Institutions and Foreign Finance: Sovereign and Private Flows

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PRELIMINARY AND INCOMPLETE

Abstract

We model the interactions between sovereign and private borrowing in a small open economy. We assume that sovereign borrowing is subject to the government's strategic default, while private borrowing relies on the country's financial institutions. We find that the latter institutions create a complementarity between capital flows to the private and public sectors. This complementarity causes asymmetric effects of financial liberalization, which reduces sovereign risk only in countries with sufficiently good institutions, and of unanticipated global liquidity shortages, which – through government default – cause the most severe dislocations in countries with relatively weak institutions. We present empirical evidence that is broadly consistent with some of the predictions of our model.

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1 Introduction

One distinctive feature of sovereign defaults in the last twenty years is that they have often triggered a credit crunch in the debtor's financial system (Sturzenegger and Zettelmeyer 2006). The Russian default of 1998 is a telling example of the way in which such credit crunch may happen: the Russian government's default led to a banking crisis and in turn to the eventual collapse of the entire Russian financial system. By contrast, the sovereign debt crises of the eighties mainly hurt foreign banks, leaving the debtors' financial systems virtually unaffected. In other episodes the order of events was reversed, with a weakening of the domestic financial system preceding sovereign default, as for instance in Ecuador in 1998 (IMF 2002). More systematically, Kraay and Nehru (2006) and Reinhart, Rogoff, and Savastano (2003) show that the risk of sovereign default is smaller in more financially developed countries, supporting the idea that markets for private and government borrowing are tightly connected.

These interactions between the markets for government and private borrowing raise intriguing questions. How does the development of private financial markets affect sovereign risk? How does the risk of sovereign default affect the financing of the private sector? How do financial institutions affect the mix of capital flows to the government and the private sector of a country? Addressing these questions can help shed light on how financial crises spread across public and private debt markets, and on the ability of emerging economies to finance public and private projects depending on the quality of their financial institutions.

Existing theories do not address these questions as they either focus on government borrowing or on private financial markets, and do not study them jointly. On the one hand, starting with Eaton and Gersovitz (1981), the sovereign risk literature studies the conditions under which the governments will repay their foreign debt but it mostly abstracts from private financial markets, often by assuming the existence of a representative agent. Conversely, the literature on cross-country capital flows (e.g. Boyd and Smith 1997, Caballero and Krishnamurthy 2001, Matsuyama 2004) stresses the role of a country's financial institutions in attracting foreign private capital but it abstracts from sovereign risk and government borrowing.

We combine the sovereign risk and the cross-country capital flows approaches in a model where private and government borrowing face different enforcement frictions. Government debt is subject to sovereign risk, as the government can unilaterally default if it finds it profitable to do so. Private debt is subject to legal enforcement, as lenders can seize a defaulter's collateral up to the extent

allowed by the country's financial institutions. Crucially, this last feature allows us to study the impact of financial institutions on sovereign risk, on the country's total financing and on its mix.

To see the intuition of our model, imagine a developing economy whose government must borrow abroad to finance an initial public investment (for example, the building of a railway, or the cabling and wiring of the major cities) that allows a modern productive sector to develop. Such sector is finance-intensive because, to exploit its investment opportunities, entrepreneurs must borrow from non-entrepreneurs. The problem, though, is that once the modern sector is up and running, the government may want to default on its debt. Following Broner and Ventura (2008), we assume that a government default cannot discriminate between domestic and foreign bondholders.

In choosing whether or not to default, the government then faces the following trade-off. On the one hand, since some government bonds are held abroad, default beneficially increases total domestic resources for consumption. On the other hand, to the extent that domestic entrepreneurs (or banks) hold government bonds, default destroys their collateral, undermining modern sector financing, investment and output. One immediate implication of this trade-off is that, since the cost of default is smaller if the modern sector is less productive, defaults will tend to be countercyclical, consistent with extant empirical evidence (e.g. Arellano 2008).[1]

Crucially, better financial institutions affect the government's incentive to default in two conflicting ways. To see how, consider the case of a financially closed economy where no private capital flows are allowed. On the one hand, better financial institutions boost the entrepreneurs' borrowing capacity, allowing them to buy more government bonds ex-ante and to finance more investment projects ex-post. As a result, government defaults become more disruptive by increasing the extent of underinvestment in the modern sector and thus curtailing its output, which in turn enhances the government's incentive to repay. On the other hand, however, better financial institutions increase the financial system's ability to channel the proceeds from default toward investment in the modern sector. So if financial institutions are sufficiently good, all domestic resources are eventually invested in the modern sector anyway, implying that the government faces no cost of default at the margin. These effects together imply that the costs of default initially increase and then decrease

[1] Crucially, our model explains rather than assumes why financial intermediaries such as banks or entrepreneurs want to hold government bonds. Entrepreneurs in our model strictly benefit from storing their wealth in government bonds because those bonds repay if and only if the modern sector productivity is high, which is precisely the state in which entrepreneurs need funds to invest. Empirically, the evidence confirms that the domestic financial system holds a large fraction of government debt (Reinhart, Rogoff and Savastano, 2003), even controlling for financial repression (Kumhof and Tanner 2008). One informal explanation given to such domestic debt holding pattern is the use of government bonds as collateral (Kumhof and Tanner 2008).

with the extent of financial development, yielding a non-monotonic relationship between public debt sustainability and the quality of financial institutions.

Matters drastically change when the economy opens up. If entrepreneurs can directly access foreign funds, the beneficial effect of better financial institutions becomes much stronger. By borrowing abroad, entrepreneurs can increase both their holdings of government bonds ex-ante and their modern sector investment ex-post, well beyond the constraints dictated by total domestic resources. Therefore the adverse effect of default on entrepreneurial wealth and investment will be very large, fully restoring the positive impact of institutional quality on debt sustainability. Of course, financial opening will only lead to greater borrowing if the international interest rate is below the domestic interest rate in autarky. If this is not the case, financial opening will lead to capital outflows, thereby decreasing leverage and investment in the modern sector. This contraction in the size of the modern sector decreases the government's incentives for repayment ex-post. Potentially, thus, financial liberalization might compromise the government's ability to borrow and hence to undertake the investment needed in order to develop the modern sector.

The general message of our model is that of a close complementarity between capital flows to the private and public sector. On the one hand, private borrowing sustains the government's debt capacity by mitigating sovereign risk. On the other hand, government borrowing and repayment respectively enable private investment by developing a modern sector and by avoiding costly disruptions in financial markets. This complementarity arises especially in countries with good financial institutions and, more generally, in countries whose regulatory arrangements facilitate modern sector growth. This complementarity provides new insights to the literature on sovereign risk and on financial liberalization.

With respect to the sovereign risk literature, we offer an alternative to the view according to which private flows exacerbate sovereign risk by inducing domestic agents to over-borrow (e.g. Tirole 2002, Jeske 2006, Wright 2006). In our setup, private capital flows discipline governments by enhancing the negative impact of default on the ability of domestic financial markets to absorb foreign capital and thus on modern sector output. In this sense, our model proposes one way in which sovereign defaults can cause a credit crunch, suggesting that if capital flows to the private sector grow steadily, then sovereign defaults should become less frequent but cause more severe disruptions when they occur. Our model, though, also warns about the cost of private capital flows' volatility. A sudden stop in private capital flows, perhaps caused by a scarcity in global liquidity, may trigger government defaults, in turn propagating financial shortages to the domestic

economy and endangering domestic intermediation.

With respect to the literature on financial liberalization, we show that the catalytic role of domestic financial institutions in attracting private flows crucially relies also on their ability to mitigate sovereign default risk. If financial institutions are so weak that sovereign risk is severe, private flows are small not only due to limited entrepreneurial collateral, but also because the government's inability to invest restrains the development of the modern sector, thereby thwarting the entrepreneurs' future financing needs. By contrast, as financial institutions become sufficiently good to mitigate sovereign risk, the modern sector will develop, increasing the private sector's willingness and ability to absorb private flows and boosting modern sector output. This can help explain the presence of threshold effects whereby the beneficial effects of financial liberalization on economic growth (Bekaert et al. 2005) and financial markets development (Henry 2000, Stultz 2005) are most pronounced above a certain level of institutional quality (Kose et al. 2006)

Section 6 reports some empirical evidence consistent with our theoretical predictions. At its most basic level, our theory predicts that sovereign defaults should be followed by private credit crunches and outflows of private capital. Not only is this prediction supported in the data, but those crunches and outflows appear to have been strongest in recent years after Russian default in 1998, during a period of intense financial globalization. We also find support for the prediction of our theory that the cost of default should initially increase with the level of institutional development. Finally, and consistent with the view that private and public capital flows complement each other, we find a strong and positive within country correlation between private debt and public debt, particularly when capital markets are open.

2 The Basic Model

There is a small open economy (home) that lasts for three periods $t = 0, 1, 2$. This economy is populated by a measure 1 of individuals, each of whom is risk neutral, indifferent between consumption in the three dates, and endowed with $\omega_0 < 1$ units of the economy's only consumption good at $t = 0$. A fraction β of the population consists of "bankers", the remaining fraction $(1 - \beta)$ of "savers". The difference between bankers and savers is that the former agents have an advantage in monitoring projects, which implies that they are more productive at investing.

At $t = 0$, everyone is endowed with a fixed-size project in the traditional sector that produces output $\Omega_j \theta$ at $t = 1$, where $j \in \{S, B\}$ indicates an individual's type, where S and B respectively

denote savers and bankers, and $\theta > 1$. Bankers' monitoring advantage is reflected in the fact that $\Omega_B = \Omega > 1 = \Omega_S$.[2] To escape the traditional sector's decreasing returns, a modern productive sector can be developed at $t = 1$. To do so, the government must undertake a fixed size public investment of 1 at $t = 0$. Investment by type j in the modern sector at $t = 1$ yields a gross return of:

$$f(I) = A_j \cdot I, \text{ for } j \in \{S, B\}, \tag{1}$$

at $t = 2$, where I is the capital invested. We assume that $A_B \geq 1 = A_S$, so that bankers obtain a higher productivity from modern-sector investment than savers. Thus, only banks can generate a social surplus from modern sector investment. The return to the public investment is uncertain, because A_B is stochastic, taking value $A > 1$ with probability p and value 1 with probability $1 - p$. Stochasticity in A_B allows us to study the cyclical properties of government default.

The timing of the model is thus as follows. At $t = 0$ the government decides whether to invest or not in the public project. If the government invests, at $t = 1$ the modern sector develops and A_B is realized. Production occurs at dates $t \in \{1, 2\}$. At $t = 0$ each individual runs his traditional sector project, which yields output at $t = 1$. At $t = 1$ – provided that the government has undertaken the public investment – agents can run a modern sector project, whose output is realized at $t = 2$.

2.1 Financial Markets

To finance the public project at $t = 0$ and modern sector investment at $t = 1$, the government and bankers need to borrow. We assume that all borrowing and lending contracts are short-term and non-contingent.[3] For clarity, we refer to banks' borrowing contracts as deposits. There is also an international financial market, which is willing and able to lend or borrow any amount as long as the transaction yields an expected return equal to the world interest rate r^*, which for now we normalize to 1.

There are two key differences between the financial contracts written by the government and private agents. The first one concerns the enforcement frictions characterizing them. Deposit contracts are subject to imperfect court enforcement; if a bank defaults, only a share α of its revenues are

[2] To simplify the analysis we assume that the traditional sector project is only available at $t = 0$, but nothing substative would change if such project is also available at $t = 1$ (we have in fact solved the model also under this alternative assumption).

[3] As we later discuss in Section 4.6, **this asset structure** entails no loss of generality.

seizeable by depositors. If $\alpha = 1$, the bank can pledge all of its revenues to depositors and financial frictions are non-existent. These frictions rise as α falls below 1. The level of α captures the quality of home's financial institutions and, in particular, the strength of creditor protection at home. Government bonds are instead subject to sovereign risk. That is, the government opportunistically decides whether to repay at $t = 1$ so as to maximize the welfare of home residents.

The second distinction between private and public financial contracts concerns their access to foreign credit. We assume that the government can always access international financial markets and, in particular, that it sells public bonds in a unified market to both domestic and foreign residents. As for the private sector, we consider first the case of a financially closed economy, in which – unlike the government – it cannot borrow or lend to the international financial market. This case allows us to study the impact of domestic private credit markets on sovereign borrowing and it provides a useful benchmark to study, in Section 5, the effects of financial liberalization.

In our model, then, institutions are such that imperfect contract enforcement and sovereign risk coexist with one another.[4] This approach is novel in the international finance literature, which has so far abstracted from the interactions among different institutions. On the one hand, the literature on financial liberalization (Boyd and Smith 1997, Matsuyama 2004) abstracts from sovereign risk and views capital flows only as being determined by the quality of a country's financial institutions. This view, however, cannot explain why a government default should hurt the ability of domestic agents to tap foreign private capital, or why weakening in the domestic financial system – caused, for instance, by a sudden stop in foreign capital flows – should increase the government's incentive to default. On the other hand, the literature on sovereign risk either abstracts from domestic frictions in private borrowing and lending (e.g. Eaton and Gersovitz 1981) or it views the enforcement of private contracts as being entirely dependent on a strategic decision by the government (e.g. Broner and Ventura 2007).[5] In this view, institutions do not prevent the sovereign from interfering with private contracts, so that contracting institutions are irrelevant. Although this approach usefully

[4] The coexistence of these two frictions has a precedent in North's (1981) distinction between contracting and property rights institutions. Contracting institutions, as represented for instance by a country's court system (e.g. La Porta et al. 1998), secure the enforcement of private contracts. In our model, those institutions are equivalent to what we call financial institutions and their quality is measured by parameter α. Property rights institutions, as represented for instance by the presence of constraints on the executive (e.g. Acemoglu et al. 2001), protect ordinary citizens from government expropriation. In our model, these institutions are sufficiently good to ensure that the government is benevolent and does not intervene in private contracts, but not so strong as to prevent the government from defaulting ex-post on public debt if, by doing so, it enhances domestic welfare.

[5] One important exception is Brutti (2008), who constructs a model in which sovereign risk interacts with frictions in the enforcement of private contracts. That paper, though, is mainly concerned with showing how government borrowing can arise in equilibrium, whereas we wish to stress the relationship between foreign borrowing by the public and the private sectors.

sheds light on some determinants of sovereign risk, it fails to capture the idea that often sovereign defaults hurt the private sector because domestic financial institutions are fragile, and not because the government destroys them. Indeed, in most cases of practical relevance the government's ability to interfere with private domestic contracts is limited.[6] In this sense, our approach allows us to study how a country's private market institutions can affect government behavior.

The overall timing of the model is therefore:

1. $t = 0$: Financial markets open. Public bonds are issued and banks accept deposits from savers. Given the interest rates r_g, r^* and r_0 on government bonds, foreign bonds and deposits, respectively, savers and banks optimally determine their portfolio.

2. $t = 1$: Modern sector productivity is realized. Foreign bonds, deposits, and public bonds mature. Banks attract new deposits and use these, and their own resources, to finance investment in the modern sector. The capital stock I, is determined.

3. $t = 2$: Private output is realized and consumption takes place.

This timing is represented below:

t=0	t=1	t=2
ω realized	$\Omega\theta$ realized A becomes known	AI realized
	Asset payments made (r_0) **GOVERNMENT REPAYMENT**	Asset payments made (r_1)
Asset Markets Open	Asset Markets Open	
Public investment	Private investment	

[6] To give a concrete example, during the 2002 default the Argentinian government attempted to interfere with private contracts by forcing the "pesification" (at non-market exchange rates) of all dollar denominated private sector assets and liabilities. Many creditors, however, took legal action against the government, which was forced to "redollarize" the assets (Sturzenegger and Zettelmeyer 2005). This example illustrates that, in many relevant cases, the presence of institutional checks such as judicial independence curtails the government's ability to interfere with private contracts.

This baseline model could, of course, be replaced by an alternative specification in which individuals borrow and lend through financial markets directly, by purchasing and issuing bonds. Such a specification would not affect any of the formal aspects of our model, and all of our equations and results would be equally applicable to it. The reason for which we chose to introduce the role of financial intermediaries in domestic financial markets is to better illustrate the main mechanism that we wish to depict. In real economies, it is often financial intermediaries, and not individuals directly, who finance investment opportunities due to their monitoring advantage (Diamond 1984). Of course, the ultimate owners and creditors of financial institutions are individuals, and in this sense our model is an accurate depiction of reality. Keeping this in mind, then, we now return to characterize the equilibrium of our baseline model.

2.2 The Modern Sector

Before studying the government's default decision, let us analyze the role of financial markets by solving for the modern sector equilibrium (the traditional sector is straightforward) at $t = 1$. Here we study the case of a closed economy, where banks only take deposits from domestic residents. If the government invests, and after the modern sector productivity A_B is realized, a bank entering period $t = 1$ with capital ω_B chooses the level of investment i by solving:

$$\max_{I} \; A_B i - r_1 \left[i - \omega_B \right] \quad \text{subject to,} \tag{2}$$

$$\left[i - \omega_B \right] r_1 \leq \alpha A_B i, \tag{3}$$

where Equation (3) represents the bank's credit constraint. As long as $A_B \geq r_1$, the bank tries to capture as many deposits as possible in order to channel them towards investment in the modern sector. If $r_1 \leq \alpha A_B$, it will demand an infinite amount of deposits, which cannot occur in equilibrium. If $r_1 > \alpha A$ the bank's credit constraint is binding. As a result, aggregate investment in state A_B is given by,

$$I(\omega_B) = \beta \frac{r_1 \omega_B}{r_1 - \alpha A_B}. \tag{4}$$

Equation (4) illustrates that creditor protection α affects the extent to which banks are able to leverage their capital to expand investment, implying that the aggregate demand for funds by banks (net of their own capital) at $t = 1$ is equal to

$$\beta \frac{\alpha A_B}{r_1 - \alpha A_B} \omega_B. \tag{5}$$

The totality of bank deposits supplied by domestic savers is instead equal to

$$(1-\beta)\,\omega_S, \tag{6}$$

whenever $r_1 > 1$ and lies in the interval $[0, (1-\beta)\,\omega_S]$ when $r_1 = 1$, where ω_S denotes the wealth of a saver entering period $t = 1$. There are thus two types of equilibria in the private lending market at $t = 1$. In the first equilibrium, investment in the modern sector is constrained by banks' capital, which are therefore unable to channel all domestic resources to investment. This case arises when Equation (5) evaluated at $r_1 = 1$ is less than (6) or – alternatively – when $\alpha \leq \alpha^{\max}$, where $\alpha^{\max}$ is defined as

$$\alpha^{\max}(\beta) = \frac{(1-\beta)\,\omega_S}{A_B\left[\beta\omega_B + (1-\beta)\,\omega_S\right]}. \tag{7}$$

In this case, the social surplus generated by the modern sector is equal to:

$$(A_B - 1)\beta I(\omega_B) = \frac{A_B - 1}{1 - \alpha A_B}\beta\omega_B \tag{8}$$

which is the product of total investment at $r_1 = 1$ times the rent $(A_B - 1)$ that banks earn per unit invested. Intuitively, the modern sector only produces a positive social surplus when it is productive, i.e. when $A_B > 1$.

As creditor protection becomes sufficiently high, i.e. $\alpha > \alpha^{\max}$, the ability of the banking system to capture deposits for investment expands until it is able to channel the totality of domestic resources towards the modern sector. The surplus created by investment is then equal to:

$$(A_B - 1)\left[\beta\omega_B + (1-\beta)\,\omega_S\right]. \tag{9}$$

Inspection of Equations (8) and (9) allows us to establish the following result:

Lemma 1 *If $\alpha \leq \alpha^{\max}$, investment is constrained by the capital of banks. In this case, modern sector surplus: i) increases in bank capital ω_B and in creditor protection α, ii) increases in the size of the banking sector β. If $\alpha > \alpha^{\max}$, modern sector surplus is constrained only by the total amount of resources in the economy, and it is independent of α and ω_B.*

If creditor protection is very high, i.e. $\alpha > \alpha^{\max}$, financial constraints do not bind in the aggregate and modern sector growth is only constrained by aggregate domestic resources. If instead creditor protection is not so high, i.e. $\alpha \leq \alpha_1$, modern sector growth is limited by banks' ability to borrow. In this range, higher bank capital, better creditor protection and a larger banking system reduce the severity of financial frictions and expand private borrowing, expanding in turn modern sector size and surplus.

We have so far taken the wealth of banks and savers, ω_j for $j \in \{S, B\}$, as given. As we shall see, in equilibrium ω_j depends on the investment decision made by each type of agent and on the government's repayment decision. Whenever the government defaults, bankers and savers will suffer to the extent that they hold government bonds. In the next sections we solve for the equilibrium and show how ω_j is determined under different assumptions regarding the enforcement of government bonds.

Before doing so, we make the following assumption:

A1: $p(A-1)I(\omega_B) > 1$

Assumption A1 restricts combinations (α, β) to those for which the development of the modern sector is socially profitable, so that the public investment is undertaken in the absence of sovereign risk.

3 Equilibrium under Strategic Enforcement

After the productivity of the modern sector is realized at $t = 1$, the government chooses how much of its debt to repay. Denote by $\rho \in [0, 1]$ the fraction of the outstanding debt b that the government chooses to honour: $\rho = 1$ means full repayment, $\rho = 0$ full default. Note that now the interest rate on government bonds r_g can be different from 1 because investors may require a default premium. As a result, the government's taxation can be expressed as

$$\tau(b, \rho) = \rho r_g b, \tag{10}$$

capturing the idea that a default ($\rho < 1$) amounts to a smaller taxation of domestic residents.

We follow the recent literature on sovereign risk (Broner and Ventura 2007, 2008) in assuming that government policy is non-discriminatory. There are two aspects of such non-discrimination. First, when deciding on repayment, the government cannot discriminate between domestic and

foreign bondholders. This aspect is justified by noting that, in recent years, most sovereign borrowing is undertaken through decentralized bond markets, and subject to active trading in secondary markets.[7] As a result, the sovereign often does not know the identity of bondholders at any given point in time. Anecdotal and formal evidence support this assumption. For instance, Sturzenegger and Zettelmeyer (2007) document that in the Argentine default of 2001, an estimated 60 percent of the defaulted debt was held by Argentines themselves. These authors also analyze a large sample of recent sovereign defaults and find that, overall, foreign creditors do not appear to have been treated differently from domestic ones.

Second, when deciding on the taxation of home residents, the government cannot discriminate between banks and savers. While this is an admittedly extreme way of restricting the government's ability to redistribute resources among its residents, for our argument to hold we just need that the government is unable to completely undo the distributional effects of a default by taxing savers to subsidize banks. In Section 4.6 we rationalize this assumption in an extension of the basic model where each bank has superior information about its own monitoring ability/productivity.

In this setup, government default naturally affects the domestic distribution of wealth at $t = 1$. To see that, let b_j denote the bondholdings of a domestic resident of type j. Given these bondholdings, the wealth of an individual of type j at $t = 1$ can be expressed as,

$$\omega_j(\rho) = \Omega_j\theta + r_g\rho\left[b_j - b\right] + \widetilde{r}_0 d_{0j}, \tag{11}$$

where d_{0j} is the amount of deposits made by the individual at $t = 0$. A negative value of d_{0j} means that the type-j individual is a bank that accepted deposits from savers at $t = 0$. Naturally, in Equation (11) an individual's bondholdings b_j affect the impact of repayment ρ on his wealth at $t = 1$. In particular, if $b_j \geq b$, government default reduces the wealth of agent type j. Note that $\widetilde{r}_0$ is the interest rate on $t = 0$ deposits realized ex-post [where $E(\widetilde{r}_0) = r_0 \geq 1$]. In fact, although deposits are formally non-contingent, their ex-post return is stochastic because the government's repayment decision affects banks' wealth, affecting the ex-post return obtained by depositors.

[7] Broner et al. (2008) analyze the conditions under which trading in secondary markets leads to non-discrimination in equilibrium.

3.1 Individual Bondholdings

To analyze the redistributive effects of government default, we must determine equilibrium bondholdings. To do so, we anticipate one key finding of the next section: government default always occurs when modern sector productivity is low, that is when $A_B = 1$. Thus, if government debt is to be sustainable, government bonds must repay when modern sector productivity is high (i.e. when $A_B > 1$) a contractual interest rate of $r_g = 1/p$. This payout structure has far reaching implications for equilibrium bondholdings.

Note first that each bank or saver can buy ω_0 government bonds at $t = 0$ by using his initial wealth. Additionally, any one of them can also borrow against his future revenues if he wishes to increase his bondholdings. In the case of savers this latter possibility is irrelevant as long as government bonds and private borrowing yield the same expected return. For banks, though, this is not the case.

To see this, suppose that a bank, initially with no deposits, receives a deposit at $t = 0$ and uses it to purchase a government bond. Assume, additionally, that $r_0 = 1$, so that the expected return of the deposit account and the government bond are the same. By accepting a deposit of one unit of the consumption good, a bank commits to paying that unit with certainty at $t = 1$. By purchasing a government bond, it expects to receive $1/p$ units of the consumption good at $t = 1$ in the high-productivity state and zero in the low-productivity state (because in this state the government defaults). This transaction generates an expected cash flow of zero, but it entitles the bank to receive a net income of $(1/p - 1) > 0$ if productivity is high. But then, since in this state banks earn rents from investing (i.e. $A \geq r_1$,), the above transaction allows them to increase their expected profits at $t = 2$. Indeed, by leveraging itself as much as possible in order to purchase government bonds, an individual bank can increase its consumption at $t = 2$ by the amount:

$$r_1 \left[\frac{A - r_1}{r_1 - \alpha A} \right] \Omega \theta \alpha \left(1 - p\right) > 0.$$

That is, since the government repays (if at all) when modern sector productivity is high, a government bond is very valuable to the bank because it allows banks to transfer resources to those states of the world in which the modern sector investment is most productive. If $r_0 = 1$, this transfer is costless for a banks, which therefore uses all of his pledgeable wealth to back deposits. If r_0 is greater than 1, this transfer will be costly but banks will nonetheless undertake it as long as r_0 is

not too large.[8] As a result, banks will invest all of their deposits at $t = 0$ in government bonds, implying that the bondholdings of each bank as a function of r_0 are given by

$$b_B = \frac{\omega_0 r_0 + \alpha\Omega\theta}{r_0 - \alpha}. \tag{12}$$

The interest rate r_0 prevailing in the deposit market at $t = 0$ equalizes the demand of funds by banks and the supply of funds by savers. If the quality of financial institutions is sufficiently low, the demand of funds by banks falls short of the supply and $r_0 = 1$. Formally, this is the case when

$$\alpha \leq \alpha_0(\beta) \equiv \frac{(1-\beta)\,\omega_0}{\omega_0 + \beta \cdot \Omega\theta}. \tag{13}$$

In this case the holding of government bonds by any given bank is equal to $(\omega_0 + \alpha\Omega\theta)/(1-\alpha)$. Once α crosses this threshold, $r_0 > 1$ and banks use all of the economy's initial wealth ω_0 to buy government bonds[9], implying that the aggregate bondholdings of banks are equal to ω_0.

The basic message of this section is that domestic banks have a greater incentive to invest in government bonds than savers. It is well known that the major holders of government bonds in developing countries are indeed banks, who hold a substantial proportion of their assets in public debt. Kumhof and Tanner (2005) for instance document that between 1998 and 2002 this proportion was commonly between 20% and 40%, surpassing 50% in some of the largest developing countries like Mexico and Indonesia. For some countries, this exposure is much higher: in Argentina, bondholdings of the banking sector were 50% of total domestic credit in 2003, while in Mexico this figure was an also significant 42% of total domestic credit (IADB, 2007). We provide one specific explanation for this evidence, but also other factors – including government regulation of banks – may help explain domestic banks' demand for government bonds.[10] All of our key results survive

[8] See Section **??** in the Appendix for a more detailed derivation of domestic bondholdings. Throughout, we assume that whenever savers are indifferent between investing in government bonds and not doing so, they invest all of their available resources in government bonds. In a sense, then, we determine the weakest possible conditions under which government debt is sustainable in equilibrium. In Section 4.6, we comment on the consequences of relaxing this assumption.

[9] In this case, as long as it's below its maximum, the equilibrium interest rate is determined by:

$$r_0 = \alpha\frac{\omega_0 + \beta\Omega\theta}{\omega_0(1-\beta)},$$

and the aggregate bondholdings of entrepreneurs are equal to the economy's initial resources ω_0.

[10] Besides our explanation – which is based on government bonds' payout structure – banks' holdings can be rationalized by government bonds' liquidity, which makes of them a better form of collateral. In the past, bondholdings were often "forced" by governments on domestic banks. Nowadays, though, reserve requirements no longer exist in many developing countries and – even when they exist – they are frequently not binding (Kumhof and Tanner, 2005).

the explicit introduction of these factors in the analysis. As we shall see next, what is really crucial for our story is that – at the time of repayment – banks hold a larger share of government bonds than other domestic agents.

3.2 Default, Sustainable Debt and Financial Institutions

We are now ready to consider the government's incentives to repay its debt at $t = 1$. In choosing whether or not to do so, the government maximizes social welfare as given by

$$[\beta\omega_B(\rho) + (1-\beta)\omega_S(\rho)] + (A_B - 1)I(\omega_B(\rho)), \tag{14}$$

which is simply the sum of total domestic resources (the term in square brackets) plus the surplus generated by investment in the modern sector. The tradeoff faced by the government is straightforward. On the one hand, as long as foreigners hold some debt, default beneficially increases total domestic resources available for consumption. On the other hand, if banks hold a sufficiently large amount of government bonds, default destroys the capital of the banking system, reducing modern-sector investment.

In other words, the cost of government default is that it may generate a redistribution of resources away from the financial sector ultimately reducing investment and output. Of course, for this cost to be present it must be that investment is socially valuable. This implies that repayment never takes place in the low productivity state, in which $A_B = 1$. In this case, Equation (14) shows that modern sector investment generates no surplus and the only effect of default is to beneficially increase total domestic resources. This preliminary analysis shows that if the government is ever to repay, it will only do so when productivity is high, i.e. when $A_B = A$. As previously anticipated, then in such state the government must pay investors an interest rate $r_g = 1/p$.[11]

Consider now the government's incentive to repay when $A_B = A$. Let us start with the case $r_1 = 1$ in which aggregate investment is constrained by the capital of the banking sector. Equation (14) then becomes

$$[\beta\omega_B(\rho) + (1-\beta)\omega_S(\rho)] + p\frac{A-1}{1-\alpha A}\beta\omega_B(\rho). \tag{15}$$

Taking into account the definitions of $\omega_B(\rho)$ from Equation (11) and of a bank's equilibrium bond-holdings from Equation (12) yields the following condition for the sustainability of the optimal level

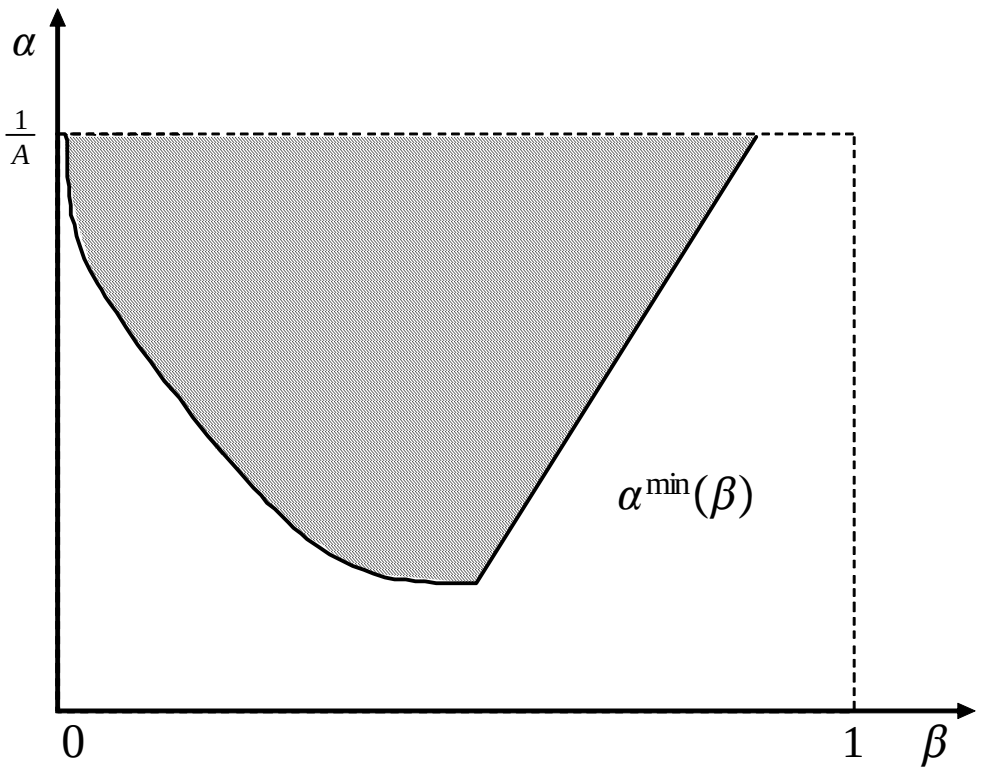
[11] The Appendix identifies parametrizations guaranteeing the feasibility of lump-sum taxation.

of debt $b = 1$:

$$[\omega_0 - 1] + \frac{A-1}{1-\alpha A}\beta \left[\min\left(\omega_0 + \alpha\Omega\theta, (1-\alpha)\frac{\omega_0}{\beta}\right) - 1\right] \geq 0, \tag{16}$$

where $\omega_0 = \beta b_B + (1-\beta)b_S < 1$ captures the total domestic holdings of public bonds while $\min\left(\omega_0 + \alpha\Omega\theta, (1-\alpha)\frac{\omega_0}{\beta}\right)$ captures the impact of repayment on banks' revenues. Equation (16) shows that government debt is sustainable only if the fall in domestic resources $1 - \omega_0$ associated with repayment is small relative to the resulting increase in investment and thus in modern sector surplus. Thus, a necessary condition for Equation (16) to be satisfied is that government repayment must improves banks' balance sheets, in turn requiring banks' bondholdings to be large relative to banks' tax share. When this is the case, a sovereign default is costly because it destroys the capital of the banking system, causing a credit crunch that affects the modern sector.

Crucially, Equation (16) establishes an important relationship between debt sustainability and the level of financial development as captured by α. In particular, it shows that – insofar as $\min(\cdot,\cdot) > 1$ – incentives to repay are increasing in α. This happens because of two reasons. The first is that a higher level of α enables banks to increase their leverage to expand modern-sector investment: the higher α is, then, the higher is the fall in investment induced by a sovereign default. The second reason for which a higher α enhances debt sustainability is that it increases the ability of banks to purchase government bonds at $t = 0$ by pledging their $t = 1$ capital as collateral: this increases bank exposure to a public default and also provides further incentives for repayment. Indeed, by replacing the equilibrium bondholdings of the previous section into Equation (16) it is possible to derive the minimum level of α, denoted by $\alpha^{\min}(\beta)$, beyond which the optimal level of public debt can be sustainable. The following figure depicts $\alpha^{\min}(\beta)$, and the shaded area represents the combinations (α, β) for which the government can have the incentive to repay:



As the preceding figure shows, $\alpha^{\min}(\beta)$ is non-monotonic in the share of bankers β in the population.[12] The reason for this is that, given any level of α, the total exposure of bankers to a public default is non-monotonic in β. To see this, imagine initially that $\beta \approx 0$. In this case incentives for repayment are only provided if those few banks i) hold a disproportionately high share of government bonds and ii) are highly leveraged. Both of these conditions require a very high level of α. As the number of banks expands, each of these new bankers will themselves hold a more than proportionate share of bonds and finance a commensurate modern sector investment level, which implies that now the minimum level of α at which the government can repay is smaller. There is a limit, though, to the total bondholdings of banks which is equal to ω_0, the economy's total resources at $t = 0$. From this point onwards, additional increases in β lead to a decrease in the banking sector's exposure to a public default, requiring greater bank leverage at $t = 1$, and thus higher α for sustainability.

Our analysis thus far has been based on the assumption that investment in the modern sector is constrained by the capital of the banking sector. But what if this is not the case, and investment

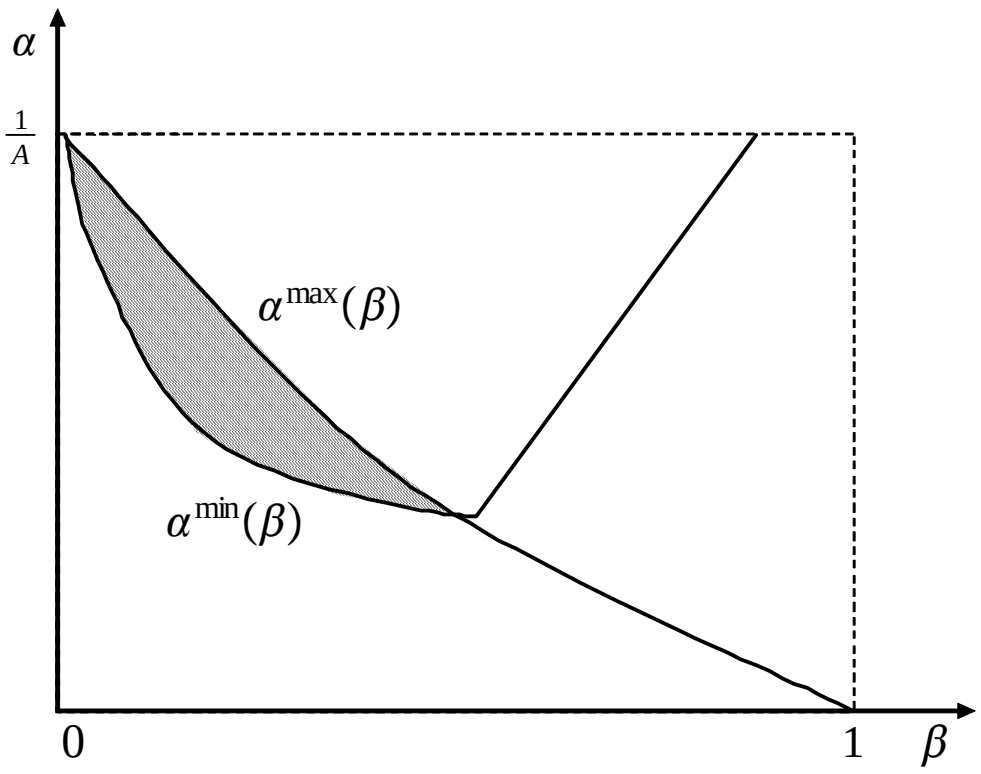
[12] Section (COMPLETE THIS) in the Appendix contains a thorough derivation of $\alpha^{\min}(\beta)$.

is instead constrained by the availability of domestic resources? This situation is possible in the closed economy as long as $\alpha > \alpha^{\max}(\beta)$, where the latter is defined as in Equation (7). In this case, investment simply equals the total amount of resources in the economy, and the government´s first order condition reduces to

$$A\left[\omega_0 - 1\right] \geq 0, \tag{17}$$

which can never hold because some of the public bonds are in the hands of foreigners. The implication of this is clear: whenever $\alpha > \alpha^{\max}(\beta)$, the government always has an incentive to default at the margin. This suggests that, somewhat paradoxically, the ability of financial institutions to provide the government with the incentive to repay may be limited in the closed economy. The intuition is that very good financial institutions enable the proceeds from a default to be efficiently invested in the modern sector, reducing the government's incentive to repay. This argument relies on two aspects. First, even if default destroys banks' capital and transfers wealth to savers, an efficient domestic financial system is able to capture this transferred wealth as deposits in order to channel it back to the modern sector. As a result, default adversely affects banks' profits but not the ability of the financial system to channel all domestic resources to modern sector investment. Hence the cost of default is zero for the government. Second, by eliminating payments to foreigners, the default creates additional resources that – given the high quality of domestic financial institutions – are fully channeled to the modern sector. This implies that default is beneficial, at least at the margin, as evident in Equation (17).

The following figure summarizes our discussion by jointly depicting $\alpha^{\min}(\beta)$ and $\alpha^{\max}(\beta)$. The shaded are between both loci depicts combinations (α, β) for which the optimal level of debt is sustainable:



An interesting consideration derived from the previous figure is that, although default is equally attractive whether financial development is very low or very high, the consequences of such a default are very different. When $\alpha < \alpha^{\min}(\beta)$, a government default leads to a contraction in investment and in modern-sector output. When $\alpha > \alpha^{\max}(\beta)$, though, a default is associated with an investment boom and an increase in modern sector surplus.

The following Proposition concludes our analysis of debt sustainability in the closed economy:

Proposition 1 *In the closed economy, the government can finance the public project if and only if* (α, β) *is such that* $\alpha \in \left[\alpha^{\min}(\beta), \alpha^{\max}(\beta)\right]$. *In this case, the government borrows at a rate equal to* $1/p$, *and it repays if and only if* $A_B = A$. *The set of combinations* (α, β) *fulfilling the previous condition is non empty if* $p > p^*$, *where* p^* *is a given threshold.*

Proposition 1 states that a sufficient condition for debt sustainability to be possible for some paramtetrizations of the economy is that p exceed some critical value p^*. The intuition behind this condition is that, as previously seen, debt sustainability is only possible if bankers are unable to channel all domestic resources towards investment in the modern sector. But whether or not they can do this depends on the probability that investment is productive, p. This follows from

the fact that a high value of p induces a low rate of interest on government bonds, which in turn limits the profits of banks in the event of government repayment. Hence, a high value of p increases the likelihood that productive investment will be limited by the capital of banks and it therefore provides incentives for government repayment. The appendix characterizes p^* as the minimum value of p above which there is always a combination (α, β) that makes public debt is sustainable.

In sum, more developed financial institutions help sustain public debt by increasing the cost of government default. Interestingly, our model shows that in the closed economy there is – at least theoretically – a limit to this effect: once financial institutions are good enough to allocate the totality of domestic resources to modern sector investment, debt sustainability is impaired. The extent to which this limit is empirically relevant is not clear, as financial constraints appear to be present not only in developing, but also in developed countries (CITE PAPER), implying that cases of $\alpha > \alpha^{\max}(\beta)$ are unlikely to be observed. This may be due not only to the fact that the required level of financial development is perhaps implausibly high, but also to the presence of regulations that effectively limit the extent of leverage by the banking system.[13] The broad idea of these findings, through, is that in the closed economy better institutional quality increases the cost of government default by increasing the size of the banking sector, but only up to a limit. Beyond such limit, banks become resilient to the disruptions in their balance sheets caused by default and so domestic financial markets can no longer discipline the government. We shall see later how this idea allows us to grasp the intuition for the complementarity between capital flows to the private and public sector that is present in our model.

3.3 Discussion

Our model conveys the notion that an economy's ability to sustain public debt is intimately related to the development of its financial system. This relationship comes about because, in equilibrium, the banking system holds public debt, thus being exposed to a default. The damages caused by default to domestic banks, investment and output in turn depend on the quality of domestic financial institutions.

[13] Although the non-monotonicity of debt sustainability in α may seem counter-intuitive, the idea that very developed private financial markets may undermine government borrowing is quite standard in the sovereign debt literature. Take for instance a canonical model where government borrowing serves, among other things, consumption smoothing purposes and where default on public debt results in the government's exclusion from international financial markets (e.g. Arellano 2008). In this setting, the presence of perfect private insurance markets would reduce the government's incentive to repay because, even under government exclusion, consumers can implement consumption smoothing through private markets.

This narrative resonates well with a growing body of evidence that relates default events with domestic credit markets. A 2002 IMF report analyzing four recent sovereign defaults (Russia, Ecuador, Ukraine and Pakistan) indeed stresses that a main transmission channels of these defaults to the domestic economy was through the insolvency of the banking system. In particular, "the size of the economic dislocations depended crucially on how much restructured debt was held by domestic agents" and that this was "one key reason why in Russia and Ecuador, where banks had invested heavily in bonds subject to the restructuring, the effects on the financial system and on the economy as a whole were so much bigger than in Ukraine and Pakistan". Crucially, and consistent with our model, the cost of default appear to have depended on financial development because "in Russia, the severe banking crisis had a much weaker effect on overall wealth and activity than what could have been expected in more typical cases because financial intermediation was so small to begin with", while "the disruptions caused by Ecuador's bigger and more developed financial system were comparatively larger". Interestingly, the report hints at the possibility that the disruption generated by default could have been significantly mitigated by more developed financial systems where firms have alternative sources of borrowing besides the banking system.

The basic mechanism of our model is also consistent with cross-country econometric evidence. Arteta and Hale (2008), for example, find that sovereign debt crises have a negative effect on private sector access to international credit. These authors do not look at the role of institutional development, but in Section 5 we show that default-induced credit crunches are indeed stronger in financially more developed countries. Relatedly, Reinhart, Rogoff, and Savastano (2003), study the default histories of a wide sample of countries and stress that debt sustainability is negatively correlated with the strength of the domestic financial system, while Kraay and Nehru (2004) find that the rule of law is negatively associated with its probability of default. Finally, Jeanne and Guscina (2006) find that a country's ability to sustain domestic public debt is positively correlated with measures of domestic financial development.

We now illustrate how our basic model can shed new light on the interaction between capital flows to the private and public sectors of a country, and thus on the role of financial liberalization.

4 Financial Liberalization

Suppose that the capital account of our economy opens up, allowing private agents to borrow from and lend to the international financial market at $t = 0$ and $t = 1$. The effect of private capital flows

is best analyzed by considering two cases. In the first case the international interest rate is equal to one and the domestic economy turns out to be an importer of private capital. In the second case the international interest rate is above one, so that the domestic economy may (but need not) become an exporter of private capital.

4.1 The Case of Capital Importers

If the world interest rate is equal to one at both $t = 0$ and $t = 1$ ($r_0^* = r_1^* = 1$), financial liberalization exerts one immediate effect: it relaxes the domestic resource constraint, allowing for potentially greater domestic holdings of government bonds at $t = 0$ and for greater modern sector investment at $t = 1$.

As opening up to private flows enables the economy to resort to foreign savings, it allows banks to take deposits from the international financial market at $t = 1$. This effect makes modern-sector investment dependent only on the capital of banks and on the quality of domestic financial institutions, and not on the availability of domestic resources. Formally, this implies that opening up to private flows relaxes constraint $\alpha^{\max}(\beta)$ so that modern sector investment is monotonically increasing in α even if $\alpha > \alpha^{\max}(\beta)$. The intuition is that when the economy becomes financially integrated, regardless of the amount of domestic resources, bankers will always be able to accept deposits and expand their investment until their credit constraint binds.

Besides relaxing the economy's resource constraint at $t = 1$, opening up to private flows also relaxes the resource constraint at $t = 0$, allowing bankers and savers to expand their holdings of government bonds by borrowing from abroad. This effect operates through the government's incentive constraint $\alpha^{\min}(\beta)$, which decreases along with the proportion of the public debt that is held by foreigners. These effects imply that the government's first-order condition in Equation (16) becomes:

$$\left[\omega_0 + \alpha\overline{\Omega}\theta - 1\right] + \frac{A-1}{1-\alpha A}\beta\left[\omega_0 + \alpha\Omega\theta - 1\right] \geq 0. \tag{18}$$

where $\overline{\Omega}\theta = [\beta\Omega + (1-\beta)]$ denotes total traditional sector output at $t = 1$. The second term in brackets shows that now bankers can always hold government bonds up to the maximum amount $\omega_0 + \alpha\Omega\theta$ permitted by their pledgeable resources. Additionally, total domestic holdings of government bonds are above initial domestic wealth ω_0 by the amount $\alpha\overline{\Omega}\theta$, which also reflects the ability of savers to borrow from foreigners and purchase government bonds.

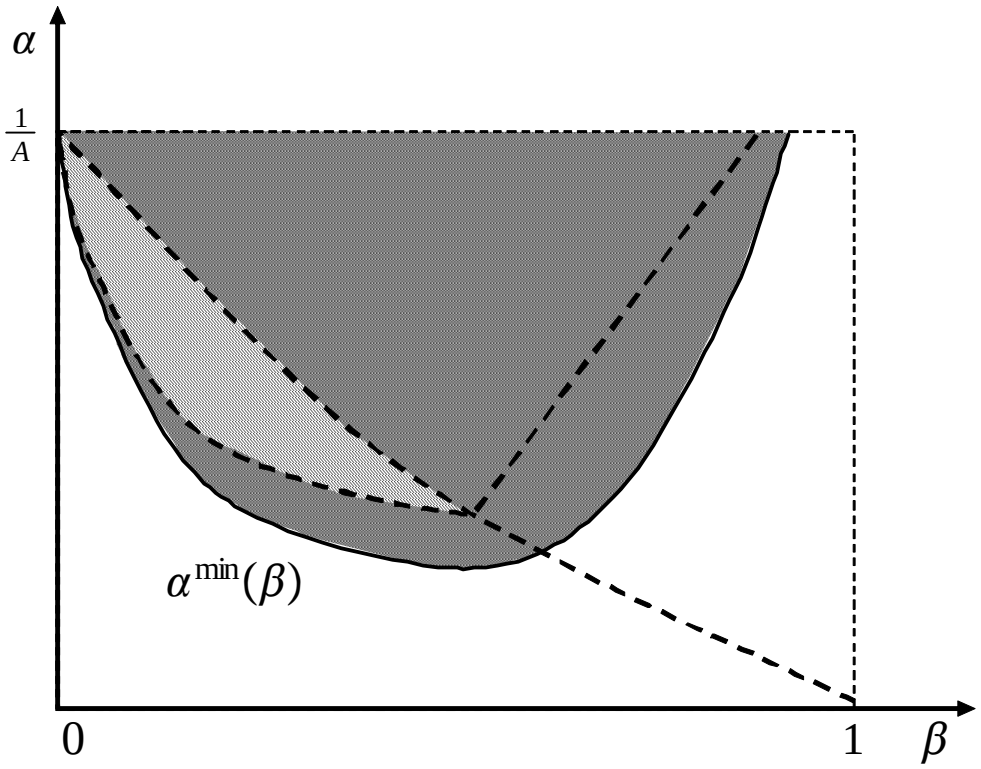
Note that, as long as α is sufficiently large that $\alpha\overline{\Omega}\theta \geq 1-\omega_0$, all government debt can be held by

domestic residents, ensuring full sustainability. More broadly, our model predicts that in financially more developed countries a larger fraction of government debt is held domestically, consistent with empirical findings by Reinhart, Rogoff, and Savastano (2003) and Jeanne and Guscina (2007).

Equation (18) then implies that:

Proposition 2 *When $r_0^* = r_1^* = 1$, there exists a U-shaped threshold $\alpha_{open}^{\min}(\beta) < \alpha^{\min}(\beta)$ such that the government can finance the public project at combinations (α, β) such that $\alpha \geq \alpha_{open}^{\min}(\beta)$.*

When the home economy is a capital importer, financial liberalization is weakly beneficial because foreign private capital inflows allow to expand: i) modern sector investment at $t = 1$, and ii) domestic holdings of government bonds at $t = 0$. Effect ii) implies that financial liberalization increases the damage cause by default on banks' balance sheet, effect i) implies that such damage always translates into a drop in investment. Both effects increase the cost of government default, enhancing debt sustainability. The darker area below graphically illustrates the impact of financial liberalization on debt sustainability:



In the context of our figures, financial liberalization implies that, at unchanged interest rates, the mapping $\alpha^{\max}(\beta)$ disappears and the mapping $\alpha^{\min}(\beta)$ moves down. As a result, financial

liberalization enhances the ability of countries with relatively high as well as relatively low levels of institutional development to finance the public project. The benefit of financial liberalization varies across economies, consisting only in expanded domestic bondholding in countries with low α, but also in greater modern sector investment in countries with high α. More generally, a private capital inflow helps to sustain government borrowing, as reflected by the fact that now government debt can be sustained at lower levels of α than in the closed economy case.

4.2 The Case of Capital Exporters

Consider now the case of a capital exporter, whose autarky interest rate lies below the international interest rate. We keep matters as simple as possible by assuming that the international interest rate is 1 at $t = 1$, i.e. $r_0^* = 1$, and $r_1^* \in (1, A)$ at $t = 1$.[14] In this case, the cost of capital for the government is still 1 and financial opening only increases the interest rate at which the modern sector borrows at $t = 1$.

As in the previous analysis, financial liberalization removes constraint $\alpha^{\max}(\beta)$, but it now affects the government's incentive to default in Equation (16), which now becomes equal to:

$$(\omega_0 + \alpha\overline{\Omega}\theta - 1) + \frac{A - r_1^*}{r_1^* - \alpha A}\beta\left[\omega_0 + \alpha\Omega\theta - 1\right] \geq 0. \tag{19}$$

Financial liberalization has still a beneficial effect on incentives by enabling domestic residents to increase their holdings of public bonds: this is reflected by the inclusion of $\alpha\overline{\Omega}\theta$ in the first term of Equation (19). But, to the extent that the autarky interest rate r_1 is lower than r_1^*, financial liberalization also reduces the extent to which banks are able to leverage their capital at $t = 1$, which decreases the cost of a government default. In particular, in the appendix we prove:

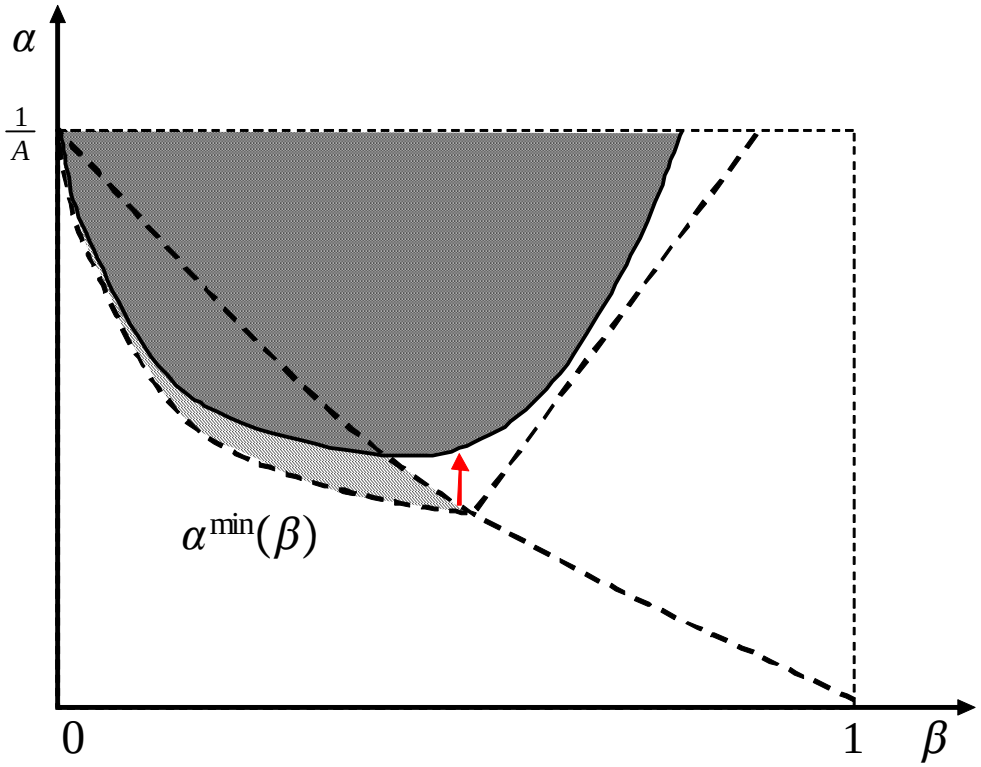
Proposition 3 *Assume that $A(1 - \omega_0) > E(\theta)$. There exists a threshold $r^* \in (1, A)$ such that, whenever $r_1^* > r^*$, we have that*

$$\alpha_{open}^{\min}(\beta, r_1^*) > \alpha^{\min}(\beta),$$

for $\beta \in (0, 1)$, where $\alpha_{open}^{\min}(\beta, r_1^*)$ is defined as the smallest level of α satisfying Equation (19).

[14] In other words, we assume for simplicity that the international interest rate is higher at $t = 1$ than at $t = 0$. The reason is that we want to assess the effects of liberalization when the international interest rate is higher than the one prevailing at home under autarky. In our model that cannot happen at $t = 0$, because the government sells bonds to domestic residents and to foreigners in a unified market. As a result, the domestic interest rate r_0 must always be equal to the international interest rate r_0^*, even if private sector agents cannot directly borrow from and lend to foreigners. The only assumption we really need is that r_0^* is not so high so as to prevent the government from beign able (or willing) to repay its debt ex-post.

Proposition 3 is particularly interesting when it is applied to economies for which $\alpha \leq \alpha^{\max}(\beta)$. It implies that, in these economies in which institutions are sufficiently weak so that the autarky interest rate $r_1 = 1$, financial liberalization reduces debt sustainability provided the international interest rate is sufficiently high. When $r_1^* > r^*$ the adverse affect of financial liberalization on modern sector borrowing more than compensates its beneficial effect on domestic bondholdings. This result is graphically represented below:



In contrast to the previous section, now financial liberalization increases the minimum level of institutional quality $\alpha_{open}^{\min}(\beta)$ at which the public project can be financed. The intuition is that now financial liberalization induces a private capital outflow at $t = 1$. Such outflow lowers the cost of default in terms of modern sector investment, thereby reducing the sustainability of government debt relative to the closed economy case. Interestingly, this implies that for countries with relatively weak institutions, financial liberalization is going to undermine government borrowing and welfare unless such measure is preceded by institutional reform.

4.3 The Complementarity of Public and Private Flows

In our model private capital inflows enhance the government's ability to borrow while private capital outflows do the reverse, relative to a financially closed economy. This complementarity between

capital flows to the private and public sectors of a country is the most fundamental insight of our analysis, and highlights the key role of domestic market institutions in allowing not only the private sector but also the government to tap foreign funds.

This idea suggests a novel perspective on the interaction between these different types of capital flows. The traditional international finance literature views these flows as substitutes rather than complements. In models with full commitment, substitutability emanates from Ricardian equivalence. In models of sovereign risk, the government decides whether to repay (enforce) all of the country's external debt, so that substitutability simply arises because the government's decision depends on the total amount of payments, not on their private vs public nature.

In our model, by contrast, the composition of capital flows is a crucial part of the story. This is because our government can hurt foreigners by defaulting on public debt but it does not directly intervene into private contracts (although a government default will indirectly induce private defaults). This feature captures the presence of an intuitive pecking order where it is easier for governments to default on public debt than to destroy domestic financial or legal institutions.[15] Crucially to understanding the world, this pecking order implies that domestic market institutions shape the effect and thus the cost of government default. In institutionally developed countries, private capital inflows expand the size of domestic banks, increasing the cost of default; in institutionally undeveloped countries the complementarity works the other way around, as private capital outflows reduces the size of domestic banks, lowering the cost of default.

We now illustrate how this perspective can yield novel insights on the effects of financial liberalization and the timing of institutional reform, on the role of centralization of borrowing by the government, and on crisis management.

4.4 Financial Liberalization and the Timing of Institutional Reform

The last twenty years witnessed a reduction in the frequency of government defaults which has attracted the attention of both academics and policy makers (Reinhart and Rogoff 2008). Interestingly, this period saw also a steady increase in private capital flows to debtor countries, consistent with our story of complementarity. One interesting example is Latin America, where capital inflows

[15] Of course, our view is complementary to the sovereign risk literature, which very usefully illustrates the possibility that in particularly severe crises the government might be tempted to alter domestic institutions, rendering the pecking order between different violations of investors' rights irrelevant. In future work, it may be interesting to study the government's decision of whether to infringe upon domestic institutions or not.

have been substantial.[16] Cowan et. al. (2006) show that over the nineties government debt rose moderately but, crucially, the share of domestically-issued bonds increased substantially, ranging from an average of 34% in the 1990-94 period to about 40% in the 2000-04 period. It is tempting to think that the private sector may have played a role in intermediating between the international financial market and the region's governments. The large dislocations in domestic credit markets caused by some recent defaults such as the Argentine one of 2001 seem to confirm that increasing capital inflows may have precisely reduced the frequency of government defaults by increasing their cost, in line with the predictions of our model. Section 5 provides some formal evidence in support of these facts.

At the same time, it is well known that the financial liberalizations of the nineties have not been uniformly beneficial for all countries, as some notorious cases of reversals of capital flows clearly illustrate (Eichengreen 2004). Formal econometric analyses (Kose et al. 2006) confirm this idea, further suggesting the presence of "threshold effects" whereby financial liberalization seems to have benefited only countries with sufficiently good institutions. Our model does not only provide a way to rationalize these findings, it also allows us to inquire on the potential problems associated with financial liberalization. In most countries, financial liberalization occurred in the absence of reforms aimed at strengthening domestic market institutions, the so called "second generation" reforms. This timing may have proven problematic for institutionally weak countries, those laying on the bottom part of the gray region in Figure 4. In those countries, financial liberalization could only prove beneficial if preceded by domestic market reform.[17] In this sense, domestic market institutions can bridge the gap between more sanguine (e.g. Summers 2000) and skeptical (e.g. Rodrik 1998) views of the benefits of financial globalization for emerging economies.

4.5 Centralized Borrowing

The complementarity between private and government debt delivers a novel view on the extent to which a country's capital inflows should be centralized by the government via direct borrowing or ownership and control of banks. Besides the debate on the merits of financial liberalization, the formal literature on sovereign risk sees it as welfare-enhancing for the government to undertake all

[16] In these countries, the average external debt of the private sector amounted in 1991 to a meagre 2% of GDP: by 2003, this share exceeded 12% of GDP.

[17] Another manifestation of this effect concerns the economy's fragility to global liquidity shocks. Section APP shows that a "sudden stop", intended as an unexpected increase in the international interest rate at $t = 1$, is much more damaing in countries with relatively weak institutions. In those countries, the sudden stop does not just lead to a private capital outflow but also to a government default, which enhances the damage caused to the private sector.

borrowing in a centralized fashion. This usually arises when atomistic private agents do not internalize the effect of their individual borrowing decisions on the government's incentive to enforce payments, which leads to overborrowing.[18] In this case, centralization is welfare enhancing because, being a large agent, the government internalizes the aggregate consequences of its borrowing decisions.

Our model suggests a more nuanced perspective, which stresses not only the benefits but also the costs of centralization. To see that, consider the figure below, which represents public borrowing at $t = 0$ in our model:

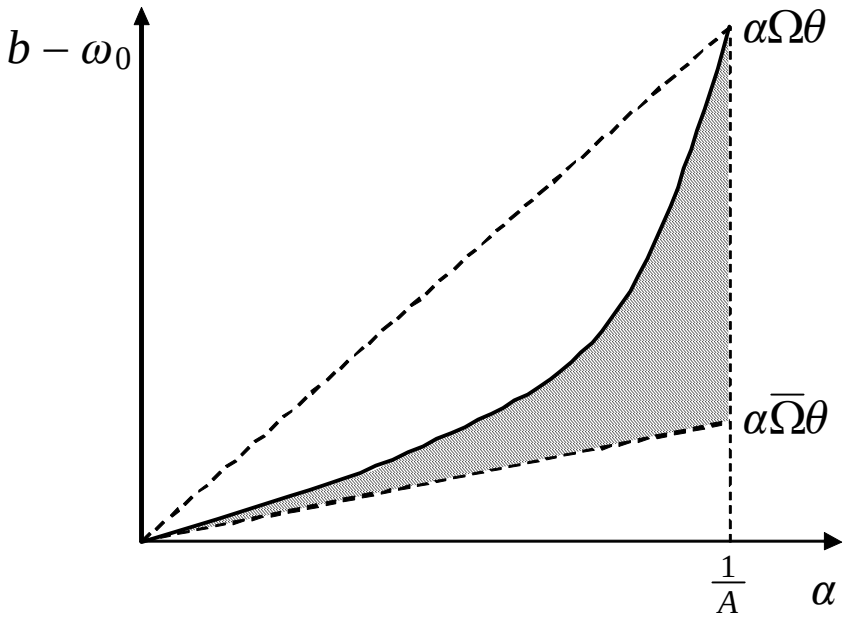


Figure 5 provides a clear characterization of the relationship between private and public borrowing in our model for a given level of β. The continuous line represents sustainable government borrowing in excess of initial endowment ω_0. As for the two dotted lines, the top one represents pledgeable resources of individual banks while the bottom one represents per-capita pledgeable resources of the economy. The shaded area represents direct government borrowing from foreigners. In a world in which only the private sector can borrow from foreigners, the economy as a whole can only borrow up to the value of its collateral $\alpha\theta\overline{\Omega}$. The same is true, though, if the government alone were to run the whole economy: even if government is constrained by the same pledgeability constraint as the private sector, its borrowing could not exceed $\alpha\theta\overline{\Omega}$, which is what foreigners could

[18] For a basic exposition of the overborrowing argument, see Eton and Fernandez. For more recent examples of alternative settings in which overborrowing may arise, see Jaeske, Wright, and Broner and Ventura.

collect in the event of default. By combining private and public borrowing, though, the figure shows that the aggregate borrowing constraint of the economy is relaxed.

In the first place, the presence of a private sector implies that a public default reduces investment because it is effectively a transfer from banks to savers. These distributional consequences would collapse if the government were to run the whole economy. On the other hand, the presence of a benevolent government implies that there is a large agent who internalizes these consequences of default, and is therefore able to borrow in excess of the economy's seizeable collateral. This ability to borrow would disappear in the absence of a government. Hence, the combination of a private sector with pledgeable output and a benevolent government that can borrow directly maximizes the amount of resources that the economy can access in international financial markets.

Once again, this result contrasts those emerging from traditional models of sovereign debt, in which capital controls are instrumental in avoiding problems of overborrowing. Our model, instead, suggests a mechanism through which capital controls might be counterproductive, thereby providing a rationale for the contrasting empirical findings regarding the effectiveness and consequences of such policy measures.

4.5.1 Crisis Management and Government Provision of Liquidity

One major role of government debt management that has been stressed by academics and policy makers is to provide liquidity to the private sector (Holmström and Tirole, 1998). This role is also present in our model, in which domestic banks demand government bonds precisely because they provide additional resources or "liquidity" when they are most constrained: in our environment, this happens when investment is most productive. One consideration that naturally follows from this observation is that there is a tension between the role of government debt as a provider of domestic liquidity and its role as a vehicle to obtain foreign finance.

4.6 Discussion and Extensions

Since our main results have been derived in a stylized setting, it is natural to inquire whether they are robust to alternative specifications. The current section comments on some natural directions in which the assumptions of the model could be relaxed and on their effects on our basic results.

1. We have assumed that the government cannot discriminate to any extent in its tax policy. If, on the other extreme, the government had the ability to costlessly adopt any degree of

discrimination, it would clearly always choose to default: any negative effects to the capital of banks could simply be undone by taxing consumers and transferring the proceeds to banks. Both of these cases are clearly extreme. Perhaps a more realistic environment is one in which some type of discrimination is possible, but a full reversal of the effects of a default might be too costly. Such is the case if, for example, bankers differ in their ability to monitor projects. To see this, assume that each banker in our benchmark model has an idiosyncractic productivity parameter A_i: if the economy is unproductive, $A_i = 1$ for all bankers, but if the economy is productive, A_i differs across bankers while satisfying $E(A_i) = A$ Assume also that each banker knows his idiosyncratic productivity parameter at $t = 0$, but that its value is private information.[19] In such a model, high-productivity bankers have a higher demand for government bonds than their less productive competitors. Hence, whenever total bondholdings of the banking sector are constrained by total domestic resources ω_0 (i.e., $\alpha > \alpha_0$), government bonds will tend to be in the hands of the most productive banks. This implies that the capital of these banks will suffer disproportionately from a public default. Since the government cannot distinguish between these banks and the less productive ones, though, the only way to avoid a fall in social surplus would be to make a large transfer to the banking sector as a whole. As long as there is some cost to redistributive taxation, the government might have an incentive to repay instead of defaulting and adopting large and expensive redistributive schemes.

2. We have assumed that the public investment directly enhances the productivity of the modern sector. All of our results would be equally valid without this assumption. Government incentives to repay its debt depend only on the size and distribution of domestic bondholdings: regardless of the reason for which the government borrows, the government incentives to repay will be increasing in the productivity of private investment. At the same time, domestic demand for government bonds – in particular that of bankers – depends only on their return being correlated with the productivity of domestic investment, and not on the relationship between the latter and the public investment.

3. We have assumed that private financial assets are non-contingent. If agents were allowed

[19] This means that, unlike our benchmark model, bankers cannot pledge their future revenues since they are private information. One way to get around this is to assume that bankers pledge their capital or investment instead. Additionally, and to make the model consistent, it should be assumed that bondholdings are also not observable and – hence – that bond revenues are not collateralizable.

to write and trade contingent assets, entrepreneurs would like to condition payments on the realization of A_B. In particular, they would like to issue assets promising to deliver when $A_B = 1$ and to purchase assets promising to deliver when $A_B > 1$.[20] These latter assets would be equivalent to government bonds in our model, and – if they were available – entrepreneurs would be indifferent between purchasing them or government bonds. This is because in our two-state world the existence of contingent assets is irrelevant because individuals already has access to two linearly independent assets. In a more complex world, though, in which the support of A had more than two values, the introduction of contingent assets would clearly diminish the appeal of government bonds by providing a more effective way of transferring resources to the relatively productive states of nature.

4. Finally, we discuss our assumptions regarding domestic bondholdings. In the equilibrium of our baseline model, bankers strictly want to hold bonds issued by their government. With respect to savers, we have assumed throughout that – being indifferent between holding government bonds or other assets – they hold as many bonds as they can purchase. Since government debt is a risky asset, the holdings of savers are not robust to the introduction of some risk aversion. Note, however, that risk aversion would not in itself change the qualitative nature of our conclusions. As long as risk aversion is not too large, bankers would still use government bonds to transfer resources to the more productive states of nature.

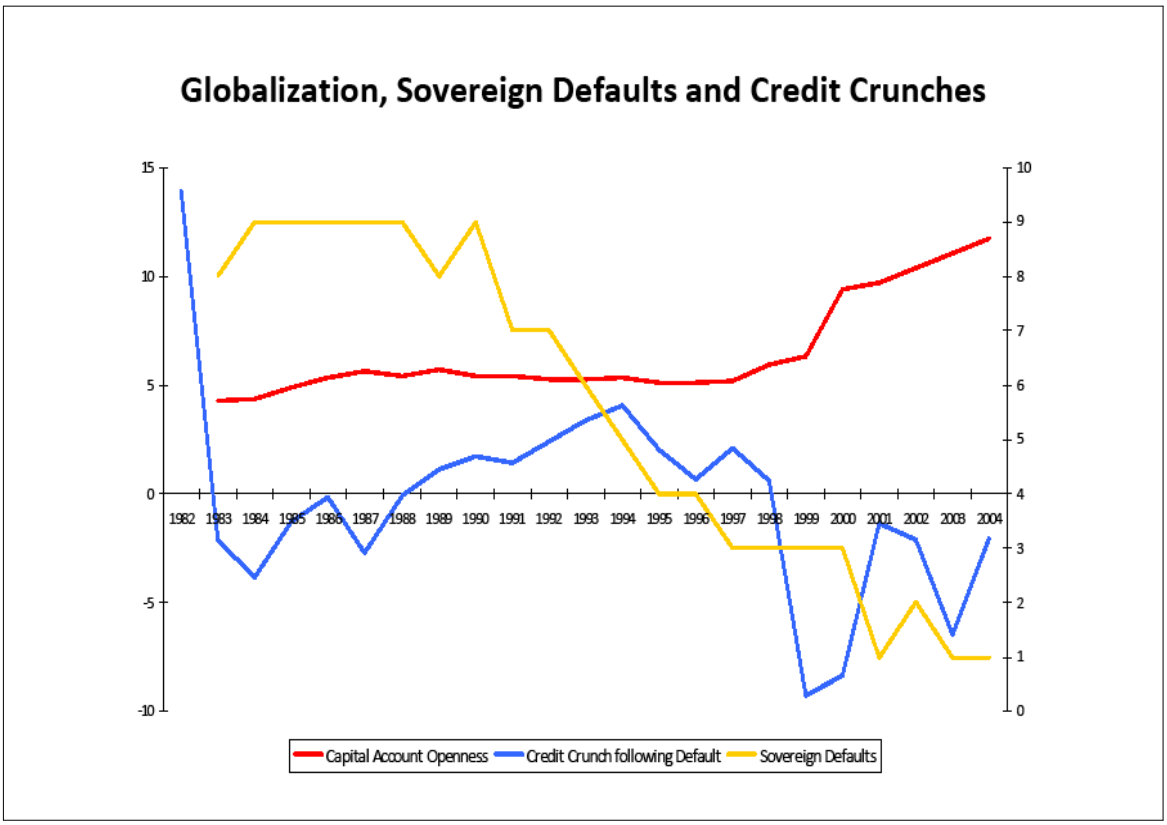
5 Empirical Section

The core insight of our model, and the source of our results on the role of domestic institutions, is the complementarity between capital flows to the private and the public sector of a country. We begin with a first look at the data for evidence of such complementarity. The steady increase in private capital flows to emerging economies that started in the mid nineties (Kose et al. 2006) provides a natural background against which our hypothesis can be evaluated. Importantly for our purposes, such boost in private flows has mainly financed the operations of private sector actors such as industrial firms and financial institutions via private bonds, portfolio equity and FDIs (e.g.

[20] It should be clear that issuing equity would not be enough for entrepreneurs to replicate the payout of government bonds. In the case of equity, entrepreneurs would also need to commit ex-ante to implement a dividend policy whereby retained earnings increase in modern sector productivity.

Lane and Milesi-Ferretti 2007).[21]

If complementarity is to play a role, then we would expect such boost in private capital inflows to have enhanced the sustainability of government debt by increasing the resources available for domestic intermediation, thereby aggravating the disruption in domestic financial markets caused by government default. Figure *I* below shows raw data over the 1980-2004 period of the number of sovereign defaults from Standard & Poor's[22] (2008 - yellow line), a measure of the extent of capital account openness from Lane and Milesi-Ferretti (2007 - red line) and the average change in private credit over GDP in countries where the government defaulted on its debt in the previous year (blue line), where the private credit data are from the IMF International Financial Statistics (2008). The data is from a representative sample of emerging and developed countries from the World Bank. Table *I* describes the variables used and their sources in detail.



The red line confirms the steady increase in global financial integration after the mid 1990s. The

[21] Following the East Asian crisis, there has been a reallocation of these capital flows towards FDIs but the volume of flows to emerging economies has continued to increase throughout.

[22] Standard & Poor's defines sovereign default as the failure of an obligor to meet a principal or interest payment on the due date (or within the specified grace period) contained in the original terms of the debt issue. A debt restructuring where the new debt contains less favourable terms than the original issue is also counted as default. See Table *I* for details.

yellow and blue lines are then strikingly consistent with the existence of a complementarity between private and sovereign flows. First, financial integration appears to have been accompanied by a fall in the number of countries in default, from 8-9 per year during the 1980s to 2-1 in the most recent years. This is consistent with the idea that the temptation to default of emerging countries' governments has fallen over time. Second, although the frequency of defaults has fallen over time, default episodes have been followed by more severe credit crunches. In particular, while in the early part of the sample, which includes the LDC debt crises of the eighties, defaults were followed by minor crunches in domestic financial systems, in the late 1990s these credit crunches have become much more severe. This can help explain why the governments' temptation to default has fallen over time.

The raw data are thus consistent with the notion that private capital inflows may have alleviated sovereign risk by increasing the disruption in domestic financial markets caused by government default. Of course, Figure I is also consistent with other explanations. For instance, a downward trend in world interest rates may explain the path of the number and perhaps even of the severity of defaults. On the other hand, the countries defaulting in the eighties may be very different from those defaulting in the late nineties, obscuring the comparison across sample periods. Finally, Figure I does not tell us whether the role played by private capital flows depends on the quality of a country's financial institutions, which is another prediction of our model. To shed some light on these issues, we probe deeper into the patterns of Figure I by performing some more formal econometric tests.

5.1 The Data

We use a representative sample of 56 emerging (defaulting and non-defaulting) countries over the 1981-2005 period. Besides using the private credit and default measures described above, we sometime use in our regressions the private debt data from the World Development Indicators of the IMF (September 2008), which measures the external obligations of private debtors that are not guaranteed for repayment by a public entity. This is a good proxy for the private foreign capital obtained by emerging economies in our sample because debt accounts for the bulk of total private flows.[23]

[23] Our theory has also predictions for the level of investment in the modern sector after default, which mirror the ones for capital flows. In what follows we focus only on credit markets, because it is hard to identify in the data the relevant finance intensive modern sector.

To study the determinants of default, and its consequences for domestic credit markets, we control for each country's growth of GDP and inflation rate as proxies for real and monetary factors independently affecting default and credit markets. The GDP data come from the World Bank's January 2008 World Development Indicators and, like private credit data, are not available for many countries in the earlier part of our period. The inflation data come from the World Development Indicators of the IMF.

We proxy for a country's financial institutions with the creditor rights index of Djankov, McLiesh and Shleifer (2007), who compute it for 133 countries as at January for every year between 1978 and 2003, following that constructed by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998).[24]

We control for time dummies to capture global economic trends and for country dummies to capture country specific invariant factors. Throughout we report standard errors that adjust both for heteroskedasticity and clustering at the country level.[25]

Table II presents correlations among the variables. It shows a positive correlation between the amount of private debt and private credit over GDP and GDP per capita. It also shows a negative correlation between creditor rights and sovereign defaults.

5.2 Tests

We begin by studying the impact of sovereign default at time t on private credit flows, where the latter is measured as the change in private credit over GDP between year t and $t-1$. Column 1 presents the specification without country fixed effects, and shows a statistically significant and economically large negative effect of default on private credit flows. Column 2 shows that the effect become statistically insignificant once we control for country dummies and GDP growth and inflation, but remains economically large: private credit over GDP falls by 1.7 percentage points after default. Crucially, and very much in line with Figure 1, the adverse effect of default on private credit flows is small or insignificant in the early 1990s but it is very large and highly significant

[24] The creditor rights index measures four powers of secured lenders in bankruptcy: (1) whether there are restrictions, such as creditor consent, when a debtor files for reorganization; (2) whether secured creditors are able to seize their collateral after the petition for reorganization is approved, that is, whether there is no automatic stay or asset freeze imposed by the court; (3) whether secured creditors are paid first out of the proceeds of liquidating a bankrupt firm; and (4) whether an administrator, and not management, is responsible for running the business during the reorganization. A value of one is added to the index when a country's laws and regulations provide each of these powers to secured lenders. The creditor rights index aggregates the scores and varies between 0 (poor creditor rights) and 4 (strong creditor rights).

[25] While this is a very conservative practice that is likely to produce very large estimated standard errors, it will greatly increase our confidence in the robustness of our results.

after year 1999. In this latter period, private credit over GDP falls by a staggering 5.8 percentage points after default, .

Columns 4 to 6 repeat the analysis on private debt flows. These regressions test whether, besides curbing domestic financing, government default also undermines private sector access to foreign financing. The results are similar to those of Columns 1 to 3: following a default, private debt flows are reduced by 1.5 as a percent of GDP. This result is consistent with the empirical findings of Arteta and Hale (2008) that, during sovereign debt crises, foreign banks reduce their syndicated loans to domestic private firms. Crucially, and again consistent with Column 3, the adverse impact of default is strongest in the recent years, where default reduced private debt flows by 2.7 as a percent of GDP.

These results strongly confirm the trend of Figure 1 about the greater severity of default-induced credit crunches. It is now interesting to test whether there is cross-country heterogeneity in the severity of those effects depending on: i) the amount of foreign private funds received by a country, and ii) the quality of the country's financial institutions. In this respect, our model predicts that default should cause larger disruptions in countries whose private sector borrows more from foreigners. Crucially, our model also suggests that this effect should be less prominent once we control for the quality of a country's financial institutions, as institutions are themselves the key determinants of domestics agents' ability to borrow from foreigners.

Table *IV* confirms these predictions of our theory. Column 1 shows that the fall in private credit is strongest in those defaulting countries where the stock of private external debt is highest. Column 2 introduces in the previous regression the interaction of sovereign default and creditor rights, and shows that once we control for institutional quality, the effect of private debt becomes marginally insignificant and economically reduced by 30%; by contrast, the effect of institutions is negative and statistically significant as expected, suggesting that more developed financial institutions increase the size of the default-induced credit crunch by 1.1 as a percent of GDP. These effects are robust to the inclusion of country and time dummies. Overall, the results of Columns 1 ans 3 line up with our prediction that better financial institutions should increase the cost of government default by allowing domestic firms to borrow from foreigners.

Table *IV* also provides some evidence for the non-monotonicity of the effect of financial institutions stressed by our model. In column 3 we interact sovereign default with creditor rights and creditor rights squared. We find that while the interactive term of sovereign default with creditor rights is still negative and significant, the interactive term of sovereign default with creditor rights

squared is positive and significant. This provides some evidence of "diminishing returns" in the extent to which more developed financial institutions exacerbate the cost of government default. This evidence of diminishing returns is consistent with the possibility, stressed by our model, that more developed financial systems may become progressively more resilient to the dislocations caused by government default, thereby softening the impact of default on economic activity.[26]

Finally, we ask whether increasing capital flows to the private sector might reduce the probability of government default, as suggested by the yellow line of Figure I.[27] Table V reports the results of probit regressions where the dependent variable is the probability that the country is in default in year t. The main explanatory variables are private debt flows from year $t-1$ to t, GDP per capita growth from year $t-1$ to t, and creditor rights. We find that private debt flows and GDP per capita growth are negatively correlated with the probability of sovereign defaults, so that an inflow of private capital should reduce the probability of default while a capital outflows should do the opposite. The economic magnitude is extremely large. A standard deviation decrease in the extent of private debt flows makes a sovereign default more likely by 8.2 percent. In comparison, the effect of GDP growth is smaller. A standard deviation decrease in the extent of GDP per capita growth makes a sovereign default more likely by 6.0 percent. This is consistent with the idea that when private investors withdraw their funds the government may not be so interested to restore the wealth of domestic banks and entrepreneurs by repaying its debt because the ability to borrow from foreigners is small anyway.[28]

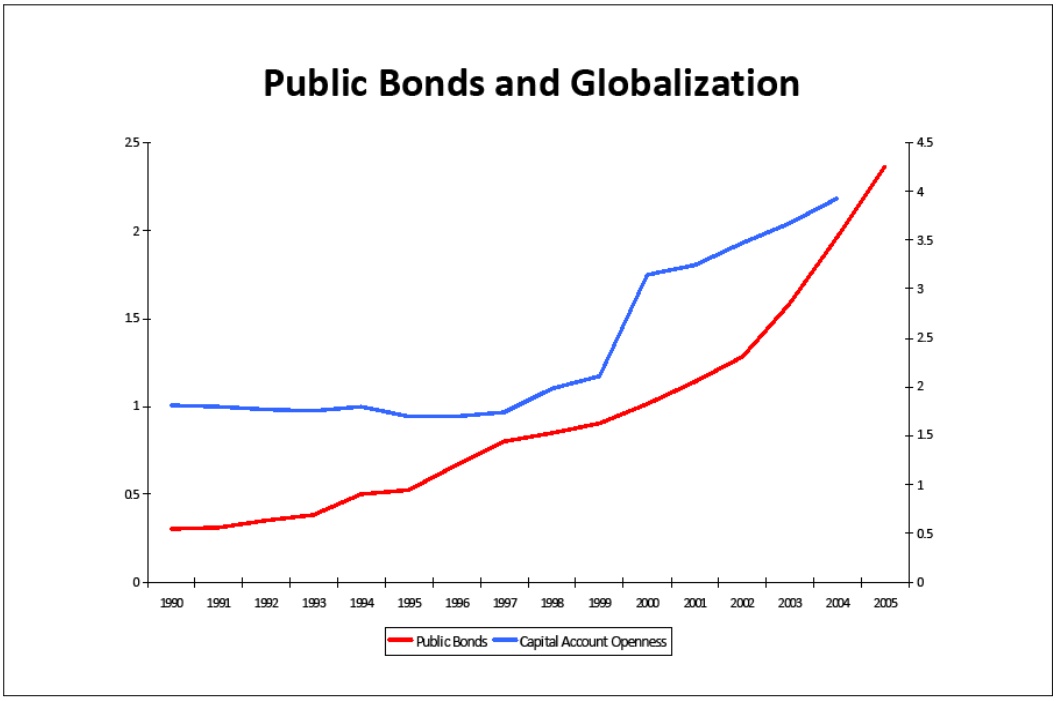
We conclude the section with a cursory look at some ex ante effects of capital account openness on the ability of the government to borrow. One major problem with such analysis is the lack of reliable and comparable public sector debt data across emerging countries. For our purpose the

[26] Note that in the open economy version of our model the effect of better financial institutions (higher α) on the cost of default is not dampened as institutions become very good. This feature, however, depends on the simplifying assumption of constant returns to scale in production. When the technology features decreasing returns in capital, even in the open economy version of our model the cost of default for the government eventually tends to fall as α increases because at higher α the level of investment is also higher and so entrepreneurs' willingness to invest additional funds is also smaller. In this sense, by limiting the *willingness* of entrepreneurs to fund additional investment, decreasing returns would play - in the open economy version of our model - a role similar to the one played in the closed economy by domestic savings (which reduce entrepreneurs' *ability* to finance additional investments).

[27] We focus on the probability of a default and not on monetary measures of creditors' recovery such as the loss given default, for two main reasons. First, estimates of creditors' losses given defaults ("haircuts") are heavily dependent on the assumptions one makes about counterfactuals (e.g. Sturzenegger and Zettelmeyer 2007). Second, it is widely accepted that sovereign defaults are very large and disruptive events. Moody's (2007) estimates the average recovery rate on sovereign bonds as 55% on an issuer-weighted basis, and 29% on a volume-weighted basis. Sturzenegger and Zettelmeyer (2007) find that even under the most conservative assumptions, recovery rates range from a minimum of 13% to a maximum of 90% of the bonds' par value.

[28] Note that **in our regressions** creditor rights is not significant, suggesting that at any given level of **institutions, public** borrowing is on average optimally adjusted accordingly.

usual measures of external government debt are not sufficient because domestic debt holdings are a crucial ingredient of our argument.[29] Unfortunately, despite some notable recent efforts (Reinhart et al. 2003, Jeanne and Guscina 2006), reliable information about total public debt is still limited to very few countries. To partially circumvent this problem, we focus on a narrower aspect of the ex ante debt structure of government debt, namely public bonds. Although this evidence is only suggestive, as public bonds data is only available from 1990 for fifteen countries or so, it is interesting to consider because public bonds: i) are the instrument that in practice supports our non-discriminatory default assumption, ii) are naturally sustainable under our argument that the government is afraid of destroying domestic credit markets, and iii) are much harder to sustain by reputational considerations alone, which are obviously much weaker in the case of dispersed bondholders. Figure *II* plots the time series of public bonds as a proportion of total borrowing against the measure of capital account liberalization of Lane and Milesi-Ferretti (2007).



The Figure shows that increased globalization in recent years has come hand in hand with increased government ability to issue public bonds. This finding is consistent with several explanations, two of which are consistent with the complementarity stressed by our model. On the one hand, financial

[29] In an ideal world, we would **also** like to observe the holdings and trades of sovereign debt by domestic, non-financial firms (the entrepreneurs in our model), as well as by foreign investors, to study how the composition of these holdings affect the expected cost of default ex ante. As it turns out, such detailed holdings data are typically not available at the micro level.

integration may have increased the government's ability to issue public bonds by increasing the domestic costs of defaulting on such bonds. On the other hand, reliance on public bonds may have itself sped up financial globalization by alleviating sovereign risk, thereby increasing the ability of governments to borrow from foreign atomistic investors. While this simple pattern is certainly far from establishing conclusive evidence on the complementarity between private and sovereign capital flows, it is at least suggestive of the role that such complementarity may play in shaping international financing patterns and of the need for further empirical work on this important but under-researched topic.

6 Concluding Remarks

We have built a stylized model of the interaction between public credit markets where government bonds are issued and traded, and private credit markets where banks intermediate savings to investment projects. The model unveils a novel complementarity between capital flows to the private and the public sectors of a country where private inflows help sustain public borrowing by increasing the cost of government default. These findings suggest that domestic market institutions can play a key role not only in boosting private sector borrowing, but also in disciplining the government, allowing it to borrow in international markets.

This idea lines up with recent empirical evidence on the effects of financial globalization (see Kose et al. 2006) which stresses that the main benefits of successful financial integration are catalytic and indirect. In other words, these benefits are not simply, or even primarily, the result of enhanced access to foreign financing, but they are also the result of increased discipline on macroeconomic policies and on public governance more generally. Our model can help gain a better understanding of these findings. At one level, it does so by stressing that the "discipline" effect of international financial markets is neither fate, nor it comes for free: it is only present in countries with good market institutions. As our model points out, in countries with weak market infrastructure financial integration may actually reduce the government's discipline,and thus induce default.

At a broader level, we believe that our model provides a useful framework to study the way domestic markets modulate the impact of financial integration on a variety of government policies. This paper has focused on default, but interesting extensions could consider other policies such as opportunistic devaluations or inflations, to mention just a few. Besides affecting the returns ob-

tained by foreigners, these policies are likely to have other important macroeconomic consequences and may thereby inflict losses on some classes of domestic residents. Crucially from our standpoint, the magnitude of these losses, and hence the governments' incentive to misbehave in the first place, are likely to importantly depend on the quality and development of domestic markets. Our current analysis hints at the possibility that the government may be able to build commitment not to pursue these policies on top of domestic market institutions, broadening the scope of the complementarity between well functioning private markets and good government behavior. At the current stage, thought, a fuller understanding of these interactions remains an exciting topic for future research.

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7 Appendix

7.1 Theoretical Appendix

To be written.

7.2 Empirical Appendix

TABLE I – DESCRIPTION OF THE VARIABLES USED IN THE ANALYSIS

Variable	Description
Public Debt to GDP	Ratio of public debt, which is an external obligation of a public debtor, including the national government, a political subdivision (or an agency of either), and autonomous public bodies. Source: World Development Indicators (September 2008).
Private Debt to GDP	Ratio of private, nonguaranteed external debt,which is an external obligation of a private debtor that is not guaranteed for repayment by a public entity. Source: International Monetary Fund, World Development Indicators (September 2008).
Private Credit to GDP	Ratio of credit from deposit taking financial institutions to the private sector (International Financial Statistics lines 22d and 42d) to GDP (International Financial Statistics line 99b), expressed as a percentage. Line 22d measures claims on the private sector by commercial banks and other financial institutions that accept transferable deposits such as demand deposits. Line 42d measures claims on the private sector given by other financial institutions that do not accept transferable deposits but that perform financial intermediation by accepting other types of deposits or close substitutes for deposits (e.g., savings and mortgage institutions, post office savings institutions, building and loan associations, certain finance companies, development banks, and offshore banking institutions). Source: International Monetary Fund, International Financial Statistics (September 2008).
Public Bond Share	Ratio of Public Bond, which is the public domestic debt securities issued by government, as a share of Public Debt, which is an external obligation of a public debtor, including the national government, a political subdivision (or an agency of either), and autonomous public bodies. Government bond data is taken from the electronic version of the Bank of International Settlements' Quarterly Review: International Banking and Financial Market Developments by sector and country of issuer.
Sovereign Default	Dummy variable that equals 1 if in year t–1 the sovereign issuer is in default. Sovereign default is defined as the failure to meet a principal or interest payment on the due date (or within the specified grace period) contained in the original terms of the debt issue. In particular, each issuer's debt is considered in default in any of the following circumstances: (i) For local and foreign currency bonds, notes and bills, when either scheduled debt service is not paid on the due date, or an exchange offer of new debt contains terms less favorable than the original issue; (ii) For central bank currency, when notes are converted into new currency of less than equivalent face value; (iii) For bank loans, when either scheduled debt service is not paid on the due date, or a rescheduling of principal and/or interest is agreed to by creditors at less favorable terms then the original loan. Such rescheduling agreements covering short and long term debt are considered defaults even where, for legal or regulatory reasons, creditors deem forced rollover of principal to be voluntary. Source: Standard & Poor's (2008).
Creditor Rights	An index aggregating creditor rights, following La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). A score of one is assigned when each of the following rights of secured lenders are defined in laws and regulations: First, there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization. Second, secured creditors are able to seize their collateral after the reorganization petition is approved, i.e., there is no automatic stay or asset freeze. Third, secured creditors are paid first out of the proceeds of liquidating a bankrupt firm, as opposed to other creditors such as government or workers. Finally, if management does not retain administration of its property pending the resolution of the reorganization. The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights) and is constructed as at January for every year from 1978 to 2003.
GDP	Logarithm of gross domestic product (current US dollars) from 1981 to 2005. Source: World Development Indicators (2008).
GDP per Capita	Logarithm of gross domestic product per capita (Atlas method) from 1981 to 2005. Source: World Development Indicators (2008).
GDP per Capita Growth	Annual growth in gross domestic product per capita from 1981 to 2005. Source: World Development Indicators (2008).

Table II - Pairwise Correlations

The table presents Bonferroni-adjusted simple correlations between all variables used in the analysis. The definition of each variable is shown in Table 1. The analysis covers 56 countries and 24 years. p-values are in parentheses; *** indicates significance at the 1 percent level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	Public Debt	Private Debt	Private Credit	Public Bond Share	Sovereign Default	Creditor Rights	GDP	GDP p.c.
Private Debt	-0.0943***							
	0.0000							
Private Credit	-0.1431***	0.2165***						
	0.0000	0.0000						
Public Bond Share	-0.3792***	-0.049	-0.438[a]					
	0.0000	1.0000	0.0000					
Sovereign Default	0.2861***	-0.0079	-0.254***	-0.2754***				
	0.0000	1.0000	0.0000	0.0001				
Creditor Rights	-0.0303	0.0451	0.2491***	0.4357***	-0.1424***			
	1.0000	1.0000	0.0000	0.0000	0.0000			
GDP	-0.4884***	0.0800	0.4477***	0.0617	-0.0606	-0.1048**		
	0.0000	1.0000	0.0000	1.0000	1.0000	0.0292		
GDP p.c.	0.0321	0.2408***	0.5735***	0.1742	-0.1845***	0.1182***	0.5108***	
	1.0000	0.0000	0.0000	0.2110	0.0000	0.0058	0.0000	
GDP p.c. growth	-0.2232***	-0.0207	-0.0286	0.0528	-0.1000**	0.0307	0.1179***	0.1017***
	0.0000	1.0000	1.0000	1.0000	0.0171	1.0000	0.0004	0.0056

Table III - Private Flows and Sovereign Defaults

The table presents panel regressions for 56 countries over the 1980-2005 period. The dependent variable in columns 1 to 3 private credit flows to GDP is computed as private credit to GDP in year t - private credit to GDP in year t-1. The dependent variable in columns 4 to 6 private debt flows to GDP is computed as private debt in year t - private debt in year t-1. Sovereign default is a discrete variable that equals one if the sovereign is in default in year t-1, zero otherwise. Regressions include country and year fixed effects; standard errors (in parentheses below the coefficient estimates) are adjusted for heteroskedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the country level using the Huber (1967) correction. *** indicates significance at the 1 percent level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	Private Credit Flows to GDP			Private Debt Flows to GDP		
	(1)	(2)	(3)	(4)	(5)	(6)
Sovereign Default	−0.019**	−0.017		−0.008**	−0.015**	
	(0.007)	(0.014)		(0.003)	(0.006)	
(Sovereign Default)*(2000-2004)			−0.058***			−0.027***
			(0.010)			(0.008)
(Sovereign Default)*(1995-1999)			−0.023			−0.020*
			(0.041)			(0.011)
(Sovereign Default)*(1990-1994)			0.018			−0.007
			(0.013)			(0.005)
(Sovereign Default)*(1985-1989)			−0.033**			−0.018*
			(0.013)			(0.009)
(Sovereign Default)*(1980-1984)			−0.038***			−0.008
			(0.014)			(0.017)
GDP per capita growth		−0.171	−0.198		0.076**	0.076**
		(0.113)	(0.111)		(0.031)	(0.035)
Inflation			0.000			0.000
			(0.001)			(0.000)
Constant	0.019*	0.029***	0.028***	0.006*	−0.005	−0.001
	(0.010)	(0.009)	(0.009)	(0.003)	(0.005)	(0.003)
Time dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies?	No	Yes	Yes	No	Yes	Yes
SE Robust and clustered by country?	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1198	1104	1004	630	501	501
Number of countries	56	47	47	29	23	23
Adjusted R-squared	0.030	0.033	0.042	0.172	0.176	0.192

Table IV - Private Credit Flows, Sovereign Defaults, and Creditor Rights

The table presents panel regressions for 21 emerging countries over the 1981-2005 period. The dependent variable private credit flows to GDP is computed as private credit to GDP in year t - private credit to GDP in year t-1. Sovereign default is a discrete variable that equals one if the sovereign is in default in year t-1, zero otherwise. Creditor rights is a discrete index ranging from zero to four aggregating creditor rights, following La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). Regressions include country and year fixed effects; standard errors (in parentheses below the coefficient estimates) are adjusted for heteroskedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the country level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	(1)	(2)	(3)
(Sovereign Default)*(Private Debt to GDP)	−0.209**	−0.141	−0.092
	(0.097)	(0.090)	(0.097)
(Sovereign Default)*(Creditor Rights)		−0.011**	−0.038**
		(0.004)	(0.016)
(Sovereign Default)*(Creditor Rights)^2			0.007*
			(0.003)
Creditor Rights		0.081*	0.038
		(0.046)	(0.142)
(Creditor Rights)^2			0.010
			(0.036)
Private Debt to GDP	−0.149	−0.147	−0.160
	(0.077)	(0.085)	(0.092)
Sovereign Default	0.001	0.023	0.036***
	(0.013)	(0.015)	(0.010)
GDP per capita growth	−0.036	−0.122	−0.118
	(0.111)	(0.117)	(0.119)
Inflation	0.000	0.004	0.006
	(0.001)	(0.008)	(0.007)
Constant	0.014	−0.052	−0.105
	(0.016)	(0.042)	(0.104)
Time dummies?	Yes	Yes	Yes
Country dummies?	Yes	Yes	Yes
SE Robust and clustered by country?	Yes	Yes	Yes
Observations	417	349	349
Number of countries	21	21	21
Adjusted R-squared	0.063	0.079	0.085

Table V - Determinants of Sovereign Default

The table presents probit regressions for 56 countries over the 1980-2005 period. The dependent variable is the probability that the country is in default in year t. The reported coefficients are estimates of the effect of a marginal change in the corresponding regressor on the probability of sovereign default, computed at the average of the dependent variable. Private debt flows to GDP is computed as private debt in year t — private debt in year t-1. Creditor rights is a discrete index ranging from zero to four aggregating creditor rights, following La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). Regressions include year fixed effects; standard errors (in parentheses below the coefficient estimates) are adjusted for heteroskedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the country level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	(1)	(2)	(3)	(4)	(5)
Private Debt Flows	−3.781***		−3.733***		−3.743***
	(1.090)		(1.265)		(1.141)
Creditor Rights				−0.023	0.004
				(0.026)	(0.057)
GDP per capita growth		−0.430**	−0.976**	−0.504***	−1.198**
		(0.222)	(0.492)	(0.257)	(0.569)
Time dummies?	Yes	Yes	Yes	Yes	Yes
SE Robust and clustered by country?	Yes	Yes	Yes	Yes	Yes
Observations	600	1058	455	921	391
Number of countries	29	50	23	50	23
Pseudo R-squared	0.134	0.075	0.178	0.097	0.182