by the creditors, such that

• in period 0 the entrepreneur sets the debt structure (d_1, d_2) that maximizes his welfare U_0 subject to the participation constraint of the lenders,

• "between" period 0 and period 1 the governments sets the level of creditor rights r to maximize domestic welfare U_0 conditional on the entrepreneur's debt structure,

• in period 1 each creditor decides to ask for early repayment, or not, conditional on the state (r, θ), taking the actions of the other creditors as given.

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[9]This is without substantial restriction of generality. Assuming that r is set when θ is observed does not change the analysis, except in the case with renegotiation if the debtor country and the creditors can bargain over r (Propositions 2) . Even in this case, our results remain valid provided that the creditors' bargaining power is not too high. The details are available upon request to the author.

First, let us look at the case of a country that can commit to the level of creditor rights in period 0 (a country with "good institutions"). Then the government sets $r = r_H$, and the private sector can finance its investment with long-term debt.[10] The equilibrium long-term debt repayment is the level that makes foreign lenders just break even,

$$1 = \int_{\underline{\theta}}^{\overline{\theta}} \min(d_2^{fb}, \theta) f(\theta) d\theta,$$

(where the superscript stands for "first-best"). Note that d_2^{fb} exists, is unique, and is lower than r_H by assumptions (3) and (5). Hence, the private sector can credibly commit to repay d_2^{fb} once the government has committed the country to a high level of creditor rights. Domestic welfare is equal to the first-best level,

(6) $$U_0^{fb} = E(\theta) - 1.$$

The equilibrium is very different in the absence of long-term commitment. First, the private sector cannot borrow long-term. If it did, the government would maximize domestic welfare by setting $r = r_L$ once domestic investment is financed. But foreign lenders would anticipate this, and thus would not lend long-term in period 0.

How can demandable debt mitigate the government's incentives problem? The equilibrium can be solved by proceeding backwards. First, in period 1, there is a run on domestic capital in period 1 if and only if,

(7) $$d_1 > \min(r, \theta, d_2).$$

If this condition is satisfied, the creditors demand early repayment until the investment is completely liquidated. This is because as long as the investment is not completely liquidated the payoff from running remains equal to d_1 whereas the payoff from not running is reduced below $\min(r, \theta, d_2)$ by the liquidation.[11] The investment is completely liquidated because the creditors' claim is larger than the liquidation value of the investment, $d_1 > \lambda$ (this results from (4), (7), and $\theta \geq \underline{\theta}$). Note that the debt run is not a self-fulfilling "liquidity crisis" but a "solvency crisis" triggered by the domestic private sector's inability to credibly promise to repay its debt in period 2.[12] A solvency

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[10] d_1 is indeterminate as long as it is small enough for liquidation never to occur in equilibrium. Such trivial indeterminacies will be ignored in the following.

[11] More formally, if a fraction ℓ of creditors are demanding early repayment, the non-liquidated capital is $k = (1 - \ell d_1/\lambda)^+$. The payoff from not running is $\min(d_2, r, \theta \frac{k}{1-\ell})$, which is decreasing with ℓ because $d_1 > \lambda$.

[12] This notion of "insolvency" conflates unwillingness and unability to repay, since it can be caused by a low level of creditor rights rather than a low return on the investment.

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crisis could occur in spite of investor-friendly domestic policies, if the return on the investment θ is low.

This has an important implication for the equilibrium debt contract (d_1^{lf}, d_2^{lf}) (where the superscript stands for "laissez-faire"). An incentive-compatible contract must satisfy,

$$(8) \qquad r_L < d_1^{lf} \leq \min(d_2^{lf}, r_H).$$

First, d_1 cannot be lower than r_L. If it were, the probability of liquidation would be independent of r, so that the government would have no incentive to establish a high level of creditor rights. Second, d_1 cannot be higher than d_2 or r_H. Otherwise, the domestic private sector would set itself for systematic liquidation, which cannot be optimal. Condition (8) is not only necessary but also sufficient for incentive compatibility. If it is satisfied the government chooses $r = r_H$, knowing that $r = r_L$ results in complete liquidation of the investment and zero welfare.

The equilibrium debt contract can then be derived through the following steps. If the contract satisfies (8), the domestic private sector is liquidated if the return is low $(\theta < d_1)$. Using that the lenders' participation constraint is binding in equilibrium, domestic welfare is then given by,

$$(9) \qquad U_0 = \int_{\underline{\theta}}^{d_1} \lambda f(\theta) d\theta + \int_{d_1}^{\overline{\theta}} \theta f(\theta) d\theta - 1.$$

Domestic welfare is the total net surplus of the investment, taking into account that it yields a lower return λ if $\theta < d_1$. Domestic welfare is decreasing with d_1, so the private sector chooses the lowest possible d_1 subject to the incentive-compatibility constraint (8), which we denote by,

$$d_1^{lf} = r_L^+.$$

The period-2 repayment, then, is the level that allows foreign lenders to break even,

$$(10) \qquad 1 = \lambda \int_{\underline{\theta}}^{r_L^+} f(\theta) d\theta + \int_{r_L^+}^{\overline{\theta}} \min(d_2^{lf}, \theta) f(\theta) d\theta.$$

This equation has one solution d_2^{lf} if the probability of a liquidation is small enough. Note that $d_2^{lf} > d_2^{fb}$, i.e., the risk of liquidation adds a premium to the period-2 debt repayment.

Comparing (6) and (9) shows that domestic welfare is lower under laissez-faire than under the first-best because of the expected deadweight loss from liquidation,

$$(11) \qquad U_0^{lf} = U_0^{fb} - \int_{\underline{\theta}}^{r_L^+} (\theta - \lambda) f(\theta) d\theta.$$

The incentives provided by demandable debt come at a cost, which is the risk of a liquidation triggered by a bad productivity shock or a sunspot shock. The results so far are summarized in the following proposition.

Proposition 1 *In the laissez-faire equilibrium, the private sector finances domestic investment with demandable debt and exposes itself to the risk of a capital flight leading to complete liquidation of the investment. Domestic welfare is strictly below the commitment first-best level.*

Proof. See the discussion above. ∎

I.D   Other contracts

There are two layers of contract incompleteness in this model. First, sovereign immunity makes it impossible to force the country to repay more than r per creditor in period 2. Second, we have restricted the attention, so far, to a relatively narrow set of contracts (demandable debt with uncoordinated creditors). These layers of incompleteness are conceptually distinct, since subject to sovereign immunity, one could look at contracts other than demandable debt. I now relax the second restriction, and look at a broader set of contracts that satisfy sovereign immunity. The objective is to show that those contracts do not improve on demandable debt with uncoordinated creditors, thus justifying the second restriction.

First, one could relax the assumption that debt is held by a large number of uncoordinated creditors with a sequential service constraint. Let us assume instead that the debt contract (d_1, d_2) is signed with one larger lender in period 0. The large lender has the option of asking for d_1 in period 1, and of liquidating the investment up to the amount that he is not repaid. If renegotiating with the entrepreneur is costless, obviously, the creditor prefers to negotiate on a new payment d_2' larger than λ rather than forcing an inefficient liquidation. The outcome of the renegotiation is that the creditor is promised the liquidation value of the investment plus a share of the renegotiation surplus,

$$d_2' = \lambda + \omega(\theta - \lambda),$$

where ω denotes the bargaining power of the creditor. Note that $d_2' < \theta$, so that the entrepreneur has enough resources to repay this amount. However, the actual repayment is still constrained by sovereign immunity: the large creditor receives $\min(r, d_2')$ in period 2.

If renegotiation is possible, the government, no longer being under the threat of a liquidation, maximizes welfare by setting $r = r_L$. Anticipating this, the large lender does not lend ex ante. This

extension of the model leads to the well-known result in contract theory that although renegotiation ensures ex post efficiency, the prospect of renegotiation can undermine the borrower's ex ante access to credit. This is stated more formally in the following proposition.[13]

Proposition 2 *The domestic private sector cannot borrow in period* 0 *from a large lender with whom renegotiation is possible in period 1.*

Proof. See the appendix. ∎

Second, one might envisage contracts that depend on a less coarsely defined set of contingencies. For example, the entrepreneur could finance the investment with equity contracts in which the final repayment to outside investors is contingent on the investment's return, $d_2(y)$. However, it is easy to see that if equity is subject to the same sovereign immunity constraint as debt, this would not improve welfare.

Third, with complete contracts the liquidation in period 1 and the repayment in period 2 could be made contingent on the full state (r, θ). Then it is easy to see that the first-best can be achieved with the following contract:

- liquidate the investment in period 1 if and only if $r = r_L$;
- repay d^{fb} in period 2.

This contract is optimal because it provides the appropriate incentives at no cost, by making liquidation conditional on policy (r), rather than on solvency, which conflates policy with a productivity shock $(\min(r, \theta))$.

However, there are at least two reasons that such contracts would be difficult to implement in the real world. First, the quality of domestic policy would have to be verifiable, i.e., a judge would have to certify the level of r. The quality of countries' policies is not easy to verify, and it is not clear what judges would be competent to verify them (at least under the status quo institutional framework—we will come back to this question). Second, as discussed above, such a contract would not be renegotiation-proof, since the country and its creditors would be better off negotiating rather than liquidating in period 1.

This being said, the optimal complete contract will provide a useful benchmark for thinking about the optimal reforms of the international financial architecture. In particular, one must explain

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[13]This result holds independently of the creditor's bargaining power because the government commits to the level of creditor rights before the negotiation takes place. If the level of r is negotiable, then Proposition 2 remains valid only if ω is not too high. The details are available upon request to the author.

how those reforms will mitigate the frictions that were preventing the emergence of the optimal contract under laissez-faire.

II Policy

Let us now consider a world with a number of countries like the one that was described in the previous section. This section looks at the impact of various forms of public interventions aimed at improving global welfare. A Pareto-optimal reform must improve the ex ante welfare of borrowing countries without decreasing welfare in the rest of the world.

A number of other proposals to reform the international financial architecture involve a mechanism that is comparable to the suspension of payments in the banking literature (Miller and Zhang, 2000).[14] The "contractual approach" relies on the inclusion of clauses in debt contracts that make it easier to coordinate creditors in a renegotiation, such as collective action clauses (Eichengreen, 2003) or debt rollover option clauses (Buiter and Siebert, 1999). By contrast, the "statutory approach" to reform involves the creation of new institutional mechanisms that would make all debts easier to renegotiate. A prominent example of the statutory approach was the sovereign debt restructuring mechanism (SDRM) proposed by the IMF's Anne Krueger (Krueger, 2002).

The notion of suspension of payments could be captured by the following assumptions in the context of my model. There is liquidation in period 1 only if the number of atomistic creditors asking for early repayment remains below a small threshold $\varepsilon > 0$. If this number is equal to or larger than ε, then an authority (a judge) declares a suspension of payments, following which there is a negotiation between a representative of all the creditors and the country (the entrepreneur and the government being merged into a single entity). Given that sovereign immunity still holds, it is reasonable to assume that this negotiation takes place like in the previous section, and in particular that the creditors have the same bargaining power, ω, as under laissez-faire.

The basic problem with this mechanism should be clear from our discussion of the case with renegotiation. The possibility of renegotiation destroys the government's incentives to adopt a creditor-friendly policies and thus prevents the country from borrowing ex ante. This has two implications. First, in the contractual approach, the private sector will choose not to include renegotiation-friendly clauses in its debt. Second, if the renegotiability of debt is imposed by

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[14]Some proposals are inspired instead by the lending-in-last-resort paradigm. See Fischer (1999) for a discussion of international crisis lending taking this perspective.

a statutory mechanism, capital-scarce countries will be cut off from external finance—a concern expressed, among others, by Dooley (2000) and Shleifer (2003) in the debates on the SDRM.[15]

The results would be very different, though, if the suspension of payments could be made contingent on the state (r, θ, s). Assume that the judge can restrict the protection of a suspension of payments to countries with investor-friendly policies $(r = r_H)$. Then it is possible to show that the welfare of borrowing countries is raised to the first-best level.

Proposition 3 *Assume that conditional on an incipient crisis, a judge can declare a suspension of payments followed by a negotiation between the debtor country and its creditors. Then*

(i) if all countries can benefit from a suspension of payments, there is no lending ex ante and welfare is reduced below the laissez-faire level;

(ii) if only countries with investor-friendly policies can benefit from a suspension of payments, welfare is increased to the first-best level.

Proof. See the appendix. ∎

To put it in more general terms, if a judge could verify ex post whether a capital flight is due to bad policy $(r = r_L)$ rather than bad luck $(\theta < r_L)$, then it would be optimal for borrowers and lenders to include in the demandable-debt contract a clause allowing the judge to declare a suspension of payments conditional on good policy. In the context of my simple model, this would raise the borrower's welfare to the first best level. This welfare gain would be achieved, furthermore, without infringement of sovereign immunity, the only role of the judge being to correctly verify the state.

This arrangement effectively reproduces the optimal complete contract discussed at the end of section I. As was suggested there, such contracts are not observed in the real world because of frictions that prevent their spontaneous emergence through a decentralized process. Can these frictions be mitigated by public intervention?

The first problem was the verifiability of the quality of policy by the judge. An exhaustive ex ante description of good policies is likely to be a daunting and costly task. The economic environment changes over time and knowledge evolves, so that the definition of a "good policy"

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[15] If the same level of creditor coordination can be achieved by the contractual and statutory approaches, then the former is always preferable to the latter since it gives borrowers the option, not the obligation to coordinate creditors. The statutory approach may dominate, however, if there are contractual externalities between lenders (Bolton and Jeanne, 2007).

should be updated during the lifetime of the contract. In addition, the certification of domestic policies would have to be made very quickly in a crisis, which is possible only if the judge has monitored the quality of domestic policies as well the exogenous economic developments before the crisis. This pre-crisis monitoring, furthermore, would have to be implemented for all the countries that have put the conditional suspension clause in their debt.

These difficulties may explain why we do not observe the optimal contingent debt contracts in the real world. But the absence of those contracts could also result from collective action problems that prevent their emergence through decentralized financial innovation. The contracting parties may fail to innovate because they bear the costs of innovation but do not internalize their benefits for future users.[16] In a decentralized equilibrium, furthermore, an individual judge may have little incentives to invest in the specific human capital (the expertise) that is required to assess the quality of domestic policies. The contracting parties may try to set up an ad hoc arbitration mechanism, but such a mechanism may not reach the critical mass and the independence that might be necessary to operate efficiently. The required investment in human capital may not be worth paying for one contract, or for one debtor country only.

Those problems, however, might be mitigated by appropriate collective action at the international level, for example by the creation of a new legal regime or new specialized institutions mandated to accumulate the required expertise. That the quality of country policies is not intrinsically unverifiable is suggested by the existence of international arrangements that are conditional on the policies of member countries. Examples include, at the regional level, the Stability and Growth Pact for the fiscal policies of European Union members or, at the global level, the conditionality in IMF programs. Those international arrangements typically involve some mechanism to monitor countries' policies—for example, the IMF already monitors the policies of its 185 members on a regular basis. In addition, these arrangements combine quantitative performance criteria with escape clauses allowing room for ex post judgment.[17] Those clauses are "vague", but not more so than contract terms such as "best efforts", "reasonable care" and "good faith" that are com-

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[16] See Franks and Sussman (2005) for a model of under-innovation in corporate bankruptcy regimes based on this externality.

[17] In the case of the Stability and Growth Pact, for example, no excessive deficit procedure will be launched if the excessive deficit is considered "temporary and exceptional". In IMF conditionality, quantitative performance criteria can be waived if the breach reflects "a situation in which the economic conditions evolved differently than had been envisaged" (IMF, 2001).

monplace in commercial contracts.[18] One role of the arbitrating institutions is precisely to guide expectations about the interpretation of the vague clauses through their jurisprudence and public communication. Finally, the fact that mistakes can be made in the interpretation of the vague clauses does not imply that that it would be better to have no clause at all.[19]

The second problem was the lack of renegotiation proofness—ex post, all parties prefer negotiation to liquidation. In the mechanism of Proposition 3, this problem would be alleviated by the fact that liquidation would still be implemented by a large number of uncoordinated creditors, like under the status quo. Thus the judge would not have to mandate a liquidation that is resisted by both parties, but rather let liquidation run its course for countries with bad policies. Obviously, there might be excessive forbearance if the judge maximizes welfare in the short-run, or is influenced by the short-run objectives of the other parties. This problem is similar to other time-consistency problems in public institutions (e.g., courts or central banks) and might be mitigated by appropriate governance.[20]

III   Concluding Comments

This paper presented a model of external debt roll-over 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 endogeneity of the debt structure implies that the normative analysis has to go beyond statements that short-term debt is "bad" and should be discouraged, or that creditors should be coordinated in a crisis. These statements are correct in an ex post sense, but from an ex ante perspective dangerous liability structures arise for a reason. The design of the optimal public intervention should take into account the underlying cause of financial fragility, and the theoretical framework presented in this paper helps to clarify how.

This paper argued that the dangerous liability structures might reflect the incompleteness of international financial contracts (rather than sovereign immunity per se). On the normative side,

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[18]See Scott and Triantis (2005) for a discussion of the importance of vague clauses in the context of the theory incomplete contracts.

[19]In the context of my model, if one assumes that the judge can make type I errors (declaring that policy is bad when it was good) or type II error (declaring policy good when it was bad), it is possible to show that a conditional suspension-of-payments clause remains valuable if the probability of error is not too large. The details are available upon request to the author.

[20]One critique against the sovereign debt restructuring mechanism proposed by Krueger (2002) was that the governance of the IMF made it too influenced by the short-run objectives of its main shareholders.

this implies that the welfare of borrowing countries could be improved by a judicial mechanism allowing a suspension of payments for countries that are affected by capital flight in spite of good policies. This conclusion begs the question of why international debt contracts have not already been completed in this way. This could be due to the fact that the relevant states are intrinsically unverifiable, but this could also be due to the fact that the institutions that might verify those states have not been created. This line of thought suggests a "judicial approach" to reforming the international financial architecture, in which the key institutions would act more like like judges certifying the relevant states rather than as "financial firefighters".

Admittedly, reforming the international financial architecture may not be the most direct route to the first best. The first best would also be achieved if borrowing countries reduced their crisis vulnerability by making their commitment to good policies more credible (i.e., by developing "good institutions"). This raises a set of questions that are important in their own right and clearly go beyond the scope of this paper. This also suggests a question for future research that could be considered in an extension of this model: how reforming the international financial architecture would affect the domestic incentives to improve domestic institutions and policy frameworks.

APPENDIX

Proof of Proposition 2. I show that the government sets $r = r_L$ after the private sector has borrowed from a large lender, implying that the lender does not lend in equilibrium. Since a negotiation is initiated by the lender, his payoff is the max of $\min(r, \theta, d_2)$ (the payoff if he does not negotiate) and $\min(r, d_2' = \lambda + \omega(\theta - \lambda))$ (the payoff if he negotiates). Thus domestic welfare is given by,

$$E_0(c|r) = \int_{\underline{\theta}}^{\overline{\theta}} \left[\theta - \max\left(\min(r, \theta, d_2), \min(r, \lambda + \omega(\theta - \lambda))\right)\right] f(\theta) d\theta.$$

This is strictly decreasing in r, so that the government sets $r = r_L$. **Q.E.D.**

Proof of Proposition 3. An incipient run occurs if and only if condition (7) is satisfied. If this condition is satisfied the number of creditors asking for early repayment cannot be strictly smaller than ε. Conversely if this condition is not satisfied no creditor is better off asking for an early repayment.

Let us look at the incentives given by demandable-debt contracts with $d_1 = r_L^+$. If the suspension of payments is not conditional on the quality of domestic policy, then renegotiation occurs with probability 1 if $r = r_L$, and with probability $\int_{\underline{\theta}}^{r_L^+} f(\theta) d\theta$ if $r = r_H$. Domestic welfare is higher with low creditor rights since,

$$
\begin{aligned}
E(c|r = r_H) &= \int_{\underline{\theta}}^{r_L^+} \left[\theta - \min(r_H, \lambda + \omega(\theta - \lambda))\right] f(\theta) d\theta + \int_{r_L^+}^{\overline{\theta}} \left[\theta - \min(r_H, \theta, d_2)\right] f(\theta) d\theta \\
&< \int_{\underline{\theta}}^{\overline{\theta}} \left[\theta - \min(r_L, \lambda + \omega(\theta - \lambda))\right] f(\theta) d\theta = E(c|r = r_L).
\end{aligned}
$$

The inequality uses the facts that $\min(r_H, \lambda + \omega(\theta - \lambda)) = \min(r_L, \lambda + \omega(\theta - \lambda))$ for $\theta \leq r_L^+$, and $\min(r_H, \theta, d_2) > \min(r_L, \lambda + \omega(\theta - \lambda))$ for $\theta \geq r_L^+$.

Hence, if the suspension of payments is unconditional, demandable debt does not provide the appropriate policy incentives and there is no lending ex ante. By contrast, if the suspension of payments is conditional on $r = r_H$, then $E(c|r = r_L) = 0$ so that demandable debt provides incentives to set $r = r_H$. **Q.E.D.**

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Figure 1. Timeline of events and actions

Domestic entrepreneur invests 1
Foreign lenders lend with
debt contract (d_1, d_2)

Domestic government sets policy
$r = r_L$ or r_H

Productivity θ observed
Foreign lenders ask for
early repayment or not
$\rightarrow$ capital k

Production $y = \theta k$
Debt repayment
Consumption

t=0

t=1

t=2