# INCENTIVE-COMPATIBLE SOVEREIGN DEBT

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Abstract. In a model of sovereign borrowing and lending–a model with asymmetric information, costly state disclosure, and no outside enforcement–I show that the sovereign borrower optimally issues a simple type of debt contract. The result can be seen as the equivalent for sovereign finance of classic debt optimality results by Townsend (1979) and Gale and Hellwig (1985); it explains why sovereign borrowers issue plain bonds instead of richer debt contracts: plain bonds economize on the political cost of state disclosure. An increase in the cost of state disclosure can increase welfare through a commitment effect: higher state disclosure costs commit the sovereign to repay her debt at face value in more states of the world; thus, reducing the likelihood of default.

**– JOB MARKET PAPER –**

## 1. Introduction

A basic contracting problem underlies sovereign borrowing and lending. If a government seeks to finance an expenditure today, but receives income in the future, *what is the optimal financial contract* the government can offer to international investors?

In an Arrow-Debreu world, with complete contingent contracts and no frictions, the question is not interesting: if expected income exceeds the expenditure, then the optimal contract is indeterminate. By contrast, the efficiency of the market for sovereign finance is limited by at least two frictions. First, efficiency is limited by the well-known willingness-to-pay problem. As there is no outside enforcement, the sovereign can repudiate any contract she has entered in the past and repay zero. Second, efficiency is limited by the sovereign's private information about her ability-to-pay (or income). The sovereign can disclose her true income, but this is costly. Building on these two frictions, I propose a new theory of sovereign debt

[1]For helpful comments I thank Ernst-Ludwig von Thadden, Enrico Perotti, Enrique Schroth, Ernst Maug, Knut Heen, Klaus Adam, Mike Burkart, Nicolas Schutz, Petra Loerke, Phillip Zahn, Malin Arve, André Stenzel, Adriano Rampini, Arnoud Boot, and seminar participants at the Stockholm School of Economics.

and show that simple debt contracts, of the type observed in sovereign borrowing, are the outcome of an optimal contracting problem.[2]

A sovereign can promise repayment in a contract, but there is no authority to enforce such payment when due. Instead, the sovereign borrower can choose to repudiate the contract, i.e. repay zero. The absence of formal outside enforcement, like a court, in sovereign finance has led the literature on the *willingness-to-pay problem* to ask why sovereign borrowers ever repay–Eaton and Gersovitz (1981) is a seminal contribution.[3] Reinhart and Rogoff (2009) summarize this literature as, 'concerns over future access to capital markets, maintaining trade, and broader international relations all support debt flows.' The sovereign pays for two reasons in this paper. First, the sovereign pays because she is concerned with the economic costs of non-repayment. I assume that creditors can charge an economic penalty in case of repudiation, following, e.g., Sachs and Cohen (1982) and Bolton and Jeanne (2009). Second, and novel to my model, the sovereign pays because she is concerned with the political fallout of non-repayment. If the sovereign does not repay the debt at face value, she is forced to concede some control, and may be forced out of office altogether.

Asymmetric information arises because the government observes its income, while outside creditors do not. Outside creditors can get informed, but only if the government discloses its willingness-to-pay truthfully. Such disclosure, however, is costly for the government: the government has to invite outside observers and concede some control to them, which it dislikes.

The problem is to find the optimal contract given the willingness-to-pay problem, asymmetric information, and positive state disclosure costs. I show that the optimal contract is a debt contract that specifies (i) a fixed payment in undisclosed states, corresponding to the face value of the debt; (ii) a payment equal to the creditor punishment threat in disclosed states; and (iii) state disclosure if and only if the sovereign's willingness-to-pay falls short of the face value of the debt. The result can be seen as the equivalent for sovereign finance of the debt optimality results in Townsend (1979) and Gale and Hellwig (1985), where the willingness-to-pay problem plays no role.

It is natural to interpret state disclosure as a *debt crisis*. In keeping with the definition in Manasse and Roubini (2005), a country experiences a debt crisis if it

[2]A priori, the prevalence of plain bonds in sovereign borrowing is puzzling. Why don't sovereign borrowers issue fully contingent contracts, with payments linked to tax receipts, GDP, or export prices? Also see Borensztein and Mauro (2004) and Shleifer (2003).

[3]Also see Bulow and Rogoff (1989a,b), Fernandez and Rosenthal (1990), Atkeson (1991), Kletzer and Wright (2000), Sandleris (2008), Guembel and Sussman (2009), and Hellwig and Lorenzoni (2009). Eaton and Fernandez (1995) and Sturzenegger and Zettelmeyer (2006) survey the literature.

is in default, or if it receives a bailout.[4] Examples abound: Argentina defaulted in 2001; Greece was bailed out by the EU-IMF-ECB triumvirate in 2010–Ireland and Portugal followed within a year. Indeed, debt crises are costly to the government: faced with increased scrutiny from within (population, press) and from outside (IMF, creditor nations), the government is forced into policy concessions and may lose office.[5] Debt crises also involve a transfer of information: more information comes available through, e.g., IMF reports or increased press coverage.[6]

With the debt crisis interpretation, the characteristics of the optimal contract match some of the salient features of sovereign borrowing: first, countries issue simple bonds that promise a fixed payment to creditors; second, in case of a debt crisis, creditors expect a haircut that depends on their bargaining power;[7] and third, a debt crisis results in states where the sovereign–based on a cost-benefit consideration–is unwilling to repay the debt at face value.[8]

A further result is that an increase in the costs of state disclosure can increase welfare by alleviating the inefficiency due to the willingness-to-pay problem. High disclosure costs work as a commitment: with high disclosure costs, the government is committed to pay its debt at face value in more states of the world. The analysis formalizes an argument–made by Dooley (2000) and Shleifer (2003) among others–that high costs of sovereign default can be ex-ante efficient in the presence of a willingness-to-pay problem.

In an extension, I include a debt renegotiation stage along the lines of Bolton and Jeanne (2009) and introduce a cost of creditor coordination. If creditors are dispersed, it may be costly for them to coordinate and renegotiate the debt burden with a sovereign borrower. Bolton and Jeanne (2007, 2009) take this observation to an extreme by assuming that sovereign debt can either be renegotiated at no cost, or not at all. I show that the contracts that Bolton and Jeanne (2007, 2009) use in their work can be understood as optimal contracts within my model: non-renegotiable debt is the solution to the optimal contracting problem if state disclosure is costly, and so is creditor coordination; renegotiable debt is optimal if debt crises are costly, but subsequent creditor coordination is costless.

[4]Formal default is sometimes averted by a private sector bail-in. In Korea 1998, e.g., default was preempted by a concerted roll over of bank debts, see Blustein (2001). Such bail-ins are considered debt crises here, as they involve debt relief and require policy concessions by the government.

[5]Governments are often forced to resign in the wake of a debt crisis, as Argentina's government was in 2001. See Blustein (2005) for a detailed account of Argentina's financial crisis in 2001.

[6]Details about Greece's tax-collection system, or the size of public sector entitlements, became widely known only after the EU-IMF-ECB bailout.

[7]All creditors are not equal. As there is no court to enforce creditor priority, creditors can expect to be repaid according to the power they wield. The IMF, for example, is typically repaid in full, whereas private creditors receive a haircut.

[8]This includes states where the government is truly unable to pay. Reinhart and Rogoff (2009) document a wide dispersion of debt-to-GDP levels at time of default, and argue that a sovereign's willingness-to-pay, rather than her ability-to-pay, determine the repayment decision.

1.1. **Related Literature.** My paper is related to theories of debt in the corporate finance literature, in particular to the costly state verification models pioneered by Townsend (1979) and Gale and Hellwig (1985).[9] Other papers that show the optimality of debt under some form of enforceability include Diamond (1984), Innes (1990), and Hart and Moore (1998). These theories are not readily applicable to sovereign finance because a sovereign debtor, unlike any corporation, can choose to repudiate contracts that she entered in the past. I choose an exposition that is close to Gale and Hellwig (1985) and add the willingness-to-pay problem, which acts as an enforcement friction.Another innovation is that the cost of state inspection is political: the sovereign does not like to disclose its true ability-to-pay. The optimal contract I derive economizes on costly information provision–as it does in Townsend (1979) and Gale and Hellwig (1985). But the optimal contract differs from standard debt on account of the willingness-to-pay problem. Compared to standard debt, the fixed-payment feature in good states is retained in the optimal contract. The disclosure decision differs due to the willingness-to-pay problem. Furthermore, the optimal contract does not specify maximum recovery in case of state disclosure. Rather, the amount that is recovered by creditors in disclosed states equals the punishment they can inflict.

My paper is close in spirit to Gale and Hellwig (1989), who consider a model of sovereign borrowing with asymmetric information and a willingness-to-pay problem. But Gale and Hellwig (1989) study the problem of debt renegotiation under asymmetric information as a signaling game: first the borrower decides how much to repay, then the lender chooses whether to accept the payment or punish instead. By contrast, I look at a specific institutional setting that applies to the sovereign finance market. In particular, investors can only punish the sovereign debtor if there is a breach of contract; whereas the initial contract does not matter in Gale and Hellwig (1989), as creditors can always use their punishment technology.

Recently, Bolton and Jeanne (2007, 2009) have argued that the sovereign debt market–left to itself–can produce equilibria in which the sovereign debt is excessively hard to restructure. In both papers the sovereign can issue two types of debt: debt that is renegotiable (r-debt), and debt that is not renegotiable (n-debt). If the government is truly unable to repay, renegotiable debt allows for an efficient renegotiation of the debt burden, while non-renegotiable debt leads to a dead-weight loss. Still, the sovereign may choose to issue non-renegotiable debt because it offers some commitment value: n-debt strengthens the sovereign's repayment incentives (Bolton and Jeanne, 2007), and n-debt cannot be diluted by subsequent

[9]Also see Border and Sobel (1987); Mookherjee and Png (1989); Krasa and Villamil (1994, 2000); Hvide and Leite (2010)

debt issues (Bolton and Jeanne, 2009). In this paper, both renegotiable debt and non-renegotiable debt may emerge as optimal contracts for specific parameters.

## 2. Model: A Simple Borrowing Problem

Consider a small open economy over two periods: the present ($t = 0$) and the future ($t = 1$). There is a single homogeneous good that can either be consumed or invested. A sovereign government, or *sovereign*, acts on behalf of the residents of the economy and seeks to finance a fixed government expenditure. The government expenditure, $g > 0$, needs to be undertaken at time 0 and benefits all residents in the economy equally. Because the sovereign has no funds at time 0, she seeks to raise the full amount from international investors. In return, the sovereign promises to repay at time 1.

At date 1 the sovereign receives some income, from tax or others, which is uncertain as of date 0. Uncertainty arises because future output is uncertain, as are the sovereign's ability to tax output, cut expenses, and privatize state property. The sovereign's income, or *ability-to-pay*, is denoted by $y$: a random variable that takes values in an interval $T \subseteq \mathbb{R}_+$ and is distributed according to a cumulative distribution function $F$. A sovereign's ability-to-pay is the upper bound to the transfer that can be made to creditors at time 1.

The sovereign maximizes the utility of the representative resident of the economy, and in addition enjoys some private benefit from holding office as long as there is no debt crisis. The utility of the sovereign is given by

$$U_S = I_g U_0 + C_1 + B_1 I_R \tag{2.1}$$

The first two terms capture the utility of the representative resident: $I_g$ is an indicator that equals 1 if the expenditure is financed; $U_0$ represents the utility value the residents derive from the expenditure at time 0; and $C_1$ is consumption at time 1 (i.e. all income net of any payment to creditors). The third term, $B_1 > 0$, is the non-pecuniary private benefit the sovereign enjoys from holding office as long as she repays the debt without having to disclose the state, i.e. as long as $I_R = 1$. If instead $I_R = 0$, the sovereign loses her private benefit. One should think of $I_R$ as a debt crisis indicator. Indeed debt crises are costly to the sovereign who may be forced to undertake structural reforms, to accept outside interference with its policies, or even to resign from office.

In autarky, the sovereign cannot finance the expenditure at date 0, there is no debt crisis at date 1, and residents are restricted to consume $y$ as it comes available. The sovereign then gets expected utility

$$EU_S^{aut} = Ey + B_1 \tag{2.2}$$

The sovereign may do better by raising funds from international creditors. There is a continuum of risk-neutral creditors that can provide funds at the prevailing opportunity cost of capital, which is normalized to 0. The sovereign seeks to borrow from a mass one subset of the creditors. Financing the government expenditure is efficient, or $g < V$, and I assume that the sovereign's expected income exceeds the expenditure, or $Ey > g$.[10] This assumption ensures that the sovereign can finance the expenditure in a first-best world where information is symmetric and all income can be pledged. The sovereign's first-best utility level is given by

$$EU_S^{FB} = U_0 + Ey - g + B_1 \tag{2.3}$$

and there are many contracts that implement the first-best allocation. As an example, consider a promise to pay a fraction $\kappa \leq 1$ of income at date 1, such that $E\kappa y = g$. With this contract, investors break even and accept to provide $g$.

Two frictions limit the efficiency of international sovereign borrowing. The first friction arises from asymmetric information: while the sovereign observes $y$ at no cost, outside investors only observe $y$ if the sovereign discloses the state. If the sovereign chooses to disclose the state, the country comes under international public scrutiny (by the IMF e.g.) and creditors learn about the sovereign's ability-to-pay. State disclosure is costly as it provokes a debt crisis: the sovereign will face interference with its policies and possibly loses office. The second friction arises from the lack of enforcement in the sovereign finance market: a sovereign borrower can repudiate any contract and pay 0. This is the well-known willingness-to-pay problem.

The interaction between the sovereign and international financiers is as follows. At date 0, the sovereign issues a financial contract to finance $g$. The contract determines (i) the sovereign's contractual payment obligation in each state; and (ii) what states are to be disclosed to creditors. Formally, a *contract* is defined as an array $(O_1, I_d)$, where $O_1 = O_1(y)$ gives the time 1 contractual obligation as a function of the state, and $I_d = I_d(y)$ is an indicator that equals 1 if the state is disclosed and 0 otherwise. At date 1, a repayment stage follows if the sovereign obtained the financing at date 0, she remains in autarky otherwise. The sequence of actions at the repayment stage is as follows:

(1) Nature chooses the state, sovereign observes $y$ ;
(2) Sovereign announces her ability-to-pay $\hat{y}$,

[10]The government expenditure should be thought of as public consumption, as the expenditure does not raise future productivity of the economy. This assumption is not crucial for any of my results, but plausible in the context of sovereign borrowing, cf. also Bolton and Jeanne (2009).

- if $I_d(\hat{y}) = 1$, then creditors observe $y$, and the contractual obligation is $O_1(y)$;
- if $I_d(\hat{y}) = 0$, then the contractual obligation is $O_1(\hat{y})$.

(3) Sovereign makes a repayment decision $r \in \{0, 1\}$,

- $r = 1$: she pays $O_1$, i.e. honors the contract, and the games ends, or
- $r = 0$: she pays 0, i.e. repudiates, and creditors charge the punishment.

At the final stage of the repayment game, the sovereign makes her repayment decision: she can either repudiate her contractual obligation, or honor it. An outside arbitrator, who has the same information as creditors, certifies whether the sovereign has honored her contractual obligation or not.[11] If the sovereign honors the contract, then investors have no further claim against her. If, instead, the sovereign repudiates, then there is a debt crisis in which the economy suffers an output loss, $\gamma y$, while creditors do not recover any payment. The output loss is best thought of as arising from a loss of market access: as long as no settlement is reached with outside investors, the country is shut out off international markets (Bolton and Jeanne, 2009); the parameter $\gamma \leq 1$ captures the power of creditors to punish the sovereign for repudiation.

The contractual obligation of the sovereign is set at the announcement stage. If the sovereign announces a state for which the contract calls for disclosure, then there is a debt crisis in which creditors observe the state and the payment obligation is set at $O_1(y)$. If, instead, the sovereign announces a state that remains undisclosed, then the obligation is set at $O_1(\hat{y})$. It follows that the contractual obligation of the sovereign, $O_1$, is fully determined by her announcement, $\hat{y}$. The repayment decision then depends on the true state, $y$, and on the contractual obligation, $O_1$. The time 1 payoff of the sovereign is summarized in the following table:

| | $r = 1$ | $r = 0$ |
|---|---|---|
| $I_d(\hat{y}) = 1$ | $y - O_1(y)$ | $y - \gamma y$ |
| $I_d(\hat{y}) = 0$ | $y - O_1(\hat{y}) + B_1$ | $y - \gamma y$ |

To conclude the section, consider the different types of debt crises that can occur. To the sovereign all debt crises are costly, as she has to explain herself, allow outside interference, agree to policy concessions, and risks a loss of office. In short, the sovereign loses her private benefit if there is a debt crisis. Still, not all debt crises are equal. If the state is disclosed, and the sovereign subsequently pays, the outcome

[11]The IMF plays an important role in most sovereign debt crises. For example, an IMF program is prerequisite to a renegotiation of any Paris club debt (i.e. debt owed to creditor nations). Sometimes, the IMF provides its seal of approval for a proposed debt renegotiation by sending so-called 'comfort letters' to private creditors (cf. Díaz-Cassou, Erce-Domínguez, and Vazguez-Zamora, 2008). Crucially, the IMF cannot enforce payments or seize assets.

resembles a successful debt workout. If the sovereign instead repudiates, the sovereign remains in default and creditors charge a penalty.[12] Finally, the sovereign may repudiate outright, i.e. without previous state disclosure. Note, however, that outright repudiation is a weakly dominated strategy at the announcement stage: the sovereign can not be worse of by disclosing the state at the announcement stage.[13]

## 3. Optimal contract

3.1. **With repayment commitment.** The optimal contract depends on whether the sovereign can commit to a repayment strategy. As a benchmark, I derive the optimal contract assuming the sovereign can commit, at date 0, to a repayment strategy at date 1. The sovereign optimally commits to full repayment, or $r = 1$ for all $O_1 \leq y$. To see why, suppose there is an optimal contract without full repayment: a contract $(O_1, I_d)$ and repayment strategy $r$ such that $r = 0$ with positive probability. Then an alternative contract given by

$$O_1' = \begin{cases} O_1 & \text{if} \quad r = 1 \\ 0 & \text{if} \quad r = 0 \end{cases}$$

$$I_d' = I_d$$

with full-repayment, $r' = 1$ for all $O_1 \leq y$, leaves the sovereign with the same incentives at the announcment stage. It follows that creditors receive the same payment in each state under the alternative contarct. As the sovereign keeps her private benefit with higher probability, the full repayment contract strictly dominates the initial contract, contradicting optimality. In the following I restrict attention to full-repayment contracts, denoted by $(P_1, I_d)$. The problem then is to derive the optimal full-repayment contract. This problem, it turns out, is equivalent to a special case of the problem studied in Gale and Hellwig (1985).[14]

Even if the sovereign can commit to a repayment strategy, she may still lie about her income at the announcement stage to lower final payment. I check that a contract $(P_1, I_d)$ is carried out as specified in the following, i.e. that the sovereign reveals her income truthfully in all states. Let $y$ be the true state. If the sovereign falsely announces a state $\hat{y}$, with $I_d(\hat{y}) = 1$, then creditors observe the true state and the sovereign pays $P_1(y)$. Thus I check that the sovereign has no incentive to falsely announce $\hat{y}$, for which $I_d(\hat{y}) = 0$.

[12]The repayment decision is made by a new government if the incumbent government loses office due to the debt crisis that arises at the announcement stage. The term *sovereign* refers to the agent that acts on behalf of the residents in the economy, not to a specific government.

[13]Outright repudiation is rarely observed. An example is the refusal of Russia's Bolshevik government to repay Tsarist debts after the revolution in 1918.

[14]Contrary to Gale and Hellwig (1985), the disclosure decision precedes the repayment decision here.

Let $W(y, \hat{y})$ denote the sovereign's date 1 payoff if her true income is $y$, while she announces $\hat{y}$ for which $I_d(\hat{y}) = 0$, so

$$W(y, \hat{y}) := y - P_1(\hat{y}) + B_1$$

As consumption cannot be negative, the announcement $\hat{y}$ is only feasible if the corresponding payment can be made, or $P_1(\hat{y}) \leq y$. If the sovereign reveals the true state $y$, her date 1 utility is

$$y - P_1(y) + B_1(1 - I_d(y))$$

A contract then is said to satisfy *truthful state revelation* if and only if: for any states $y$ and $\hat{y}$ such that $I_d(\hat{y}) = 0$, we have either (i) $P_1(\hat{y}) > y$; or (ii) $W(y, \hat{y}) \leq y - P_1(y) + B_1(1 - I_d(y))$. If a contract satisfies truthful state revelation, announcing a false state is either infeasible or unprofitable. The structure imposed by truthful state revelation is given in the following proposition.

**Proposition 1.** *A full repayment contract $(P_1, I_d)$ satisfies truthful state revelation if and only if there is a constant $D$ such that (i) $P_1(y) = D$, whenever $I_d(y) = 0$ ; and (ii) for any $y$ and $\hat{y}$ such that $I_d(\hat{y}) = 0$, $I_d(y) = 1$, and $P_1(\hat{y}) \leq y$, we have $P_1(y) \leq P_1(\hat{y}) - B_1$.*

*Proof.* Omitted □

The contracting problem is to choose an incentive compatible contract that maximizes the sovereign's expected utility, i.e. to solve

$$\max_{(P_1, I_d)} \; E\left(y - P_1 + B_1(1 - I_d(y))\right)$$

such that

$$EP_1 \geq g \tag{3.1}$$

$$P_1(y) \leq y \tag{3.2}$$

and $(P_1, I_d)$ satisfies truthful state revelation. It is easy to show that the participation constraint of the investor must bind at an optimum, or $EP_1 = g$.[15] The maximization problem reveals two objectives of the sovereign: she wishes to finance the government expenditure, while minimizing the probability of costly state disclosure.

If there is an optimal contract, Gale and Hellwig (1985) have shown that it takes the form of a standard debt contract. Three features define standard debt: (i) a fixed payment, or face value; (ii) state disclosure if and only if the ability-to-pay falls

[15]If the participation constraint does not bind, then $P_1(y)$ can be decreased such that the participation constraint of the investor, and truthful state revelation, remain satisfied. The resulting increase in expected utility for the sovereign, contradicts optimality.

short of the fixed payment; and (iii) maximum recovery in case of state disclosure. Formally, a contract $(O_1, I_d)$ is said to be a *standard debt contract* if and only if

(1) for some $D$, we have $O_1(y) = D$ if $I_d(y) = 0$ ;
(2) $I_d(y) = 1$ if and only if $y < D$ ; and
(3) $O_1(y) = y$ if $I_d(y) = 1$ ;

also see figure 3.1. As there is only a private cost of state disclosure, maximum recovery implies that all income is transferred to creditors in case of state disclosure.[16]

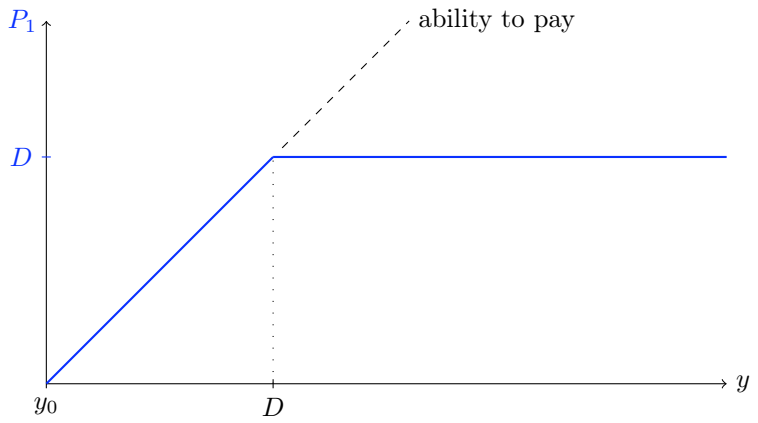


**Figure 3.1.** Payment of standard debt contract as a function of income.

3.2. **Without repayment commitment.** Without repayment commitment, the sovereign makes her repayment decision after the contractual obligation is set. To see which contractual obligations are repaid and which are repudiated, consider the repayment stage at time 1. By working backwards along the extensive game form, the equilibria of the repayment subgame are obtained. If the sovereign repudiates, there is a debt crisis in which the economy suffers an ouput loss $\gamma y$, and the sovereign loses her private benefit,$B_1$.[17] The unique time-consistent repayment strategy, $r(y, \hat{y})$, now follows from comparing the sovereign's utility in case of repayment with her utility in case of repudiation,

$$r(y,\hat{y}) = \begin{cases} 1 & \text{if} \quad O_1(y) \leq \gamma y & \text{and} \quad I_d(\hat{y}) = 1, \\ 1 & \text{if} \quad O_1(\hat{y}) \leq \min\{\gamma y + B_1, y\} & \text{and} \quad I_d(\hat{y}) = 0, \\ 0 & \text{if} \quad \text{otherwise} \end{cases} \tag{3.3}$$

[16]By contrast, the pecuniary costs of state observation in Gale and Hellwig (1985) imply that creditors recover only part of firm income in case of state disclosure.
[17]Note that the private benefit may have been lost at the announcement stage already; the sovereign only keeps the private benefit if the contractual obligation is repaid without disclosure.

For any given contract, $r(y, \hat{y})$ gives the sovereign's willingness-to-pay in each state and for each announcement. The willingness-to-pay is the maximum contractual obligation for which $r = 1$; it depends both on the true state and on the disclosure decision at the announcement stage. For non-disclosed states, the willingness-to-pay of the sovereign is increasing in the private benefit $B_1$. The intuition is that the sovereign is more likely to avert a debt crisis if the political cost of provoking one is high. The threat of an output loss, $\gamma y$, deters repudiation both in disclosed and non-disclosed states; thus, the sovereign's willingness-to-pay is increasing in $\gamma$.

For a contract, $(O_1, I_d)$, to be carried out as specified, the sovereign must reveal her income truthfully at the announcement stage. In the following, let $y$ be the true state, and let $\hat{y}$ be a false announcment. If $I_d(\hat{y}) = 1$, creditors observe the true state $y$, and the contractual obligation is set at $O_1(y)$; accordingly, I only check that the sovereign has no incentive to claim $\hat{y}$, with $I_d(\hat{y}) = 0$. I further restrict attention to false announcements, $\hat{y}$, that remain undisclosed but then lead to repayment, i.e. for which $I_d(\hat{y}) = 0$ and $r(y, \hat{y}) = 1$. False announcements that lead to repudiation are weakly dominated at the announcement stage, as the sovereign can not be worse off by announcing the true state. The following proposition gives the structure imposed by truthful state revelation.

**Proposition 2.** *A contract $(O_1, I_d)$ satisfies truthful state revelation if and only if there is a constant $D$ such that (i) $O_1(y) = D$, whenever $I_d(y) = 0$; and (ii) for any $y$ and $\hat{y}$ such that $I_d(\hat{y}) = 0$, $I_d(y) = 1$, and $O_1(\hat{y}) \leq min\{\gamma y + B_1, y\}$, we have $O_1(y) \leq O_1(\hat{y}) - B_1$.*

*Proof.* Sufficiency of (i) and (ii) for truthful state revelation is easily checked. To see that (i) and (ii) are necessary, suppose $O_1(y)$ is not constant whenever $I_d(y) = 0$; then, the sovereign has an incentive to announce the unobserved state that results in the lowest contractual obligation, contradicting truthful state revelation. Likewise, suppose condition (ii) is violated; then, there exists $y$ and $\hat{y}$ with $I_d(\hat{y}) = 0$ and $I_d(y) = 1$, such that $O_1(y) > O_1(\hat{y}) - B_1$. This implies that the sovereign announces $\hat{y}$, again a contradiction. □

False announcements, $\hat{y}$, are constrained by the sovereign's ex-post willingness-to-pay, and by the available income.[18] Condition (i) of the proposition ensures that the sovereign has no gain from announcing a different state if the actual realization is undisclosed. Condition (ii) of the proposition ensures that the sovereign has no gain from announcing an undisclosed state if the actual realization calls for state disclosure. She may be tempted to do so to avert a debt crisis in which she loses her private benefit.

[18]By contrast, in proposition 1 of section 3.1, where the sovereign can commit to a repayment strategy, false announcements are only constrained by the available income.

Moving back to date 0, the sovereign optimally issues a contract that is repudiation-proof, i.e. a contract that is not repudiated at the repayment stage. A contract is said to be *repudiation-proof* if and only if:

(i) $O_1(y) \leq \min\{\gamma y + B_1, y\}$ for $y \in \{x | I_d(x) = 0\}$, and

(ii) $O_1(y) \leq \gamma y$ for $y \in \{x | I_d(x) = 1\}$

For any contract that is not repudiation-proof, there is a repudiation-proof contract that leaves the sovereign with higher expected payoff. So I restrict attention to repudiation-proof contracts. As an example, note that the standard debt contract is not repudiation-proof; the contractual obligation exceeds the sovereign's willingness-to-pay in disclosed states.[19]

The contracting problem now is to solve:

$$\max_{(O_1, I_d)} \; E\left(y + B_1(1 - I_d(y)\right) - g$$

such that

$$\begin{aligned} EO_1(y) &= g \\ O_1(y) &\leq y \end{aligned}$$

and

$$\begin{aligned} O_1(y) &\leq \gamma y + B_1 \quad \text{for } y \in \{x | I_d(x) = 0\} \\ O_1(y) &\leq \gamma y \quad \text{for } y \in \{x | I_d(x) = 1\} \end{aligned}$$

where $(O_1, I_d)$ satisfies truthful state revelation. The primitives of the contracting problem are (i) the private benefit $B_1$, (ii) the investors' power $\gamma$, (iii) the government expenditure $g$, and (iv) the cdf and support of income $y$, i.e. $F$ and $T$.

To gain some intuition for the role of the problem's primitives, consider the contracting problem under symmetric information. With symmetric information, the only remaining friction is the willingness-to-pay problem and the scope for inefficiency is extreme: either the expenditure can be financed and the first-best is achieved, or there exists no contract with which the expenditure can be financed. To see this, note that with symmetric information the sovereign can pledge a maximum of $\gamma y + B_1$ in each state as long as the income constraint is satisfied. Expected pledgeable income therefore equals

$$E\left(\min\{\gamma y + B_1, y\}\right) \tag{3.4}$$

If the pledgeable income exceeds the expenditure requirement ($g$), then the first-best can be achieved and the optimal contract is indeterminate; if the expenditure

[19] Except if $\gamma = 1$, a boundary case

requirement exceeeds pledgeable income, then no contract allows the sovereign to finance the expenditure. The example shows that the primitives of the problem can be such that the sovereign is not able to finance the expenditure with any contract. In particular this is the case if creditors have little bargaining power ($\gamma \ll 1$), or if the government expenditure is high ($g \gg y_0$).

I return to the general case of asymmetric information and assume that the primitives are such that a solution of the contracting problem exists. To characterize the solution, I introduce a new type of financial contract: the sovereign debt contract. A contract is said to be a *sovereign debt contract* if and only if

(i) for some $D$, we have $O_1(y) = D$ if $I_d(y) = 0$ ;
(ii) $I_d(y) = 1$ if and only if $D > \min\{\gamma y + B_1, y\}$ ; and
(iii) $O_1(y) = \gamma y$ if $I_d(y) = 1$.

A sovereign debt contract specifies: (i) a fixed payment, or face value; (ii) state disclosure if and only if the willingness-to-pay falls short of the fixed payment; and (iii) a payment equal to the creditor punishment threat if the state is disclosed, also see figure 3.2. Sovereign debt contracts are repudiation-proof, they satisfy truthful state revelation, and they are uniquely characterized by their face value. The following proposition shows that an optimal contract must be a sovereign debt contract.

**Proposition 3.** *Let $(O_1, I_d)$ be an optimal contract, then $(O_1, I_d)$* is a sovereign debt contract.

*Proof.* Let $(O_1, I_d)$ be an optimal contract and let $D$ be the constant value of $O_1$ when $I_d(y) = 0$. Consider a new contract $(\tilde{O}_1, \tilde{I}_d)$ given by

$$\tilde{I}_d(y) = \begin{cases} 0 & \text{if} \quad \tilde{D} \leq \min\{\gamma y + B_1, y\} \\ 1 & \text{if} \quad \tilde{D} > \min\{\gamma y + B_1, y\} \end{cases}$$

and

$$\tilde{O}_1(y) = \begin{cases} \tilde{D} & \text{if} \quad \tilde{I}_d(y) = 0 \\ \gamma y & \text{if} \quad \tilde{I}_d(y) = 1 \end{cases}$$

and suppose first that $\tilde{D} = D$. If $\tilde{I}_d(y) = I_d(y)$, then the construction of $\tilde{O}_1$ implies that $\tilde{O}_1(y) \geq O_1(y)$. If $\tilde{I}_d(y) < I_d(y)$, i.e. if $\tilde{I}_d(y) = 0$ and $I_d(y) = 1$, then it follows from proposition 1 that

$$O_1(y) \leq D \leq \tilde{O}_1(y)$$

Furthermore, we can rule out $\tilde{I}_d(y) > I_d(y)$. To see this, suppose that $y$ is such that $\tilde{I}_d(y) = 1$ and $I_d(y) = 0$. Then we know that $O_1(y) = D$, but this cannot be repayment incentive compatible as we also know that $\gamma y + B_1 < D$ from $\tilde{I}_d(y) = 1$. This proves that $\tilde{O}_1(y) \geq O_1(y)$ if $\tilde{D} = D$.

Now, one can choose $\tilde{D} \leq D$ such that the investor participation constraint is still satisfied. By construction, the resulting contract $(\tilde{O}_1, \tilde{I}_d)$ satisfies truthful revelation and is repudiation-proof–like any sovereign debt contract. As $\tilde{I}_d(y) \leq I_d(y)$, it must be optimal.

Since both $(O_1, I_d)$ and $(\tilde{O}_1, \tilde{I}_d)$ are optimal contracts, we have

$$E(I_d - \tilde{I}_d)B_1 = 0 \tag{3.5}$$

Consider the state observation function $I_d(y)$. For all states $y \in \left[0, \frac{D-B_1}{\gamma}\right)$ we must have $I_d(y) = 1$, since $I_d(y) = 0$ would mean that $O_1(y) = D$ which contradicts repudiation-proofness. There may be more states for which $I_d(y) = 1$, as we only know that $I_d(y) \geq \tilde{I}_d(y)$. Let $T_2$ denote the set of those states, so $T_2 = \left\{ y \geq \frac{D-B_1}{\gamma} \middle| I_d(y) = 1 \right\}$. We see that

$$EI_d = \int_0^{\frac{D-B_1}{\gamma}} 1f(y)dy + \int_{T_2} 1f(y)dy$$

furthermore we have

$$E\tilde{I}_d = \int_0^{\frac{\tilde{D}-B_1}{\gamma}} 1f(y)dy$$

Now since $\tilde{D} \leq D$ and $B_1 > 0$, it follows that (i) $D = \tilde{D}$ and (ii) $T_2$ has probability mass zero; hence we see that $I_d = \tilde{I}_d$ almost surely. It follows that, as $EO_1 = E\tilde{O}_1$, we must also have that $O_1 = \tilde{O}_1$ almost surely, and I conclude that the optimal contract is a sovereign debt contract. □

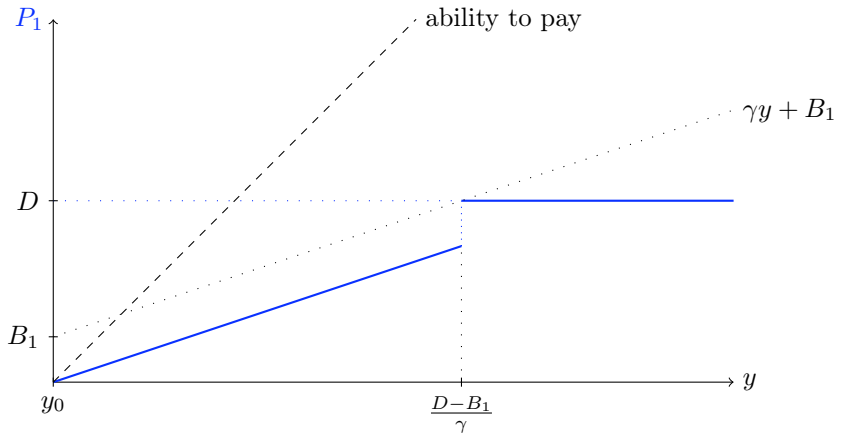


**Figure 3.2.** Payment of sovereign debt contract as a function of income

Proposition 3 shows that an optimal contract, if there is one, is a sovereign debt contract. Intuitively, the sovereign debt contract is optimal because it (i) economizes on the costs of state disclosure, and (ii) is never repudiated. While costly state observation serves to determine the sovereign's true willingness-to-pay, repudiation represents a pure waste of resources. The sovereign debt contract is repaid at face value in high income states, where the sovereign's willingness-to-pay is high; it specifies state disclosure and a payment that is contingent on output in low income states, where the sovereign's willingness-to-pay is low.

Compared to standard debt, the fixed payment feature is retained in the sovereign debt contract. The disclosure decision differs due to the willingness-to-pay problem. The sovereign debt contract also does not specify maximum recovery for disclosed states. Rather, the amount that is recovered in disclosed states equals the punishment that creditors can inflict. For the boundary case $\gamma = 1$, the sovereign debt contract coincides with standard debt contract. The intuition is that the willingness-to-pay problem poses no constraint if creditors can punish repudiation with a complete destruction of output. For the more plausible cases with $\gamma < 1$, the payment of the sovereign debt contract is discontinuous at the income threshold for disclosure, i.e. at $y = \frac{D-B_1}{\gamma}$. The payment discontinuity ensures that the sovereign reveals her income truthfully (cf. figure 3.2; proposition 2).

## 4. Sovereign Debt Contract

In a model of sovereign borrowing and lending, I have shown that the sovereign optimally issues–what I've called–a sovereign debt contract. I derive some of the properties of sovereign debt contracts in the following.

Figure 3.2 shows the payout to an investor who holds a sovereign debt contract as a function of the state of the world $y$. The expected repayment is given by the surface under the graph, or

$$EP_1 = \gamma \int_{y_0}^{D-B_1/\gamma} y f(y) dy + D \int_{D-B_1/\gamma}^{\infty} f(y) dy \tag{4.1}$$

and equals the *market value* of the contract $(P_1, I_d)$, i.e. the price a risk neutral investor is willing to pay for it.[20] Simple comparative statics show that

**Proposition 4.** *The market value of a given sovereign debt contract $(P_1, I_d)$ is increasing in creditor power $\gamma$ and in the private cost of state disclosure $B_1$.*

[20]As investors are homogeneous, there is no trade and hence no market in my model. However one could easily introduce liquidity shocks to generate trade among otherwise equal investors. The market value would be the price of the sovereign debt contract in this market.

The proposition is intuitive. An increase in creditor power, $\gamma$, increases the bargaining power of creditors over the sovereign, thereby increasing the sovereign's willingness-to-pay in all states. An increase in the private benefit, $B_1$, also increases the sovereign's willingness-to-pay, but only in non-disclosed states.[21]

*Primary market.* Consider the primary market for sovereign debt, i.e. the market at date 0. The main question at the date of issuance is whether the sovereign is able to raise $g$ from international creditors. She may not be: for example, if creditors have little power (i.e. $\gamma \ll 1$), cf. section 3.2. Proposition 4 now implies that an increase in $B_1$ may lift the sovereign out of autarky if she can issue a sovereign debt contract with a market value of at least $g$. Likewise, an increase in $\gamma$ can leave the sovereign debtor better off by allowing her to finance the expenditure. There is, however, a difference between an increase in $\gamma$ and an increase in $B_1$: while an increase in $\gamma$ unambiguously enhances efficiency, an increase in $B_1$ raises the cost of state disclosure and exacerbates the asymmetric information problem. At the same time an increase in $B_1$ alleviates the willingness-to-pay problem, which means the sovereign may be better off.

Predictions of the model relating to the primary market are not conducive to standard empirical tests. Ideally, one wishes to compare expenditures that cannot be financed with expenditures that can be financed across countries. But expenditures that are not financed are typically not observed. Predictions of the model relating to the secondary market may be easier to test as secondary market prices and market responses are observable.

*Secondary market.* Suppose the sovereign is able to finance the expenditure by issuing a sovereign debt contract $(P_1, I_d)$. The market value of this contract at the date of issuance is $g$, by the investor's participation constraint. After the date of issuance, the market value may change due to trade in the secondary market.

One can now ask how the market responds to different events of interest. Suppose, for example, that the government announces a debt crisis state at time 1, cf. timing of events in section 2. Then creditors will observe the state of the economy as information on the economy comes available. This may not be immediate. By contrast any market response will be immediate. At the moment the government announces state disclosure the market value drops to

$$E(P_1|I_d = 1) = \gamma \int_0^{D-B_1/\gamma} yf(y|I_d = 1)dy$$

[21]In disclosed states, the private benefit is lost and only the threat of creditor punishment deters the sovereign from repudiation.

where $f(y|I_d = 1)$ is the conditional probability density function. When creditors learn about $y$, the market value converges to $\gamma y$.[22]

Another event of interest is a change of government before the repayment stage. Within the framework of the model, there are two channels through which a change in government can effect the secondary market price of outstanding debt:

(1) a change in the private benefit $B_1$ (willingness-to-pay channel) ; or
(2) a change in the distribution, $F$, and support ,$T$, of the income $y$ (competence channel) .

Suppose a new government takes office that is understood to be more competent at undertaking structural reforms, collecting taxes, and privatizing state property than its predecessor.[23] Then the probability of a high income state increases and so does the market value of outstanding debt. The opposite happens if a government moves in that is less competent than its predecessor. Likewise, suppose a government takes over that is known to be highly committed to avoid state disclosure (high $B_1$), then the market will view this favorably and the market value of outstanding debt increases. A new government that is perceived as less committed to pay the debt at face value (low $B_1$) leads to a decline in the market value of outstanding debt.

Finally, one may consider the impact of changes in $\gamma$ and $B_1$ in the secondary market. If changes take place before date 1, then the effect is given by proposition 4. Hence the market value of the sovereign debt contract increases with an increase in either $\gamma$ or $B_1$.[24] If the change in $B_1$ takes place after the debt crisis, then there is no effect on the market value of debt as the private cost of state disclosure is sunk at this stage.

## 5. Alternative Repayment Game

I consider an alternative repayment game, one in which a debt crisis is followed by the debt renegotiation of Bolton and Jeanne (2009). The repayment game at time $t = 1$ then is as follows:

(1) Nature chooses state, sovereign observes $y$ ;
(2) Sovereign announces ability-to-pay $\hat{y}$,
    (a) if $I_d(\hat{y}) = 1$, investor observes $y$, and a debt renegotiation starts;
    (b) if $I_d(\hat{y}) = 0$, then contractual obligation is $O_1(\hat{y})$.

[22]Learning about $y$ can, for example, be modeled as a narrowing of the support of $y$.
[23]Any market response must run through expectations of investors, as there is not yet a realization of $y$.
[24]A subtlety of the analysis is that both an increase in $\gamma$ and an increase in $B_1$ destroy truthful state revelation of the contract that was initially issued: the sovereign pays $D$ even in states where the contract calls for state disclosure. Indeed, this is one reasons why the market value increases; but it also means that the initial contract might no longer be optimal.

(3) In case of a debt renegotiation, coordinated creditors make a repayment offer $\eta$. Otherwise, the contract binds both parties to $O_1(\hat{y})$.
(4) Sovereign makes a repayment decision $r \in \{0, 1\}$:
    (a) she pays and the game ends ($r = 1$), or
    (b) she repudiates and creditors execute the punishment ($r = 0$).

In the new formulation of the repayment game, a debt crisis is followed by a renegotiation. In the original formulation of the repayment game (cf. section 2), there is no need to renegotiate the contract, as the contract specifies the course of action in each contingency. The alternative view, explored here, is that the contract is mute in case of a debt crisis, and that a renegotiation takes place.

If there is no debt crisis (i.e. $I_d(\hat{y}) = 0$), then the contractual obligation $O_1(\hat{y})$ is binding for all parties. If there is a debt crisis (i.e. $I_d(\hat{y}) = 1$), then creditors can make a repayment offer at stage 3 of the repayment game if they manage to coordinate: creditors make an offer $\eta$ for which they are willing to withhold sanctions. Formally, there is a coordination cost $c_R$, incurred by creditors if they make a repayment offer $\eta$. As the renegotiation surplus in a debt crisis is $\gamma y$, creditors cannot be coordinated if the income realization is too low, or $\gamma y < c_R$. In such states, no renegotiation takes place, creditors receive 0, and the sovereign suffers the creditor punishment *as if* she had repudiated. If creditors can coordinate, i.e. $\gamma y \geq c_R$, then the creditor offer follows from solving the repayment game backwards along the debt crisis branch. As the sovereign accepts any offer $\eta \leq \gamma y$, creditors set their offer at $\eta = \gamma y$, and receive a net payment of $\gamma y - c_R$.

I assume, as Bolton and Jeanne (2009) do, that creditors can either coordinate at no cost ($c_R = 0$); or creditors cannot coordinate at all ($c_R = \infty$). If creditors can coordinate at no cost, then introducing the debt renegotiation is equivalent to setting the final payment equal to $P_1(y) = \gamma y$ for disclosed states in the original specification of the model.[25] Thus, the optimal contracting problem is a special case of the optimal contracting problem I considered in section 3.2: the set of admissible contracts is restricted. By proposition 3, the optimal contract–if there is one–is a sovereign debt contract. Furthermore, a sovereign debt contract specifies a payment of $\gamma y$ in debt crisis states. It follows that proposition 3 applies to the special case I consider here.

**Proposition 5.** *For $c_R = 0$ and $\gamma = 1$, the optimal contract is a standard debt contract and corresponds to r-debt as in Bolton and Jeanne (2009); for $c_R = 0$ and $\gamma < 1$ the optimal contract is a sovereign debt contract.*

[25]Stage 3 can be collapsed into Stage 2a of the original repayment game, by setting $O_1(y) = \gamma y$ for disclosed states (cf. section 2). Since this contractual obligation is fully repaid by proposition **??**, we have $P_1(y) = \gamma y$ for debt crisis states.

*Proof.* Let $c_R = 0$ and $\gamma = 1$ and assume that primitives are such that there exists an optimal contract. Then, by proposition 3, the optimal contract is a sovereign debt contract. As $\gamma = 1$, the sovereign debt contract coincides with a standard debt contract, or r-debt in Bolton and Jeanne (2009). If $c_R = 0$ and $\gamma < 1$, and there exists an optimal contract, then the optimal contract is a sovereign debt contract by proposition 3. □

Assuming that an optimal contract exists, proposition 5 shows that the optimal contract is a sovereign debt contract. The conditions for the existence of an optimal contract are the same as in section 3.2, i.e. $g$ cannot be too big, and $\gamma$ cannot be too small.

If creditors cannot coordinate at all, then no renegotiation can take place and state disclosure leads to the same payoff as repudiation: creditors receive 0; the sovereign incurs a loss of $\gamma y$, and loses her private benefit $B_1$. In an optimal contract, the payment to creditors in non-disclosed states must compensate for the zero payment to creditors in disclosed states.[26] Furthermore, the contract must specify a constant contractual obligation across states. Any other contract leaves the sovereign with an incentive to announce the state with the lowest contractual obligation and cannot satisfy truthful revelation. Let $D$ denote the constant contractual obligation, or face value, of the optimal contract. Then expected payment is given by

$$EP_1 = D \int_{\{y|D<\min\{\gamma y+B_1,y\}\}} f(y)dy$$

The sovereign only pays the debt at face value in states where the face value $D$ neither exceeds the willingness-to-pay of the sovereign, nor her ability-to-pay. For $\gamma = 1$, the willingness-to-pay exceeds the ability-to-pay of the sovereign in all states. It follows that expected payment is given by

$$EP_1 = D \int_{D}^{\infty} f(y)dy$$

and the optimal contract corresponds to non-renegotiable debt as in Bolton and Jeanne (2009). If creditor punishment is less than maximal ($\gamma < 1$), and the ability-to-pay of the sovereign exceeds the willingness-to-pay, then expected payment is

$$EP_1 = D \int_{\frac{D-B_1}{\gamma}}^{\infty} f(y)dy$$

[26]The contracting problem may, of course, not have a solution. The conditions for existence are more stringent than before as creditors recover nothing in the event of state disclosure. As before, I assume there is an optimal contract and proceed to derive its properties.

which corresponds to n-debt, but with a different repudiation threshold, which simply equals $\frac{D}{\gamma}$ in Bolton and Jeanne (2009). This is intuitive, the willingness-to-pay in their paper derives solely from creditors' ability to punish repudiation. By contrast, in my paper the sovereign also motivated to pay because she wishes to retain her private benefit $B_1$. The following proposition summarizes the discussion above.

**Proposition 6.** *For $c_R = \infty$ and $\gamma = 1$, the optimal contract corresponds to n-debt as in Bolton and Jeanne (2009); for $c_R = \infty$ and $\gamma < 1$ the optimal contract is an n-debt contract with a repudiation threshold of $\frac{D-B_1}{\gamma}$.*

*Proof.* Omitted □

## 6. Discussion and Conclusion

Before I conclude, some observations about the model:

(1) Although contracts cannot be enforced by a court, they are not meaningless. The contractual obligation, denoted by $O_1$, determines what constitutes a breach of contract, and thus the states in which creditors can punish the sovereign.

(2) The option of repudiation, or 'total default' as it is called in Reinhart and Rogoff (2009), is unique to sovereign finance and must be part of a theory of sovereign debt. I have presented such a theory in this paper, based on the costly-state-verification approach due to Townsend (1979) and Gale and Hellwig (1985).

(3) The special case of costless disclosure, or $B_1 = 0$, is ruled out in the main body of the paper; but it is easily analyzed: with costless state disclosure, the sovereign can pledge a maximum of $\gamma y$ in each state. As long as $g < \gamma Ey$, the optimal contract exists and is indeterminate; for $g = \gamma Ey$, the optimal contract is uniquely determined and fully contingent on income; and for $g > \gamma Ey$ there exists no contract to finance $g$.

(4) Essential for the arguments in this paper is that the willingness-to-pay, $\gamma y + B_1$, be unobservable by outside creditors. To model this, I've assumed private information about the sovereign's ability to pay, $y$, while creditor power, $\gamma$, is public information. Alternatively, and without qualitatively altering the results, one can assume that there is private information about $\gamma$, while $y$ is known to all. The private benefit $B_1$ is required to be common knowledge.

(5) Compared to corporate finance, it matters who you borrow from in sovereign finance. It is cheaper to borrow from more powerful creditors. It also matters who the borrower is. Governments that find it more costly to

disclose the true state of their finances, are able to obtain funds at better terms. The intuition is that the cost of disclosure has commitment value and alleviates the willingness-to-pay problem.

In this paper, I derive the optimal financial contract a sovereign debtor can issue given that, first, there is no outside enforcement and, second, the sovereign has private information about her income. Recent events in Greece show the relevance of these issues: creditors did not have accurate information on the state of government finances—they are learning more due to the debt crisis–and sovereign debt contracts are difficult to enforce. There is no court that can enforce repayment, there is little collateral, and seizure of sovereign assets is complicated, because (i) there are few of them located abroad, and (ii) those are often protected by sovereign immunity (cf. Sturzenegger and Zettelmeyer, 2006).

I solve the optimal contracting problem to show that the sovereign debtor optimally issues a simple type of debt contract: a contract for which (i) payment is flat if income is high, and (ii) there's a crisis if income is low, and the subsequent payment depends on the power that creditors have. The intuition for the optimal contract is that simple debt saves on information costs, which is what the corporate finance literature has emphasized. The optimal contract itself, however, is different from what the corporate finance literature has found: it is still a debt contract, but the default decision and the payment in case of default are different due to the willingness-to-pay problem. Positive repayment is sustained by the economic penalty of repudiation and the political penalty of state disclosure (and repudiation). These two penalties drive the optimal contract design.

The optimal contract I derive explains some of the salient facts of sovereign borrwing. First, a sovereign's ability-to-pay is not the only determinant of actual repayment. Rather, repayment depends jointly on (i) income, (ii) creditor power, and (iii) the political cost of state disclosure, i.e. repayment depends on the sovereign's willingness-to-pay. Second, the actual payment to creditors depends on the power that these have. The most powerful creditor of all is the IMF; historically, the IMF takes priority over all other creditors. Third, the sovereign chooses to issue simple debt contracts. This, in itself, is puzzling, as Shleifer (2003) and others have argued. Why don't sovereign borrowers issue contracts that condition their payment on future contingencies like tax receipts, GDP, or export prices?

Based on the current work, the future research agenda is partly empirical, partly theoretical. The empirical agenda is to test the cross-sectional implications of the model: what are the secondary price responses to shifts in the composition (i.e. ultimate holdings) of sovereign debt, or shifts in political power? The theoretical

agenda is to develop a fully dynamic model of sovereign debt; a model that endogenizes the cost of repudiation and allows the study of repayment and refinancing decisions in one framework.

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