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# Institutions, Public Debt and Foreign Finance

Nicola Gennaioli, Alberto Martin and Stefano Rossi\*

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## Abstract

We study the role of domestic financial institutions in sustaining capital flows to the private and public sector of a country whose government can default on its debt. As in recent public debt crises, in our model public defaults weaken banks' balance sheets, disrupting domestic financial markets. This effect leads to a novel complementarity between private capital inflows and public borrowing, where the former sustain the latter by boosting the government's cost of default. Our key message is that, by shaping the direction of private capital flows, financial institutions determine whether financial integration improves or reduces government discipline. We explore the implications of this complementarity for financial liberalization and debt-financed bailouts of banks. We present some evidence consistent with complementarity.

**JEL classification:** F34, F36, G15, H63.

**Keywords:** Sovereign Risk, Capital Flows, Institutions, Financial Liberalization, Sudden Stops

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# 1 Introduction

Financial reform, defined as the strengthening of legal enforcement, investor rights and corporate governance, scores high on the list of “second generation reforms,” promising to enable emerging economies to reap the benefits of financial integration (IMF 1999, IADB 2006). Economic theory and empirical evidence confirm that better financial institutions enhance the ability of domestic financial systems to attract foreign funds and employ them efficiently (e.g. Caballero and Krishnamurthy 2001, Alfaro et al. 2008). Despite its intuitive appeal, this view overlooks the fact that foreign investors in emerging economies are not only wary of the risks deriving from the domestic legal and financial infrastructure, but also of those generated by the local government. That is, over and above direct expropriation by capital users, investors in emerging economies are subject to the risk that the government may indirectly hinder their returns through such policies as currency devaluation, inflation and default (Tirole 2002). This possibility raises one key question: Does the presence of this type of government agency obliterate the role of financial reforms in supporting effective globalization or does it still leave significant room for them?

We address this question by focusing on public defaults, which represent a major form of government agency in the real world. To set the stage, we first develop a small open economy model that is designed to parsimoniously reproduce two key features of recent public defaults in Russia, Ecuador, Pakistan, Ukraine and Argentina (see IMF 2002). First, those defaults severely weakened the balance sheets of banks because of the banking system’s high holdings of public debt. Second, these negative balance sheet effects led to severe contractions in credit and output in these economies. In a model where these features arise naturally, we show that the government decides whether or not to default on its debt by solving the following trade-off. On the one hand, default beneficially increases total domestic resources for consumption, as some public bonds are held abroad. On the other hand, since some other public bonds are held by domestic banks, a default is costly because it undermines the wealth of the banking sector, thereby hurting – through adverse balance sheet effects – credit, investment, and output.<sup>1</sup>

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<sup>1</sup>Section 2.2 shows that two realistic modelling assumptions yield this tradeoff. First, in line with recent sovereign risk models (Guembel and Sussman 2009, Broner and Ventura 2008) we assume that public defaults do not discriminate between foreign and domestic creditors. Second, as in international financial frictions models (Caballero and Krishnamurthy 2001, Matsuyama 2004), we assume that private debt is subject to legal enforcement. A similar tradeoff is used by Basu (2009) and Brutti (2009) to study the classical question of whether public external debt can be sustained in the absence of reputational incentives or default penalties (see Eaton and Fernandez 1995 for a review of the traditional sovereign risk approach). Unlike our paper, these authors neither focus on the role of financial institutions nor on that of private capital flows.

Within this basic setup, we then ask: how does the quality of financial institutions shape the government's incentive to default? We find that better financial institutions increase the government's cost of default by boosting banks' leverage. Higher leverage indeed allows banks to a) purchase more public bonds, and b) expand the amount of real investment they finance per unit of their wealth. The first effect worsens the impact of default on banks' balance sheets; the second effect boosts the extent to which such balance sheet effect causes a drop in real activity. If financial institutions are sufficiently good, both effects are so strong that the government can commit to repay, rationalizing why public default risk appears to be lower in countries endowed with a better financial or legal infrastructure (Reinhart et al. 2003, Kraay and Nehru 2006).

We then ask, how in this setup do financial institutions affect the country's ability to benefit from financial integration? Crucially, we find that the sustainability of public debt increases with financial integration insofar as the latter leads to inflows of private capital<sup>2</sup>, because these inflows allow: i) domestic banks to expand the amount of resources that they intermediate towards productive investment and ii) domestic residents to hold more public debt. Both of these effects amplify the positive impact of financial institutions on the government's cost of default.

The key insight emerging from our analysis is that, in the presence of public default risk, financial institutions create a *complementarity* between public borrowing and private capital inflows. By attracting private capital flows, strong institutions reduce governments' incentives to default, facilitating public borrowing and also allowing for even greater private inflows. This complementarity is clearly beneficial for countries with strong institutions, but it is at the same time problematic for institutionally weak countries; the inability of those countries to attract or even retain private capital exacerbates public default risk, in turn contracting private credit and real activity. As we discuss in Section 4.3, this complementarity between private inflows and public borrowing is novel in the literature. International financial frictions models (Gertler and Rogoff 1990, Caballero and Krishnamurthy 2001, Matsuyama 2004) focus only on private flows, abstracting from public debt. Sovereign risk models typically focus on public debt (e.g. Arellano 2008), but even if they allow for private flows (e.g. Broner and Ventura 2007), they view them as mere substitutes of public ones. Section 5 documents some patterns of cross country capital flows that are consistent with complementarity. In particular, the increase in the last thirty years of private capital flows to

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<sup>2</sup>We find that in a financially closed economy where only the government can tap foreign funds very good financial institutions can reduce the cost of public default by rendering banks' intermediation and investment more resilient to adverse balance sheet effects. When the economy is open to private capital inflows, however, this effect is dominated by the two positive effects discussed above of institutional quality on the cost of default.

emerging economies has been accompanied by a reduction in the frequency of public defaults but, at the same time, by increasingly more severe private credit contractions after public default events. Interestingly, these post-default credit crunches appear to be more severe in countries with better financial institutions, which is a distinctive and novel prediction of our model.

Going back to our original question then, these results imply that strong financial institutions are perhaps even more important in a world plagued by public default risk, for it is precisely the quality of these institutions that – by determining the direction of private capital flows – ultimately determines whether financial integration has a disciplinary effect on the government, strengthening or weakening its incentive to repay. We build on this notion of complementarity to analyze the presence of threshold effects whereby financial liberalization is only beneficial above a certain level of institutional quality (Kose et al. 2006), the interaction between financial liberalization and institutional reform, and the feasibility of public bailouts during banking crises. More broadly, and besides our focus on public defaults, we argue in the conclusions that our notion of complementarity can shed useful light on the role of private markets and of pro-market reforms in disciplining emerging market governments.

## 2 The Basic Model

There is a small open economy (home) that lasts for three periods  $t = 0, 1, 2$ . At  $t = 0$  a fixed-size public investment of 1 can be undertaken. To do so, the government must borrow abroad because the home economy is initially endowed with  $\omega_0 < 1$  units of the only consumption good. Foreign borrowing is feasible in principle because at  $t = 1$  the economy produces output  $\bar{\Omega}\theta > 1$ , so that it has enough resources to repay. The problem is that the government lacks commitment so it may be unwilling to repay at  $t = 1$  (as we shall see, no repayment can occur in the end period  $t = 2$ ).

Home is populated by a measure 1 of agents, each of whom is risk neutral, indifferent between consumption in the three dates, and endowed with wealth  $\omega_0$  at  $t = 0$ . A fraction  $\beta$  of the population consists of “bankers,” denoted by  $B$ , the remaining fraction  $(1 - \beta)$  of “savers,”  $S$ . At  $t = 1$  all agents have an investment opportunity yielding output:

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

at  $t = 2$ , where  $I$  is the capital invested and  $j$  indicates the agents’ type. We assume that bankers have an advantage in monitoring projects (Diamond 1984) so that they are more productive than

savers, i.e.  $A_B \geq 1 = A_S$  (for simplicity, only banks generate a social surplus). Productivity  $A_B$  is stochastic, taking value  $A > 1$  with probability  $p \in (0, 1)$  and value 1 with probability  $(1 - p)$ . This stochasticity allows us to study the cyclical properties of public default.

This setup captures the idea that when the government decides whether to repay its debt at  $t = 1$ , domestic resources have yet to be intermediated from savers to banks to exploit technology (1). This is a crucial aspect of our model, which generates the conditions for the government repayment decision to affect domestic financial markets and investment. As we discuss in Section 4, what is instead not crucial for our story is that technology (1) only becomes available at  $t = 1$  after the government has undertaken the public investment. One appealing narrative behind this timing, though, is that it is the public investment itself that generates the private investment opportunity at  $t = 1$ , very much as if the government paves the way for a modern sector to develop by investing in the necessary human capital or infrastructure. We pursue this convenient and realistic idea in the rest of the paper, so that we henceforth refer to technology (1) as “modern sector”.

To repay its debt, the government taxes home residents. At  $t = 1$ , a type  $j$  agent obtains output  $\Omega_j \theta$ , which can be viewed as being produced by a fixed sized project in the economy’s “traditional sector”. Consistent with the above, bankers are also more productive in this traditional sector, i.e.  $\Omega_B = \Omega \geq 1 = \Omega_S$ . Thus, aggregate traditional sector output at  $t = 1$  is  $\bar{\Omega} \theta = [\beta \Omega_B + (1 - \beta) \Omega_S] \theta$ .

## 2.1 Financial Markets

To finance the public project at  $t = 0$  and the modern sector investment at  $t = 1$ , the government and bankers need to borrow. All financial contracts are short term: for clarity we refer to banks’ contracts as deposits. The international financial market is able to lend or borrow any amount at 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 home government and those written by its private agents. The first one concerns the frictions in their enforcement. Public debt is subject to default. That is, the government opportunistically decides whether to repay at  $t = 1$  to maximize the welfare of home residents. By contrast, deposit (and other private) contracts are subject to imperfect court enforcement; if a bank defaults, only a share  $\alpha$  of its revenues are seizeable by depositors, regardless of whether they are domestic or foreign. If  $\alpha = 1$ , the bank can pledge all of its revenues to depositors and financial frictions are non-existent. These frictions rise as  $\alpha$  falls below 1. The level of  $\alpha$  captures the quality of home’s financial institutions and, in particular, the strength of investor protection at home.

The second distinction between private and public financial contracts concerns their access to foreign credit. The government 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 citizens – unlike the government – cannot borrow or lend internationally. Section 4 turns to the most interesting case where also the private sector can borrow and lend abroad. By comparing these two extreme cases we can study the interaction between capital flows to the private and the public sector in our model.

The timing below summarizes the main ingredients of our model:

1.  $t = 0$ : Financial markets open. Public bonds are issued and banks accept deposits from savers. Given the respective contractual interest rates  $r_g$ ,  $r^*$  and  $r_0$  on government bonds, foreign bonds and deposits, savers and banks optimally determine their portfolio. Each individual runs his traditional sector project, which yields output at  $t = 1$ . The government decides whether to invest in the public project.
2.  $t = 1$ : If the government invested at  $t = 0$ , the modern sector develops, its productivity is realized and each agent can run a modern sector project. Foreign bonds, deposits, and public bonds mature. The government chooses what share  $\rho \in [0, 1]$  of its debt to repay to maximize domestic welfare. Repayment is financed via lump sum taxation:

$$\tau(b, \rho) = \rho r_g b, \tag{2}$$

capturing the idea that if an amount  $b$  of public debt is issued, a default ( $\rho < 1$ ) amounts to a smaller taxation of domestics. Bankers and savers optimally determine their portfolio, which determines aggregate investment  $I$  in the modern sector.

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

This timing is represented below:

| t=0                | t=1  | t=2                           |
|--------------------|--|-------------------------------|
| $\omega$ realized  | $\Omega\theta$ realized<br>$A$ becomes known | $AI$ realized                 |
|                    | Asset payments made ( $r_0$ )                | Asset payments made ( $r_1$ ) |
|                    | <b>GOVERNMENT REPAYMENT</b>                  |                               |
| Asset Markets Open | Asset Markets Open                           |                               |
| Public investment  | Private investment                           |                               |

Figure 1

## 2.2 Discussion of Basic Setup

### 2.2.1 Evidence on Government Default and Private Credit Markets

As we discuss in the next subsection, the above setup seeks to parsimoniously reproduce two basic features of recent sovereign debt crises (IMF 2002, Sturzenegger and Zettelmeyer 2005). First, government defaults typically hurt the balance sheets of domestic banks, which in emerging economies hold large amounts of government bonds. Second, these adverse balance sheet effects lead to drops in investment and output.

Perhaps the best depiction of these features is provided by an IMF (2002) report analyzing four recent instances of government defaults (Russia, Ecuador, Ukraine and Pakistan), all of which were associated with private credit crunches and output losses. The report stresses that the main transmission channel of default worked through the insolvency of the banking system, as “the size of the economic dislocations depended crucially on how much restructured debt was held by domestic agents” so 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”. Using formal econometric techniques, Borensztein and Panizza (2008) confirm that government defaults are associated with severe banking crises.<sup>3</sup>

<sup>3</sup>Beyond the banking sector, and consistent with the spirit of our model, the evidence shows that public defaults are often followed by domestic credit crunches. Arteta and Hale (2008) detect strong, systematic negative effects of government default on firm financing. Kohlscheen and O’Connell (2007) document that the volume of trade credit provided by commercial banks falls sharply when countries default. The median drops in trade credit are about 35 and 51 percent two and four years after default events, respectively. In a related vein, Mendoza and Yue (2008)

It is also widely documented that domestic banks in emerging economies hold large amounts of government bonds, so it is not surprising that government defaults severely hurt the solvency of the banking system. Kumhof and Tanner (2005) document that domestic financial firms held between 20% and 40% of their total assets in government bonds between 1998 and 2002. In the largest developing countries these bondholdings have been even higher, exceeding 50% of assets for financial firms in Mexico and Indonesia and reaching 50% of total domestic credit for Argentina's banking system in 2003 (IADB, 2006). By looking at the IFS data in a sample of 17 emerging economies we find that, consistent with Kumhof and Tanner (2005), banks and financial institutions have been holding a large proportion of their total assets as net claims toward their government, with the average position steadily increasing from 7% in 1993 to about 20% in 2001.

### 2.2.2 Modelling Assumptions

Two key assumptions allow our model to reproduce the two aforementioned features of public defaults in reality. First, and in line with recent sovereign risk models (Broner and Ventura 2007, Guembel and Sussman 2009) we assume that government policy is non-discriminatory, both with respect to debt repayment and taxation. Non-discrimination in debt repayment is justified by the fact that in recent years most sovereign borrowing is undertaken through decentralized bond markets and subject to active trading in secondary markets. As a result, the government often does not know the identity of specific bondholders.<sup>4</sup> Non-discrimination in taxation captures the government's inability to perfectly redistribute resources among its residents: Section 4.6 rationalizes this assumption in a simple extension of the basic model where each bank has superior information about its own monitoring ability/productivity. Non-discrimination implies that, as in reality, government default has a negative impact on the balance sheets of domestic banks whenever they hold government bonds. This feature would obviously not arise under full discrimination, as the government would either avoid defaulting on bonds held by domestic banks or it would be able to undo the effects of such a default by subsidizing these banks immediately thereafter. Thus, while the assumption of full non-discrimination is admittedly extreme, for our argument to hold it is only necessary that the government is unable to completely avoid the adverse distributional effects of

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and Arellano and Kocherlakota (2008) document a positive correlation between private domestic lending rates and sovereign spreads.

<sup>4</sup>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. In a large sample of recent sovereign defaults these authors also find that foreign and domestic creditors were treated similarly.

default on domestic banks.

Our second assumption is that while the government can always default on public debt at will, 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. That is, in our model institutions are such that imperfect contract enforcement and sovereign risk coexist with one another, consistent with the basic question we laid out in the introduction. The presence of imperfect contract enforcement is a key feature of our model, as it implies that any negative shocks to the balance sheets of banks will translate into a drop in investment and output. It is important to stress that this assumption departs from the traditional sovereign risk literature, which abstracts from domestic financial frictions either by focusing only on public debt (e.g. Eaton and Gersovitz 1981) or, most importantly, by assuming that the enforcement of private contracts is entirely dependent on a strategic decision by the government (e.g. Broner and Ventura 2007). Our assumption captures an intuitive pecking order where it is easier for governments to default on public debt rather than to disrupt legal institutions. This pecking order rationalizes observed debt crises precisely because it implies that government default triggers private defaults by weakening banks’ balance sheets, and not because the government directly intervenes in private contracts.<sup>5</sup>

We now formally analyze our model: first we solve for the equilibrium at  $t = 1$  and we then work our way backwards to  $t = 0$ .

## 2.3 Equilibrium in Private Financial Markets

### 2.3.1 Equilibrium at $t = 1$ and Modern Sector Investment

Before analyzing the government’s default decision, let us study how domestic funds are intermediated to modern sector investment at  $t = 1$  if the government invested at  $t = 0$ . After the modern sector productivity  $A_B$  is realized, a bank entering period  $t = 1$  with capital  $\omega_B$  chooses its own

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<sup>5</sup> Although the sovereign risk literature has shed important light on some determinants of public misbehavior by assuming that governments can costlessly intervene in private contracts, this ability is quite limited in most real-world public debt crises. For instance, during the 2002 default the Argentine government tried 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 shows that often the presence of institutional checks such as judicial independence curtails the government’s ability to interfere with private contracts. Of course, in particularly severe crises the government *could* be tempted to alter domestic institutions, rendering the pecking order between different violations of investors’ rights irrelevant.

level of investment  $i$  by solving:

$$\max_i A_B i - r_1 [i - \omega_B] \quad \text{subject to,} \quad (3)$$

$$[i - \omega_B] r_1 \leq \alpha A_B i, \quad (4)$$

where Equation (4) represents the bank's credit constraint. As long as  $A_B \geq r_1$ , the bank tries to attract as many deposits as possible to channel them toward investment. If  $r_1 \leq \alpha A_B$ , it demands an infinite amount of deposits, which cannot occur in equilibrium. If  $r_1 > \alpha A_B$  the bank's credit constraint is binding. Hence, aggregate investment in state  $A_B$  is given by,

$$I(\omega_B) = \beta \frac{r_1 \omega_B}{r_1 - \alpha A_B}. \quad (5)$$

Equation (5) illustrates that investor protection  $\alpha$  affects the ability of banks 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

$$\beta \frac{\alpha A_B}{r_1 - \alpha A_B} \omega_B. \quad (6)$$

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

$$(1 - \beta) \omega_S, \quad (7)$$

whenever  $r_1 > 1$  and lies in the interval  $[0, (1 - \beta) \omega_S]$  when  $r_1 = 1$ , where  $\omega_S$  denotes the wealth of a saver entering period  $t = 1$ .

There are two types of equilibria in the private lending market at  $t = 1$ . In the first equilibrium type, investment in the modern sector is constrained by the capital of the banking system. This case arises when Equation (6) evaluated at  $r_1 = 1$  is less than the expression in Equation (7) or – alternatively – when  $\alpha \leq \alpha^{\max}$ , where  $\alpha^{\max}$  is defined as

$$\alpha^{\max}(\beta) = \frac{(1 - \beta) \omega_S}{A_B [\beta \omega_B + (1 - \beta) \omega_S]}. \quad (8)$$

When  $\alpha < \alpha^{\max}(\beta)$  the social surplus generated by the modern sector is equal to:

$$\frac{A_B - 1}{1 - \alpha A_B} \beta \omega_B, \quad (9)$$

which is the product of total investment  $I(\omega_B)$  evaluated at  $r_1 = 1$  times the rent  $(A_B - 1)$  that banks earn per unit invested.

As investor protection becomes very strong, i.e.  $\alpha > \alpha^{\max}$ , banks are able to channel the totality of domestic resources towards the modern sector, so that investment is equal to aggregate domestic wealth at  $t = 1$  and social surplus is equal to:

$$(A_B - 1) [\beta \omega_B + (1 - \beta) \omega_S]. \quad (10)$$

Inspection of Equations (9) and (10) clearly shows that social surplus is positive only if  $A_B > 1$ , and it also allows us to establish the following preliminary 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  $\omega_B$  and in investor protection  $\alpha$ , ii) increases in the size of the banking sector  $\beta$ . If  $\alpha > \alpha^{\max}$ , modern sector surplus is constrained only by the total amount of resources in the economy, and it is independent of  $\alpha$ .*

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

We have so far taken the wealth of banks and savers,  $\omega_j$  for  $j \in \{S, B\}$ , as given, but the equilibrium value of  $\omega_j$  depends on the portfolio chosen by agents at  $t = 0$  as well as on the government's repayment decision. In the next sections we solve for the equilibrium and show how  $\omega_j$  is determined. Before doing so, we make the following assumption:

$$A1: p(A - 1)I(\omega_0 - 1 + \theta\Omega) > 1,$$

which restricts combinations  $(\alpha, \beta)$  to those for which, in the absence of public default risk, the development of the modern sector is socially profitable, so that the public investment is always undertaken.

### 2.3.2 Equilibrium at $t = 0$ and Banks' Bondholdings

Consider now the equilibrium of the  $t = 0$  financial market in which banks raise deposits from savers to buy public bonds. Since these bonds are traded in the international market, they must

pay an expected return equal to the international interest rate of 1. Hence, if the equilibrium return on deposits is  $r_0 = 1$ , savers are indifferent between holding bonds and deposits; if instead  $r_0 > 1$ , savers deposit all of their initial wealth  $(1 - \beta)\omega_0$  in banks.

Consider now a bank's demand for public bonds  $b_B$ . Such demand must satisfy:

$$[b_B - \omega_0] r_0 \leq \alpha [\Omega\theta + b_B], \quad (11)$$

as the repayment of the deposits  $[b_B - \omega_0]$  raised at  $t = 0$  must not exceed the amount of traditional sector output and bond return the bank is on average able to pay out. If banks demand the maximum amount of bonds allowed by Equation (11), banks' bondholdings are equal to:

$$b_B = \min \left\{ \frac{\omega_0 + \alpha\Omega\theta}{1 - \alpha}, \frac{\omega_0}{\beta} \right\}. \quad (12)$$

The first term in brackets captures bondholdings when deposits are constrained by (11), in which case  $r_0 = 1$  and savers on aggregate hold  $(\omega_0 - \beta b_B)$  public bonds.<sup>6</sup> Formally, this case arises if

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

When instead  $\alpha > \alpha_0(\beta)$ , banks absorb all of savers' initial wealth. In this case  $r_0 > 1$  and banks hold all domestic debt, that is  $\beta b_B = \omega_0$ , as shown by the second bracketed term in (12).

Equation (12) shows that higher investor protection  $\alpha$  also allows banks to buy more bonds by enabling them to attract more deposits. Clearly, this effect is only relevant if banks are willing to demand the maximum amount of bonds implied by (11). This turns out to be true in our model, as banks wish to hold – relative to savers – as many bonds as possible. To see why, first note that – as we will prove in the next section – government repayment occurs if and only if modern sector productivity is high (i.e.  $A_B > 1$ ), which implies that the actuarially fair contractual interest rate on public bonds must be  $r_g = 1/p$ . But then, by borrowing to buy one government bond one obtains a net income of  $(1/p - 1) > 0$  when  $A_B > 1$  and a net income of  $-1$  when  $A_B = 1$ . This implies that, while savers are just indifferent between holding or not holding public bonds, banks are eager to buy these assets because they allow them to transfer resources to the state where

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<sup>6</sup>See Section 7.1.1 in the Appendix for a more detailed derivation of domestic bondholdings. Throughout, we assume that whenever domestic residents 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.

$A_B = A > 1$ , in which they earn the investment rent  $A - r_1$ .

This idea is reminiscent of Holmstrom and Tirole's (1993) notion that government debt provides a form of liquidity expanding firms' ability to invest. In our model, government repayment in good times provides liquidity to banks when their investment is productive.<sup>7</sup> We view the presence of an internally consistent reason for why banks may want to hold public bonds as an appealing feature of our model. At the same time, though, we wish to stress that many other factors – including government regulation of banks – help explain domestic banks' demand for public bonds.<sup>8</sup> Although these alternative reasons are crucial to explain why banks hold so many bonds in the real world, to keep the analysis parsimonious we do not formalize them all in our model. We just note that for our results to go through we only need that domestic banks hold a sufficiently large share of government bonds, and that there are productive investment opportunities at  $t = 1$ .<sup>9</sup>

### 3 Equilibrium under Strategic Enforcement

After the productivity of the modern sector is realized at  $t = 1$ , the government chooses what share  $\rho \in [0, 1]$  of its debt to repay. To see the government's incentives, note that in our setup default affects the domestic distribution of wealth at  $t = 1$ . Let  $b_j$  denote the bondholdings of a domestic resident of type  $j$  and  $b$  the debt issued at  $t = 0$  by the government. Then, the wealth of a type  $j$  agent at  $t = 1$  is equal to,

$$\omega_j(\rho) = \Omega_j\theta + r_g\rho[b_j - b] + \tilde{r}_0d_{0j}, \quad (14)$$

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  $t = 0$ . Note also that

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<sup>7</sup>The parallelism between our model and that of Holmstrom and Tirole (1993) would be even greater if banks had private information about their individual productivity of investment in the modern sector. An extension of our model along these lines is sketched in Section 4.6.

<sup>8</sup>Banks' holdings could also be rationalized by noting that highly liquid government bonds may represent 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). Basu (2009) shows that it might indeed be optimal for the government to load domestic agents with public bonds so as to commit to repay. Also, in many developing countries, the mere absence of investment opportunities is used to explain the large bondholdings of banks. Even this is consistent with our model, as long as there are investment opportunities at  $t = 1$ . In the absence of such investment opportunities, any impact of a government default on the balance sheets of domestic banks would be inconsequential.

<sup>9</sup>Another interesting property of our model is that, regardless of the reason for which banks want to hold public bonds, their bondholdings are increasing in  $\alpha$ . In our sample of 17 emerging economies from the IFS (IMF) we find that the correlation between banks' net claims toward their government as a proportion of total assets and a measure of creditor rights is negative, small and not significant. The IFS measure of banks' net claims on the government is, however, a rather crude and imperfect measure of their holdings of government *bonds*.

we use  $\tilde{r}_0$  to denote the interest rate on  $t = 0$  deposits realized ex post [where, in equilibrium,  $E(\tilde{r}_0) = r_0 \geq 1$ ]: this return is stochastic because, by affecting banks' wealth, the government's repayment decision affects depositors' ex-post return. This is how public default indirectly hurts private returns in our model.

Equation (14) shows that an individual's bondholdings  $b_j$  affect the impact of government repayment  $\rho$  on his wealth at  $t = 1$ . If  $b_j \geq b$ , a higher value of  $\rho$  increases the wealth of an agent of type  $j$ . Intuitively, when  $b_j \geq b$  the proportion of bonds held by  $j$  is larger than his share of the taxes used to service government debt, implying that for this agent the benefit of government repayment is larger than the cost. The opposite is true when  $b_j < b$ .

Having this in mind, note that the government chooses  $\rho$  at  $t = 1$  to maximize social welfare as given by

$$[\beta \omega_B(\rho) + (1 - \beta) \omega_S(\rho)] + (A_B - 1) I[\omega_B(\rho)], \quad (15)$$

which is simply the sum of total domestic resources (the first term in square brackets) plus the surplus generated by investment in the modern sector. The trade-off 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, increasing the first term of Equation (15). On the other hand, if banks hold a sufficiently large amount of government bonds, default hurts the capital of the banking system, reducing modern-sector investment and lowering the second term of Equation (15). By redistributing resources away from the financial sector, default may ultimately reduce investment and output.

Of course, for this redistribution to be costly it must be that investment is productive. As a result, repayment never occurs in the low productivity state when  $A_B = 1$ . Thus, 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  $r_g = 1/p$ .<sup>10</sup>

### 3.1 Default, Sustainable Debt and Financial Institutions

Suppose now that  $A_B = A > 1$ . Focus first on the case where  $\alpha \leq \alpha^{\max}(\beta)$ , so that  $r_1 = 1$  and investment is constrained by the capital of the banking sector. Public debt here is sustainable

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<sup>10</sup>In order for lump-sum taxation to be feasible, we assume throughout that

$$\omega_0 + \theta > \frac{1}{p}.$$

whenever  $\rho = 1$  maximizes social welfare. By using the definitions of  $\omega_B(\rho)$  obtained by combining Equations (14) and (12) we obtain that the debt level  $b = 1$  is indeed sustainable at  $r_1 = 1$  whenever:

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

where  $\omega_0 - 1 < 0$  captures the fall in total domestic resources caused by repayment while  $\min(\cdot, \cdot)$  captures the positive impact of repayment on banks' before-tax revenues.<sup>11</sup> Equation (16) shows that a necessary condition for debt sustainability is that  $\min(\cdot, \cdot) > 1$ , which basically requires the bondholdings of banks to be high enough as to make the capital of the banking system increasing in the repayment of public debt. Crucially, as long as this is the case, incentives to repay are increasing in financial development  $\alpha$ . There are two reasons for this.

First, for a given amount of bank's bondholdings, a higher level of  $\alpha$  enables banks to increase their leverage to expand modern-sector investment: the higher  $\alpha$ , the more severe is the balance sheet effect and thus the fall in investment induced by a sovereign default. This effect is captured by the multiplier  $1/(1 - \alpha A)$  in front of the second bracketed term above. Second, higher  $\alpha$  enhances debt sustainability by increasing banks' ability to raise deposits and thus buy government bonds at  $t = 0$ : this increases bank exposure to a public default, providing further incentives for repayment. Due to both effects, Equation (16) says that public debt is only sustainable if investor protection  $\alpha$  is above a minimum value  $\alpha^{\min}(\beta)$ . The shaded area in the following figure depicts the combinations  $(\alpha, \beta)$  for which  $\alpha > \alpha^{\min}(\beta)$ :

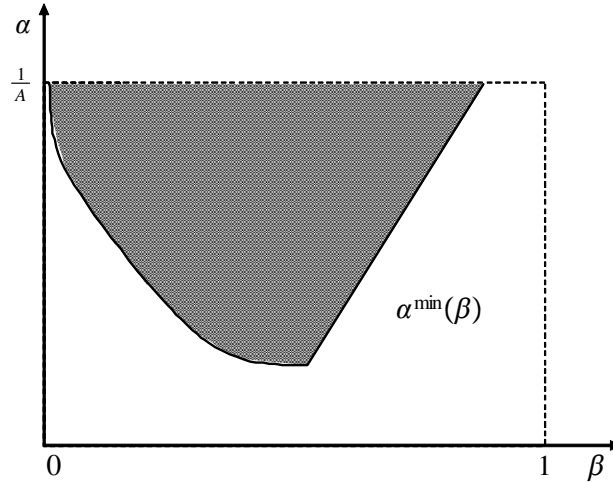


Figure 2

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<sup>11</sup>The theoretical appendix contains a thorough derivation of all the proof and equations in the text as well as a statement of the conditions under which our results obtain.

As the previous figure shows,  $\alpha^{\min}(\beta)$  is non-monotonic in the share of bankers  $\beta$  in the population. To see the intuition for this, note that if  $\beta \approx 0$ , incentives for repayment are only provided if the few existing 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  $\alpha$ . As  $\beta$  goes up, each of these new banks will hold a more than proportionate share of bonds and finance a commensurate modern sector investment, implying that now the minimum level of  $\alpha$  at which the government can repay is smaller. This effect remains at work as long as increases in  $\beta$  lead to an expansion in total bondholdings by the banking system. Yet, once banks are sufficiently numerous so as to absorb all domestic bonds  $\omega_0$ , further increases in  $\beta$  decrease the banking sector's exposure to a public default. At this stage, sustainability requires greater bank leverage, and thus a greater value of  $\alpha$ , at  $t = 1$ . When  $\beta \geq \omega_0$  domestic debt is dispersed among so many banks that public default improves their balance sheets, making public debt unsustainable at any level of  $\alpha$ . Public debt sustainability requires bank intermediation to be sizeable: if banks are either too few or too many, this can only happen when they are highly leveraged.

Consider now the other relevant case where modern sector investment is not constrained by banks' capital and absorbs total domestic resources. This is possible as long as  $\alpha > \alpha^{\max}(\beta)$ , where the latter is defined as in Equation (8). Now the government's first order condition reduces to

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

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 and so the optimal level of government debt  $b = 1$  is not sustainable. The intuition is that even if default destroys banks' capital, it also increases total domestic resources by the amount  $(1 - \omega_0)$ . But then, since a very efficient financial system is able to channel all of those resources to the modern sector, default is beneficial, at least at the margin, as evident in Equation (17). This effect hinges on the fact that at  $t = 0$  and at  $t = 1$  domestic resources are limited and so, in a sense, the need of a banking sector with strong balance sheets is limited as well.

The following figure summarizes our discussion by shading the combinations  $(\alpha, \beta)$  for which the optimal level of debt is sustainable:

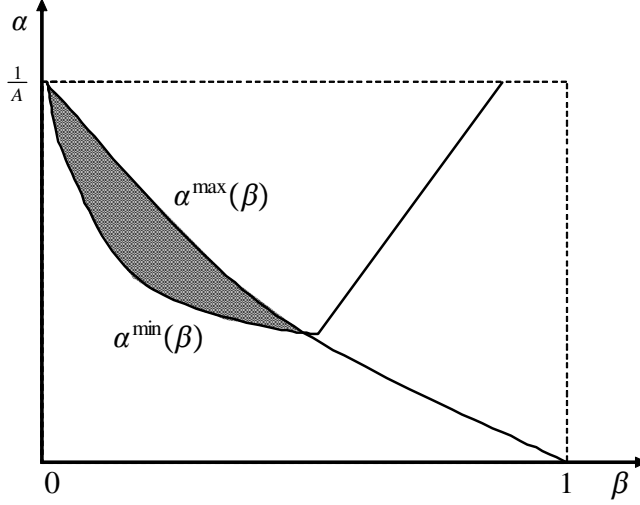


Figure 3

The Proposition below states the conditions for debt sustainability in the closed economy:

**Proposition 1** *In the closed economy, the government can finance the public project if and only if  $(\alpha, \beta)$  is such that  $\alpha \in [\alpha^{\min}(\beta), \alpha^{\max}(\beta)]$ . 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  $(\alpha, \beta)$  fulfilling the previous condition is non empty if  $p > p^*$ , where  $p^*$  is a given threshold.*

**Proof.** See Appendix. ■

A sufficient condition for debt sustainability to be possible for some parameterizations of the economy is thus that  $p$  exceeds some critical value  $p^*$ . As previously seen, debt sustainability requires banks to be unable to channel all domestic resources towards modern sector investment. This is more likely to be the case if  $p$  is high, which reduces the risk premium on government bonds, limiting banks' profits in the event of government repayment. In this case, it is more likely for investment to be limited by the capital of the banking system, which provides incentives for government repayment.

### 3.2 Discussion

Our model so far shows that an economy's ability to sustain public debt can be strongly affected by the development of its financial system. This relationship comes about because, in equilibrium, the banking sector holds public debt, thus being exposed to a default. In turn, the quality of financial institutions affects the damages caused by default to investment and output in two conflicting ways.

On the one hand, higher  $\alpha$  strengthens the balance sheet effect of default on domestic banks and its adverse consequences on investment. In line with this effect, the aforementioned report by the IMF (2002) notes that the Russian default “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”. On the other hand, if financial institutions are extremely good the banking sector becomes resilient to the disruptions caused by government default. That is, at very high levels of  $\alpha$  default still reduces banks’ wealth and profits but it does not affect investment. Interestingly, the IMF report itself hints at this possibility by stressing that the disruption generated by default could be much smaller in very developed financial systems where firms have alternative, non-bank sources of borrowing.<sup>12</sup>

According to the first effect above, higher  $\alpha$  increases the cost of default and thus reduces public default risk, capturing the idea that, by playing a valuable allocative role, better markets reduce the government’s temptation to interfere with them through default. According to the second effect instead, higher  $\alpha$  reduces the cost of default and increases public default risk, capturing the idea that, by being more resilient, better markets increase the temptation to default.<sup>13</sup>

The empirical relevance of this second effect is not clear, as financial frictions appear to constrain investment not only in developing, but also in developed countries (e.g. Bernanke et al. 1996), implying that cases of  $\alpha > \alpha^{\max}(\beta)$  are unlikely to be observed.<sup>14</sup> The existing evidence is indeed consistent with a predominance of the first effect. Reinhart, Rogoff, and Savastano (2003), study the default histories of a wide sample of countries and stress that debt sustainability is positively correlated with the strength of the domestic financial system. Kraay and Nehru (2004) find that

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<sup>12</sup> Another effect going in the same direction is that, as  $\alpha$  becomes arbitrarily high, it might be possible for private contracts to replicate the payoff structure of public bonds. Thus, increases in  $\alpha$  could also reduce the cost of default by reducing banks’ need of public bonds (Brutti (2008) explicitly models this effect). We do not formally study this effect because it goes in the same direction of the one we already consider in our model, but it is useful to bear it in mind when interpreting the empirical evidence.

<sup>13</sup> Although the non-monotonicity of debt sustainability in  $\alpha$  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.

<sup>14</sup> 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. This effect however shows that there may be – at least in theory – a limit to the ability of better financial institutions to curb public default risk. Beyond this limit, public debt sustainability requires either an increase in the share of debt held by domestics or the presence of alternative mechanisms disciplining the government.

the extent of a country's rule of law is negatively associated with its probability of default. Focusing more directly on our mechanism, Section 5 presents econometric evidence that the drop in private credit during public defaults is more severe in countries characterized by stronger creditor rights, consistent with a predominance of the first effect above.

In light of this evidence, the next section illustrates an important reason for why in reality we should expect the positive effect of financial institutions on public debt sustainability to dominate: the presence of private capital flows. This analysis will deliver our main result of complementarity between capital flows to the private and public sector.

## 4 Private Capital Flows and Public Borrowing

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 effects of private capital flows are 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 all dates ( $r_0^* = r_1^* = 1$ ), opening up to private flows relaxes the domestic resource constraint, both at  $t = 0$  and at  $t = 1$ . With respect to the resource constraint at  $t = 1$ , private inflows enable domestic banks to take deposits from the international financial markets, so that modern sector investment only depends on the capital of banks and on the quality of domestic financial institutions, not on the availability of domestic resources. Formally, this relaxes constraint  $\alpha^{\max}(\beta)$ , so that modern sector investment is always monotonically increasing in  $\alpha$  because, regardless of domestic savings, banks take deposits from foreigners and expand their investment until their credit constraint binds.

Crucially, opening up to private flows also relaxes the resource constraint at  $t = 0$ , allowing both bankers and savers to expand their holdings of government bonds by borrowing abroad. This effect operates through the government's incentive constraint  $\alpha^{\min}(\beta)$ , which moves down with the proportion of public debt that is domestically held. In sum, with private capital flows the condition

for debt sustainability is characterized by the following version of Equation (16):

$$[\omega_0 + \alpha\bar{\Omega}\theta - 1] + \frac{A-1}{1-\alpha A}\beta[\omega_0 + \alpha\Omega\theta - 1] \geq 0. \quad (18)$$

The second term in brackets shows that now banks 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 exceed initial domestic wealth  $\omega_0$  by an amount of  $\alpha\bar{\Omega}\theta$ , which also reflects the ability of savers to borrow from foreigners and purchase government bonds. Note that, whenever  $\alpha$  is so large that  $\alpha\bar{\Omega}\theta \geq 1 - \omega_0$ , all government debt can be held by domestic residents, ensuring full sustainability.

Equation (18) shows that in our model one channel through which private inflows can increase sustainability is to allow the domestic banks and savers to hold more public debt, the more so the higher is  $\alpha$ . This result rationalizes Jeanne and Guscina's (2006) finding that the extent of a country's ability to sustain domestic public debt is positively correlated with domestic financial development, a fact also confirmed by Reinhart, Rogoff, and Savastano (2003).<sup>15</sup> In addition, Equation (18) 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  $(\alpha, \beta)$  such that  $\alpha \geq \alpha_{open}^{\min}(\beta)$ .*

**Proof.** See Appendix. ■

Private capital inflows are thus weakly beneficial because they expand: (i) modern sector investment at  $t = 1$ , and (ii) domestic holdings of government bonds at  $t = 0$ . Effect (i) implies that government default always translates into a drop in investment, whereas (ii) implies that financial liberalization increases the damage caused by default on banks' balance sheet, making the drop in investment more severe. Both effects increase the cost of government default, enhancing debt sustainability. The darker area below graphically illustrates the impact of private inflows on debt sustainability:

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<sup>15</sup>The reader may wonder if opening up the capital account may reduce sustainability by allowing domestics to invest in foreign rather than public bonds. Riskless foreign bonds are especially appealing if, for instance, agents are risk averse. We thoroughly discuss the role of risk aversion in Section 4.6. Here, though, we note that our government is always allowed to sell bonds to foreigners (even if there are no private flows). Hence, public bonds must be at least as appealing as foreign bonds for foreign and, thus, also for domestic investors under risk neutrality. In this sense, opening up the capital account does not *directly* reduce the domestic demand for government bonds in our model. Obviously, this does not imply that opening up the capital account cannot undermine the demand for government bonds in our model but that, as we shall see in the next section, it can do so only *indirectly* via private capital outflows.

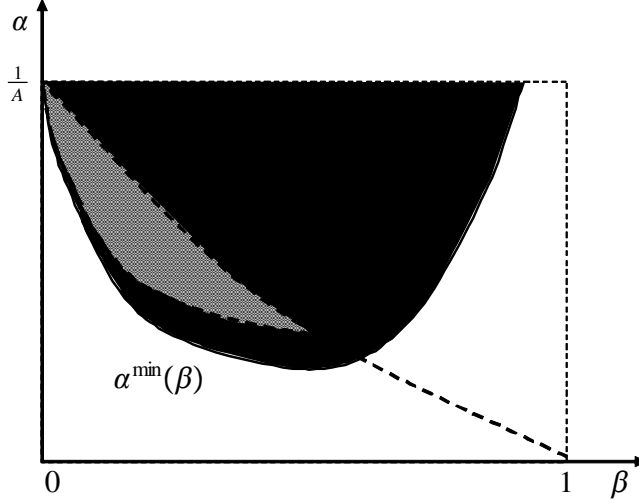


Figure 4

Since the mapping  $\alpha^{\max}(\beta)$  disappears and the mapping  $\alpha^{\min}(\beta)$  shifts down, countries with relatively high as well as relatively low levels of institutional development can now finance the public project. The benefit of private capital inflows varies across economies, consisting only in expanded domestic bondholdings in countries with low  $\alpha$ , but also in greater modern sector investment in countries with high  $\alpha$ . More generally, a private inflow helps sustain public borrowing, as reflected by the fact that now public debt can be sustained at lower levels of  $\alpha$  than in the closed economy.<sup>16</sup>

## 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  $t = 0$ , i.e.  $r_0^* = 1$ , but  $r_1^* \in (1, A)$  at  $t = 1$ .<sup>17</sup> Thus, the cost of capital for the government is still 1 and only the interest rate at which the modern sector borrows at  $t = 1$  goes up. As in the

<sup>16</sup>It is important to stress that our key result is that private inflows allow sustainability for (weakly) lower levels of  $\alpha$ , not that they render the relationship between  $\alpha$  and sustainability monotonic. Indeed, in slightly different settings non-monotonicity can naturally extend to the open economy case as well. For instance, if the modern sector technology features decreasing returns, public debt sustainability falls after  $\alpha$  is sufficiently high that the first best investment level can be financed. Once again, though, for sufficiently high levels of  $\alpha$ , the sustainability of public debt is always assured in our economy once private capital flows are allowed: in particular, this is true once the domestic private sector can purchase the totality of public debt at  $t = 0$ .

<sup>17</sup>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 – as previously discussed – the government sells bonds to domestic residents and to foreigners in a unified market. As a result, the domestic interest rate  $r_0$  can be no lower than the international interest rate  $r_0^*$ , even if private sector agents cannot directly borrow from and lend to foreigners. Of course, it might be that  $r_0^*$  is so high that it prevents the government from being able (or willing) to repay its debt ex post, but we abstract from this case because we do not find it interesting.

previous analysis, in the open economy constraint  $\alpha^{\max}(\beta)$  is relaxed, but now the government's incentive to default in Equation (16) becomes equal to:

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

the key difference with (18) is that, to the extent that the autarky interest rate  $r_1$  is lower than  $r_1^*$ , private capital outflows at  $t = 1$  reduces the extent to which banks are able to leverage their capital decreasing the cost of a government default. Note that, since  $r_0^*$ , at  $t = 0$  there is still a private inflow enabling domestic residents to increase their holdings of public bonds: this is reflected by the inclusion of  $\alpha\bar{\Omega}\theta$  in the first term of Equation (19). The presence of a private capital outflow at  $t = 1$ , however, implies that now opening up can increase public default risk. In particular, in the Appendix we prove:

**Proposition 3** *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  $\alpha$  satisfying Equation (19).

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 is  $r_1 = 1$ , private outflows reduce debt sustainability provided the international interest rate  $r_1^*$  is sufficiently high. This result is graphically represented below:

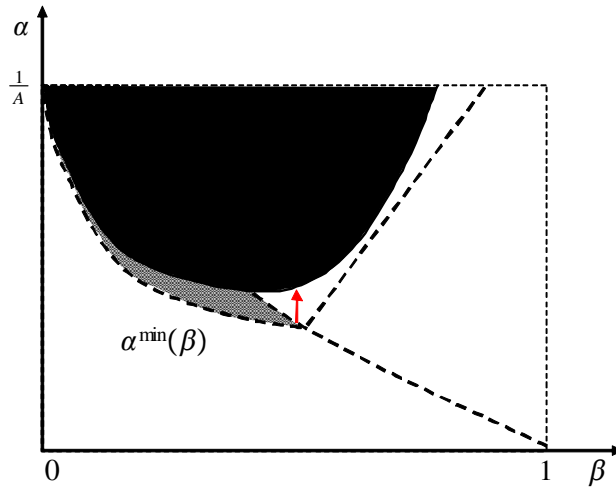


Figure 5

In contrast to the previous section, opening up to private flows increases the minimum level of institutional quality  $\alpha_{open}^{\min}(\beta)$  at which the public project can be financed. The intuition is that now the private capital outflow at  $t = 1$  lowers the cost of default, thereby reducing the sustainability of government debt relative to the closed economy case. This intuition suggests that, whenever it can credibly do so, the government of a capital-exporting economy would benefit from imposing controls to prevent the outflow of capital: beyond having a direct beneficial effect whenever the return to domestic investment is higher than the international interest rate ( $A_B > r_1^*$ ), such controls would have an additional indirect effect in enhancing the sustainability of public debt.

### 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 can do the reverse, relative to a financially closed economy. This result differs from traditional international finance models, in which capital flows to the public and private sectors are mere substitutes. In models with full commitment and complete markets, substitutability stems from Ricardian equivalence. In models of sovereign risk, the government decides whether to enforce all of the country's external debt, so that substitutability arises because the government's decision depends on the total amount of payments, not on their private or public nature.

In our model instead, private borrowing facilitates (and in this sense complements) public borrowing, so that the composition of capital flows becomes a critical dimension. This complementarity is due to the fact that government default spreads to private financial markets, generating costly dislocations. Crucially, this implies that – by determining the direction of private capital flows – domestic market institutions shape government default risk: 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 reduce the size of domestic banks, lowering the cost of default.

We now show how this perspective can yield novel insights on financial liberalization and on the ability of emerging market governments to bailout a financially distressed banking sector.

### 4.4 Complementarity and Financial Liberalization

We first highlight the role of financial reform and then discuss centralization of external borrowing by the government.

#### 4.4.1 Financial Reform

The initial motivating question of the paper was whether financial reforms or broader market reforms can help a country reap the benefits of financial integration in a world where private sector investments are not only directly subject to private default risk but also indirectly subject to public default risk. Our analysis suggests that the answer may be yes. As such, our model provides a conceptual tool to interpret some of the evidence on the effects of financial liberalization.

It is well known that the financial liberalizations of the nineties have not been uniformly beneficial for all countries (Eichengreen 2004). Formal econometric analyses (Kose et al. 2006) confirm this idea, further suggesting the presence of “threshold effects” whereby financial liberalization has benefited only countries with sufficiently good institutions. Figure 5 in Section 4.2, in particular, offers a useful perspective on these threshold effects. In autarky, economies close to the  $\alpha_{open}^{\min}(\beta)$  locus are able to finance the public project, develop a modern sector and minimize public default risk. After these economies open up, however, they would either witness a systematic capital outflow or be very vulnerable to sudden increase in world interest rates. The resulting capital outflows, besides directly reducing domestic investment would also induce a public default, hurting domestic banks and greatly amplifying domestic dislocations. These effects may cause financial liberalization to be welfare decreasing. By contrast, economies whose institutional quality is well above  $\alpha_{open}^{\min}(\beta)$  benefit from financial liberalization because at high levels of  $\alpha$  the capital outflows following an increase in world interest rates are less pronounced, so that public default risk and underinvestment are not major concerns.<sup>18</sup>

Thus, consistent with the evidence, our model suggests that financial liberalization may fail if it is not preceded by reforms aimed at strengthening domestic markets, the so-called “second generation” reforms. This timing may have amplified the domestic effects of reversals in international market conditions through public default risk.<sup>19</sup>

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<sup>18</sup>Our model also implies that countries with very poor institutions are likely to benefit from financial liberalization, because in those economies modern sector investment is very small and liberalization at least allows savers to invest their resources at a higher return. In this sense, our model predicts that financial liberalization is potentially most costly at intermediate levels of institutional development. Note that the ideas of this section are related to Caballero and Krishnamurthy (2003), who show that the negative effects of binding external borrowing constraints are particularly harmful when they interact with domestic financial frictions. In our model, though, the economy’s external constraint is itself endogenous and its tightness depends on the severity of domestic financial frictions.

<sup>19</sup>Of course, these considerations abstract from political economy constraints. In the presence of those constraints it might actually be optimal to first liberalize because only by doing so a political coalition favourable to market reform can be built. See Caselli and Gennaioli (2008) for an argument along those lines.

#### 4.4.2 Centralized Borrowing

Another important aspect in the design of financial liberalization is the extent to which should the government oversee capital flows, typically via instruments such as direct capital controls or government ownership of banks. The literature on sovereign risk sees these various forms of centralization of borrowing as welfare enhancing. The usual reason is that atomistic private agents do not internalize how their individual borrowing decisions affect the government's incentive to enforce payments, causing overborrowing.<sup>20</sup>

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

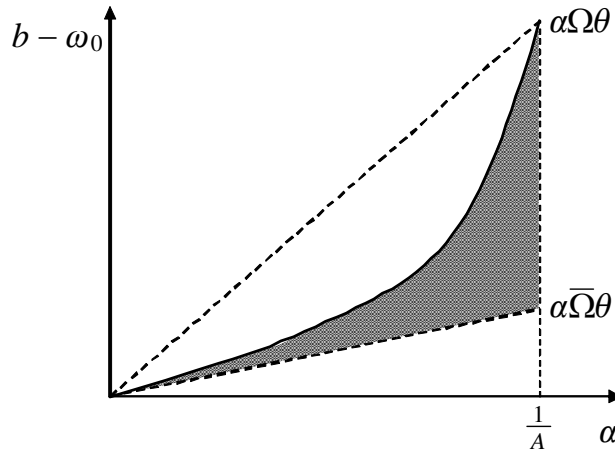


Figure 6

The continuous line above represents sustainable government borrowing in excess of initial endowment  $\omega_0$ . As for the two dotted lines, the top one represents pledgeable resources of individual banks, the bottom one represents the per-capita pledgeable resources of the whole economy. In a world in which only the private sector can access foreign funds, the economy as a whole can only borrow up to the value of its collateral  $\alpha\bar{\Omega}$ . But the same is also likely to be true even

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<sup>20</sup>By allowing to control private transactions, government oversight is welfare enhancing because – being a large agent – the government internalizes the aggregate effects of its borrowing decisions. For a basic exposition of the overborrowing argument, see Eaton and Fernandez (1995). For more recent settings where overborrowing may arise, see Jeske (2006), Wright (2006), and Broner and Ventura (2008). It is often argued that the costs of centralized borrowing are political and reflect the agency problems between the government and various constituencies (e.g. La Porta et al. 2002). In this respect, our analysis suggests that the creation of private financial markets reduces the agency problem between the government and foreign investors, in turn allowing the former to borrow more. An open and interesting question concerns the role of private financial markets in reducing the agency problems between the government and certain domestic groups. An example of such a case is the presence of secondary markets in the presence of sovereign risk (Broner et al., 2008).

if the government centralizes all of the foreign borrowing, because foreigners can at most collect the aggregate endowment  $\alpha\theta\bar{\Omega}$ . This can be clearly seen if centralization takes the form of public ownership of banks because in this case, by easily subsidizing (or avoid defaulting on) state owned banks, the government can avoid the cost of default. The shaded area in the figure thus represents what the government can borrow in excess of  $\alpha\theta\bar{\Omega}$  when foreign borrowing is decentralized. Now sustainability improves because a public default inevitably hurts the private financial sector, enhancing the incentive to repay.<sup>21</sup> This idea can shed light on recent efforts at fostering direct private sector access to foreign funds (IADB 2006, Borenzstein et al. 2008).

#### 4.5 Complementarity and Bank Bailouts

Another domain where private and public financial markets are connected is when the government bails out financially distressed banks. According to the substitutability view, there is a very natural role for the government to do so, especially so if the shock hurts banks but not the country as a whole. Bailouts do not seem so easy under complementarity: as long as a private market collapse reduces the government's ability to repay, a banking crisis might itself hamper the government's ability to bailout domestic banks by issuing debt.

To see this more concretely, suppose that at  $t = 1$ , there is an unexpected shock to the balance sheet of banks, which manifests itself in a lower realized return on traditional-sector projects run by the banking sector equal to  $\theta/\Omega < 1$ . By reducing the value of banks' balance sheets, this shock reduces their ability to invest. Consider now the possibility of a public bailout. Consistently with our assumption of non-discrimination, consider a policy in which – after traditional sector returns are realized but before asset payments are made – the government offers to buy the traditional sector project from any of its residents in exchange for an amount  $b_1$  of government bonds. Realistically, the government must finance the scheme by issuing debt because it has no resources at that time. These bonds are eventually financed through taxation, while the assets purchased through this policy are distributed in a lump-sum fashion among domestic residents. There are two interesting aspects of such an “asset purchase scheme”.

In order for this scheme to be worthwhile at all, it must effectively transfer resources to banks.

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<sup>21</sup>Once again, as previously discussed in the context of liberalization, private access to foreign financing is only beneficial if the country is a capital importer. Otherwise, it is optimal for the government to impose controls on capital outflows that can be viewed as a way to centralize foreign lending. Even in this case though, it is essential for the country to have a working private financial sector because it is the very presence of such sector that allows the government to sustain public debt. In this sense, our model stresses the benefits associated with the existence of a private financial sector over and above such sector's ability to directly attract foreign funds.

And this can only happen if the government overpays for the projects of the banking system, so that  $b_1 > \theta / (r_g \Omega)$ . Redistribution to banks is maximized by setting  $b_1 = \theta / r_g$ . If  $b_1 > \theta / r_g$  also savers – whose traditional-sector project was not hit by the shock – sell their projects to the government. At  $b_1 = \theta / r_g$  only banks sell their project and their individual assets increase by

$$\theta \left(1 - \frac{1}{\Omega}\right) (1 - \alpha),$$

where we have taken into account that a fraction  $\alpha$  of the transfer to banks will be used to pay depositors. As for their individual tax liabilities, they will increase by

$$\theta \left(1 - \frac{1}{\Omega}\right) \beta,$$

as a consequence of the asset-purchase scheme. Consequently, this type of intervention by the government will expand the capital of banks and investment as long as

$$1 - \alpha - \beta > 0. \tag{20}$$

Besides  $\alpha$ , Equation (20) reflects the importance of  $\beta$  for the feasibility of the policy. Indeed, the measure of banks directly influences the policy's cost in terms of higher total taxes. It therefore tells us that a necessary condition for the asset-purchase scheme to be effective is that banks are neither too many nor too leveraged.<sup>22</sup>

Even if Equation (20) holds and the transfer is effective in improving the balance sheet of banks, though, we must still verify that the asset purchase scheme is sustainable. For this, the government must have incentives to repay its outstanding debt, which is only the case if:

$$[(\omega_0 + \alpha\Omega\theta - 1) - p\beta\theta\alpha] + \frac{A - 1}{1 - \alpha A} \beta [(\omega_0 + \alpha\Omega\theta - 1) + p\theta(1 - \alpha - \beta)] \geq 0. \tag{21}$$

The previous condition gives rise to a number of observations. In the first place, Equation (20) clearly illustrates the conflicting effects of a bailout on government incentives: even if it improves

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<sup>22</sup>Crucially, note that such a scheme could never be used to subsidize banks in the absence of a shock to the balance sheets of the banking system. If the traditional-sector projects of the banking sector yield  $\Omega\theta$  as expected, any purchase of these assets by the government will necessarily entail a redistribution of resources from the banking sector to the savers in the economy. As a result, although in our model the government would in principle transfer liquidity to banks if it was able to do so, the non-discriminatory asset purchase scheme we have just considered is only used during a banking crisis.

the balance sheet of banks, an asset-purchase scheme increases the payments made by the private sector to foreign creditors. This last aspect is captured by the negative term inside the first bracketed term. A second interesting point is that, given that the asset-purchase scheme improves the balance sheet of banks, its sustainability is increasing in  $\alpha$ . The intuitive reason for this is that the government's ability to credibly sustain the banking system with government debt depends on how good the said system is: a high level of  $\alpha$  increases the impact of a government default on investment, thereby allowing it to issue new debt that is effectively used to back the scheme. As a result, our model indicates that the ability for the government to bailout domestic banks increases with the quality of financial institutions, again in the spirit of complementarity.

## 4.6 Possible Extensions

Since our main results have been derived in a stylized setting, it is natural to explore some extensions and alternative specifications. Here we discuss how our results are affected by relaxing some of our assumptions.

1. We have assumed that the taxation policy is fully non-discriminatory. If, on the other extreme, the government can costlessly discriminate, it would always choose to default, as any negative effects to the capital of banks could simply be undone by taxing savers 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, and such ability is private information. To see this, assume that each banker has an idiosyncratic 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  $E(A_i) = A$ .<sup>23</sup> In such a model, high-productivity bankers have a higher demand for government bonds so that in the closed economy, when  $\alpha > (1 - \beta)\omega_0/\beta\Omega\theta$  and total bondholdings by banks are equal to  $\omega_0$ , public bonds will tend to be in the hands of the most productive banks. Thus, the capital of the most productive banks will suffer disproportionately from default. Since the government cannot distinguish between these

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<sup>23</sup>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.

banks and the less productive ones, the only way to avoid a fall in social surplus would be to make a large transfer to the banking sector as a whole. But then, the government may have an incentive to repay in the first place, to avoid misallocating investment across banks with different productivities, and especially so if there are limits to its ability to tax.

2. We assumed for simplicity that the public investment enhances the productivity of the modern sector. All of our results hold true 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, bankers' demand for public bonds only depend on the latter's return being correlated with the productivity of domestic investment, and not on the economic role of the public investment.
3. Consider now our assumptions regarding domestic bondholdings. In our baseline model, bankers are indifferent between expanding their bondholdings by pledging the future proceeds of public debt and not doing so. Savers, on the other hand, are outright indifferent between holding government bonds or other assets. In both cases, we have assumed throughout that domestic residents hold as many bonds as they can purchase, thereby identifying the weakest conditions for public debt to be sustainable. In the case of savers, though, this assumption is somewhat fragile, since their bondholdings – both direct and indirect, through the banking system – are clearly 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.
4. Finally, we could relax the assumption that the modern sector project is only available at  $t = 1$  by allowing banks to access a productive investment opportunity at  $t = 0$  as well. For our story to hold, we only need that this investment opportunity does not entirely crowd out banks' investment in government bonds at  $t = 0$ . One setting in which such crowding out would naturally not arise is if the technology features decreasing returns to scale, so that banks find it profitable to carry their wealth forward by using government bonds so as to invest it at  $t = 1$ . Another possibility is to assume that banks also face some agency problems vis a vis entrepreneurs and so the amount they can profitably invest in productive project is limited by entrepreneurial wealth. Under these assumptions the analysis would be

substantially more cumbersome but our key results would go through. We thus present a more streamlined version of the model to illustrate more starkly its basic intuition.

## 5 Empirical Implications

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. It is thus of interest to inquire whether traces of complementarity can be detected in the data. One way to do so would be to look at the link between private capital flows and public debt in a sample of emerging economies, and at how such link depends on a country's financial institutions. Unfortunately, this strategy faces serious data problems because measures of total public debt are very limited. For our purposes the usual measures of external public debt are not sufficient as domestic debt holdings are a crucial ingredient of our story. There have been recent efforts (Reinhart et al. 2003, Cowan et al. 2006, Jeanne and Guscina 2006) at constructing comparable domestic debt figures for emerging economies, but this information is still limited to very few countries and periods.

Luckily, though, our notion of complementarity has also implications for the ex post link between defaults, private capital flows and financial institutions which are much easier to test than the ex ante ones. We now give a first look at these ex post links but along the way we also discuss how they square with the ex ante patterns on total public debt documented by existing studies. It is well known that the last fifteen years or so have witnessed a steady increase in private capital flows to emerging economies (Kose et al. 2006, Lane and Milesi-Ferretti 2007). For our immediate purposes it is of secondary interest whether this pattern is due to increasing financial liberalizations (Henry 2000) or other, more economic, factors. The solid red line below, which plots the evolution of privately held external debt over GDP<sup>24</sup> for a representative sample of 56 emerging countries from the World Bank, clearly illustrates this pattern:

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<sup>24</sup>Private debt 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. The formal definition of this variable as well as those of the other variables we use, together with their sources, are thoroughly described in the Appendix. 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 and the share of these flows accounted for by private debt remains sizeable.

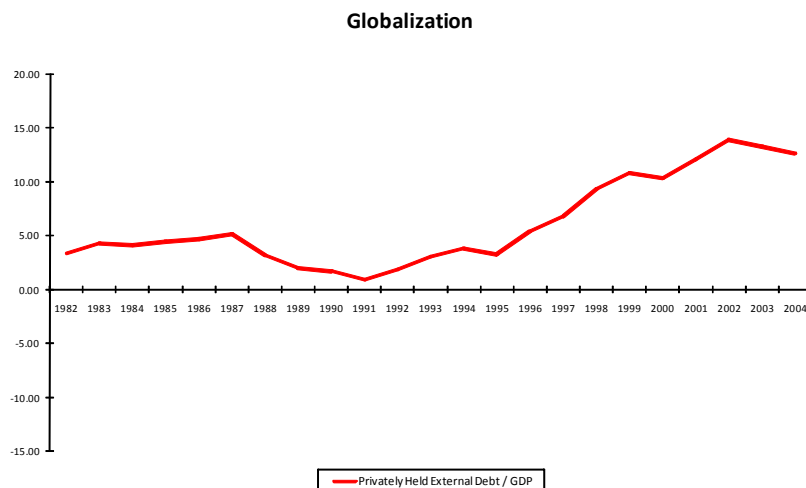


Figure 7

One interesting question then is whether these increasing private inflows have improved or deteriorated public debt sustainability. One way to check for this is to look at the frequency of government defaults in the period. The dashed yellow line below plots the number of sovereign defaults from Standard & Poor's<sup>25</sup>:

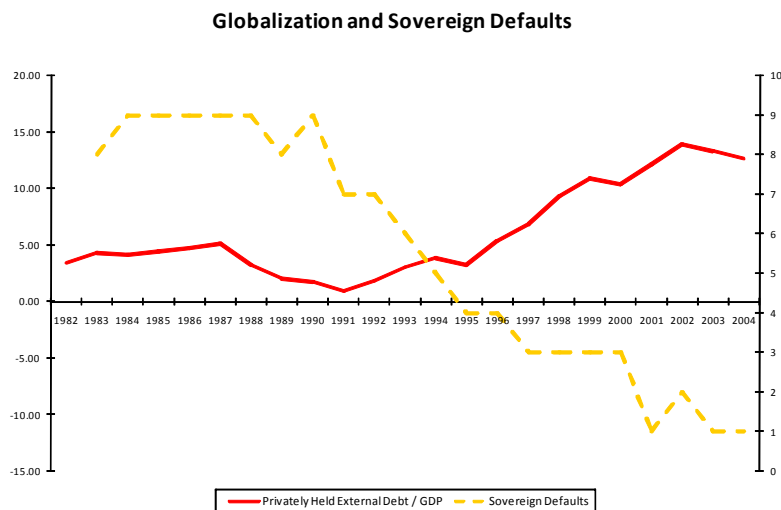


Figure 8

<sup>25</sup>We focus on whether a default occurs 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.

The increase in private flows to emerging economies in the 1990s was associated with a decline in the number of public defaults.<sup>26</sup> Far from being evidence of complementarity, these patterns might be explained by a substitution of public with private debt, rendering the former more sustainable. Existing studies of total public debt however document that in the 1990s in Latin America (Cowan et. al. 2006) as well as in Asia (Jeanne and Guscina 2006) total public debt was stable or moderately raising. Hence, the previous figure might be the product of a reduced temptation to default of emerging countries' governments, as complementarity would indeed suggest.

To probe deeper into this possibility, we examine next a further implication of our theory, namely that increasing private capital inflows should worsen the disruptions in domestic financial markets associated with default. This is indeed the channel through which in our model increasing private flows would discipline governments. The figure below shows also raw data over the 1980-2004 period of the average change in private credit over GDP in countries where the government defaulted on its debt in the previous year (dotted blue line).

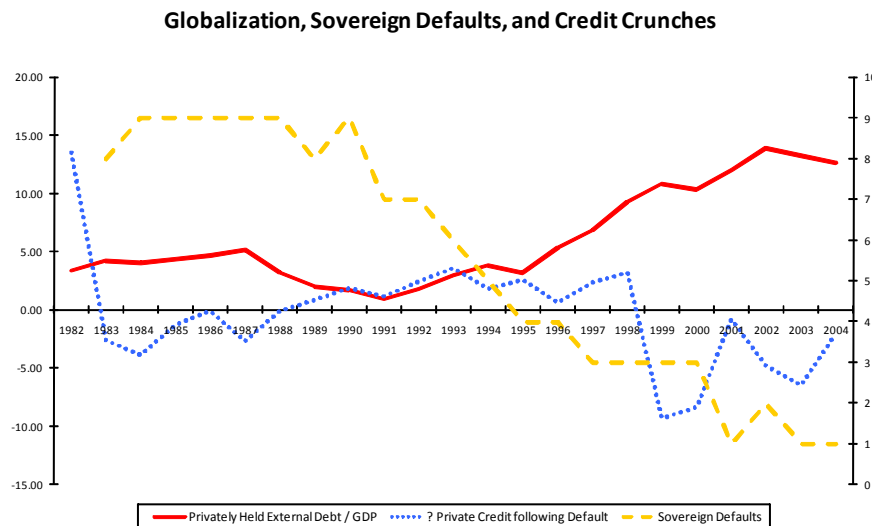


Figure 9

The dotted blue line illustrates a striking link between private capital inflows and the severity of credit crunches during public default episodes. The spectacular increase in private debt inflows

<sup>26</sup>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. According to this measure, a fall in the number of defaults may also be generated by a reduction in the time needed to resolve debt crises. We checked for this possibility in the data and found that the fall in the number of defaults over time is however robust to controlling also for the duration of default episodes.

since the early nineties has been associated with fewer defaults but, in those rare default events, private credit contractions have become much more severe, as confirmed by anecdotal evidence recent defaults in Indonesia, Argentina, and Russia.<sup>27</sup> This additional piece of evidence is also consistent with complementarity, namely with the idea that increasing private inflows increasing the government's cost of default.<sup>28</sup> Our model shows that this occurs because private inflows expand the balance sheets of banks and allow greater domestic bondholdings. It is difficult to directly look at these channels but one interesting piece of evidence is provided by Cowan et al. (2006), who find that in Latin America in the 1990s – a period of large capital inflows<sup>29</sup> – total government debt rose moderately but the share of domestically-issued bonds increased substantially 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, increasing the cost of default. Interestingly, the IFS data also show that on average the net claims toward the government held as a proportion of total assets by banks and financial institutions in the emerging economies of our sample has steadily increased from 7% in 1993 to about 20% in 2001.

Although here we do not our aim at directly testing complementarity against alternative explanations, the patterns of Figure 9 are harder to rationalize under substitutability, which in its standard version predicts that private capital inflows should exacerbate rather than dampen public default risk.<sup>30</sup> Of course, this is only a preliminary analysis and the patterns of Figure 8 are also consistent with other explanations. For example, Figure 8 could be explained with a downward trend in world interest rates, which may have reduced governments' incentives to default. Alter-

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<sup>27</sup>Interestingly, although before the mild dip in private flows of the late eighties public defaults were also associated with private credit contractions, these contractions were much less severe than those experienced in the 1990s. This difference can be partly explained with the smaller private inflows of the early eighties but also with the fact that in these early public debt crises the bulk of public debt was in the form of syndicated loans with large commercial banks. As a result, governments in the eighties were presumably better able to repay in a discriminatory manner, softening the adverse impact of default on the domestic financial system.

<sup>28</sup>This interpretation of the data does not rely on the idea that sovereign defaults *caused* the observed credit crunches as opposed to simply amplify them. In our model it might well be that a weakening of private credit markets (induced for instance by an exogenous increase in the world interest rate at  $t = 1$ ) triggers a public default. In light of this notion, Figure 9 is also consistent with the possibility that recently governments only default if the weakening of private credit markets is strong. This is consistent with complementarity because it implies that increasing private capital inflows induces governments to go at great lengths towards avoiding to default, generating the patterns we observe in the data.

<sup>29</sup>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.

<sup>30</sup>If complementarity is behind some of the patterns of Figure 9, our model warns that public default risk, which fell substantially in the last thirty years, might become severe again if private capital flows to emerging economies suddenly stop or slow down.

natively, the countries defaulting in the eighties may be very different from those defaulting in the late nineties, blurring the comparison across sample periods. Using the panel structure of our data we can control for these possibilities by using time and country dummies to control for country and time invariant factors.<sup>31</sup> Crucially, by exploiting the creditor rights index of Djankov, McLiesh and Shleifer (2007) we can also ask whether it is indeed the case that credit crunches in default events are more severe in countries with stronger creditor rights, supporting the key mechanism of our model. The next section describes in detail the tests we performs and the results so obtained.

## 5.1 The Data

We use a representative sample of 56 emerging and developed, defaulting and non-defaulting countries over the 1981-2005 period. We repeat all our tests on a subsample of 21 emerging economies,<sup>32</sup> which confirms all our results. Besides using the private credit, default and private debt measures described above, to study default episodes we also 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 comes 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 for every year between 1978 and 2003, following the index constructed by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). All variables are described in detail in Table *I*. As already said, we control for time and country dummies. We also adjust our standard errors both for heteroskedasticity and clustering at the country level.<sup>33</sup>

Table *II* presents correlations among the variables. It also shows a negative correlation between creditor rights and sovereign defaults and a positive correlation between private debt and private credit over GDP and GDP per capita.<sup>34</sup>

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<sup>31</sup>A somewhat more contrived story to rationalize the patterns of Figure 9 would invoke a reputational mechanism whereby upon public default, not only the government but also the private sector is excluded international market access. This punishment would be more costly in a more globalized world, reducing the frequency of default. Note, though, that this story would require an enormous (perhaps unpalatable) amount of coordination among foreign lenders to exclude not only the defaulting government, but also the non-defaulting private agents.

<sup>32</sup>These are Algeria, Argentina, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Hungary, India, Indonesia, Malaysia, Mexico, Morocco, Panama, Philippines, Poland, Romania, Slovak Republic, South Africa, Thailand, Turkey.

<sup>33</sup>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.

<sup>34</sup>All the Tables mentioned in the text can be found in Section 7.2 of the Appendix.

## 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  $t - 1$ .<sup>35</sup> Column 1 of Table *III* presents the specification without country fixed effects, and shows a statistically significant and economically large credit crunch after default. Column 2 shows that the effect becomes 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 9, private credit crunches are small or insignificant in the early 1990s but very large and highly significant 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, testing whether during public defaults private sector access to foreign financing is lower. 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. Overall, these results are consistent with the empirical findings of Arteta and Hale (2008). 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 9 about the greater severity of default-induced credit crunches.<sup>36</sup>

If formal regression analysis confirms the broad patterns of Figure 9, it is 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. Complementarity predicts that default should cause larger disruptions in countries whose private sector borrows more from foreigners and – conditional on ex ante borrowing – in countries with better institutions. Additionally, the effect of private debt should be less prominent once we control for financial institutions, as institutions themselves shape private borrowing.

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<sup>35</sup>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.

<sup>36</sup>We also study ex ante effects in Table *V* where we report the results of probit regressions where the dependent variable is the probability that the country is in default in year  $t$ . Table *V* confirms, in line with Figures 8 and 9, the negative association between capital flows to the private sector and the probability of government default, which is also consistent with complementarity. The table reports the results of probit regressions where the dependent variable is the probability that the country is in default in year  $t$ . We find that private debt flows from year  $t - 1$  to  $t$ , 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. Note that in our regressions creditor rights is not significant; one possible explanation is that at any given level of institutions, public borrowing is on average optimally adjusted accordingly.

Table *IV* presents results consistent with these predictions. Column 1 shows that the fall in private credit after default is strongest in those defaulting countries where in the previous period private external debt is highest. Column 2 introduces in the previous regression the interaction of sovereign default and creditor rights. The effect of institutions is negative and statistically significant as expected, suggesting that more developed financial institutions increase the size of the credit crunch after default by 1.1 as a percent of GDP. The regression also shows, again consistent with our model, that once we control for institutional quality, the effect of private debt becomes marginally insignificant and economically reduced by 30%. These effects are robust to the inclusion of country and time dummies. Overall, the results of Table *IV* line up with our prediction that better financial institutions should increase the cost of government default by allowing domestic firms to borrow from foreigners.<sup>37</sup>

While these simple patterns are certainly far from establishing conclusive evidence on the complementarity between private and sovereign capital flows, they are 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 highlights 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

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<sup>37</sup>In unreported regressions we also test for whether the effects of default are more severe in countries where banks hold more government bonds. We find no evidence for such an effect; and we find that even controlling for banks bondholdings and for the interaction of banks bondholdings and default, the interaction between creditor rights and default is still positive and significant, confirming the central role of institutions in sustaining public borrowing and suggesting that this stems from the ability of banks to undertake more productive investments rather than to buy more government bonds.

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 shed light on 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 obtains only 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 may focus on other policies such as opportunistic devaluations or hyper-inflations, to name but a few. Besides affecting the returns obtained 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’ incentives 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, though, a fuller understanding of these interactions remains an exciting topic for future research.

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## 7 Appendix

### 7.1 Theoretical Appendix

#### 7.1.1 Bondholdings

To see why in our model banks strictly want to hold government bonds, consider the portfolio decision they face at time  $t = 0$ . The government is expected to repay fully if  $A_B = A > 1$  and to default otherwise. If a bank purchases an amount  $b_B$  of bonds and accepts an amount  $d_{0B}$  of deposits at  $t = 0$  paying an expected gross interest rate of  $r_0$ , his expected consumption at  $t = 2$  is equal to:

$$p \left[ \frac{(1 - \alpha)Ar_1}{r_1 - \alpha A} \left( \Omega\theta + \frac{b_B}{p} - d_{0B}\tilde{r}_0(1) - \frac{b}{p} \right) \right] + (1 - p) [\Omega\theta - d_{0B}\tilde{r}_0(0)] r_1. \quad (22)$$

The first term in Equation (22) reflects that with probability  $p$  productivity will be high and public debt is repaid. In this state, banks leverage their  $t = 1$  wealth and borrow against their  $t = 2$  modern-sector income to expand their investment. The second term in Equation (22) reflects that with probability  $(1 - p)$  productivity is low and the government defaults. Note that Equation (22) incorporates the fact that the ex-post rate of return on deposits,  $\tilde{r}_0(\cdot)$ , is affected by the government's repayment decision. We initially restrict ourselves to the case in which  $d_{0B}r_0 \leq \alpha\Omega\theta$ : under this constraint, repayment by the bank to depositors is non-contingent and  $\tilde{r}_0(0) = \tilde{r}_0(1) = r_0$ . Since the maximum amount of bonds a bank can purchase is  $\omega_0 + d_{0B}$ , its optimal portfolio decision at  $t = 0$  reduces to:

$$\begin{aligned} \max_{d_{0B}} p \left[ \frac{(1 - \alpha)Ar_1}{r_1 - \alpha A} \left( \Omega\theta + \frac{\omega_0 + d_{0B}}{p} - d_{0B}r_0 - \frac{b}{p} \right) \right] + (1 - p) [\Omega\theta - d_{0B}r_0] r_1 \\ \text{s.t. } d_{0B} \leq \frac{\alpha\Omega\theta}{r_0}, \end{aligned} \quad (23)$$

The objective in Equation (23) implies that, as long as

$$r_0 \leq \frac{(1 - \alpha)Ar_1}{(1 - p)(r_1 - \alpha A) + p(1 - \alpha)Ar_1},$$

a bank sets  $d_{0B} = \alpha\Omega\theta/r_0$ , taking the maximum amount of deposits allowed by the constraint in order to buy bonds. The intuition is simple: at  $t = 0$ , the most valuable assets for banks are those that promise to deliver at  $t = 1$  in the event that investment is productive. The government

bond has exactly this property, since it only repays in equilibrium if productivity is high. Besides their traditional sector output, banks can also pledge the proceeds of bonds themselves in order to further increase their bondholdings. This additional borrowing, though, will *de facto* be repaid only if the government repays its debt: otherwise, banks have only their traditional sector output and can only repay  $\alpha\Omega\theta$ . In a sense, then, whenever banks pledge the proceeds of public bonds and use that to expand their bondholdings, they are borrowing funds that will have to be repaid fully in the productive state (at an effective contractual rate of  $r_0/p$ ) and they are investing these funds in bonds that also pay only in that state (at a contractual rate of  $r/p$ ). Hence, whenever  $r_0 > 1$ , banks are unwilling to pledge income beyond their traditional sector output and bondholdings are given by  $\omega_0 + \alpha\Omega\theta/r_0$ . If  $r_0 = 1$ , on the other hand, they are indifferent between expanding their bondholdings beyond  $\omega_0 + \alpha\Omega\theta$  and not doing so: we assume that, in the event of such indifference, they expand their bondholdings as much as possible. The same assumption holds for savers throughout, since they are also indifferent between holding government bonds and not doing so if  $r_0 = 1$ . In a sense, then, we determine the weakest possible conditions under which government debt is sustainable in equilibrium.

In the case of the closed economy, equilibrium bondholdings will depend on whether  $\alpha$  exceeds the threshold identified as  $\alpha_0$  in Equation (13). If  $\alpha > \alpha_0$ , then all of the economy's resources are allocated to productives at  $t = 0$ , and bondholdings will consequently be given by,

$$\begin{aligned} b_B &= \frac{\omega_0}{\beta} \\ b_S &= 0 \end{aligned} \tag{24}$$

If instead  $\alpha < \alpha_0$ , the interest rate at time 0 is equal to one and bondholdings by savers are undetermined. Assuming that savers buy an equal amount of private bonds, bondholdings will be given by,

$$\begin{aligned} b_B &= \frac{\omega_0 + \alpha\Omega\theta}{1 - \alpha} \\ b_S &= \frac{\omega_0(1 - \alpha - \beta) - \beta\alpha\Omega\theta}{(1 - \beta)(1 - \alpha)} \end{aligned} \tag{25}$$

In the case of the open economy, since the constraint imposed by  $\alpha_0$  is irrelevant and we assume throughout that  $r_0 = 1$ , bondholdings are simply given by

$$b_j = \frac{\omega_0 + \alpha\Omega_j\theta}{1 - \alpha} \quad \text{if } r_0 = 1 \quad \text{for } j \in \{B, S\}. \tag{26}$$

### 7.1.2 Government repayment and debt sustainability

At  $t = 1$ , and insofar as  $r_1 = 1$ , the government maximizes the following welfare function with respect to  $\rho$ :

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

The actual values of  $\omega_j(\cdot)$  depends, of course, on equilibrium bondholdings. There are three cases to consider:

1.  $\alpha \in (0, \alpha_0]$ , where  $\alpha_0$  is as in Equation (13): in this case, banks pledge a fraction  $\alpha$  of all their  $t = 1$  revenues, including the proceeds from public bonds, and invest these in bonds at  $t = 0$ . Replacing these bondholdings in the welfare function, the government's first-order condition becomes

$$[\omega_0 - 1] + \frac{A - 1}{1 - \alpha A}\beta[\omega_0 + \alpha\Omega\theta - 1] \geq 0.$$

2.  $\alpha \geq \bar{\alpha}_0$ , where  $\bar{\alpha}_0 = \frac{\omega(1-\beta)}{\beta\Omega\theta} > \alpha_0$ : in this case, banks can borrow all domestic funds and use them to purchase government bonds only by pledging their traditional sector income. In this case, given their bondholdings the government's first-order condition becomes

$$[\omega_0 - 1] + \frac{A - 1}{1 - \alpha A}\beta\left[\frac{\omega_0}{\beta} - 1\right] \geq 0.$$

3.  $\alpha \in (\alpha_0, \bar{\alpha}_0)$ : in this case, banks pledge some, but not all of their future proceeds from public bonds in order to acquire bonds at  $t = 0$ . This means that, unlike the previous cases, the marginal benefit of repayment is not constant for the government: whereas repayment of the first units of public debt (i.e., for  $\rho \approx 0$ ) goes partly to the banks and partly to its creditors, repayment of the last units of public debt are appropriated fully by the banks (i.e., for  $\rho \approx 1$ ). In this case, welfare as a function of  $\rho$  is given by

$$\left[\frac{(\omega_0 - 1)}{p}\rho + \bar{\Omega}\theta\right] + \frac{A - 1}{1 - \alpha A}\beta\left[\left(\frac{\omega_0}{\beta} - 1\right)\frac{\rho}{p} + \Omega\theta - \min\left\{\alpha\left(\frac{\omega_0}{\beta p}\rho + \Omega\theta\right), \frac{\omega_0(1 - \beta)}{\beta p} - \frac{(1 - p)}{p}\alpha\Omega\theta\right\}\right],$$

where the last term  $\min\{\cdot, \cdot\}$  captures the fact that whether banks are able to repay their nominal debts in full or not depends on the government's decision to repay. Since this welfare function is convex in  $\rho$ , comparing its value under  $\rho = 0$  and  $\rho = 1$  yields the following

necessary and sufficient condition for repayment,

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

which reduces to the same condition as in case 1.

Therefore, all three cases can be summarized in the condition that

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

which explains Equation (16) in the main body of the paper. From the previous analysis, we can obtain

$$\alpha^{\min}(\beta) = \min \left\{ \frac{1 + (A-1)\beta}{A + \left[ \frac{A-1}{1-\omega_0} \right] \beta\theta\Omega}, \frac{(1-\beta) + A(\beta - \omega_0)}{A(1-\omega_0)} \right\}.$$

### 7.1.3 Proof of Proposition 1

The first part of the proposition follows directly from the discussion in the main body of the text. It remains to be shown that there exist values of  $\beta$  for which  $\alpha^{\min}(\beta) < \alpha^{\max}(\beta)$ , so that the optimal level of public debt is sustainable in equilibrium. Since  $\alpha^{\min}(0) = \alpha^{\max}(0) = 1/A$ , we proceed by analyzing the conditions under which

$$\left. \frac{\partial \alpha^{\min}(\beta)}{\partial \beta} \right|_{\beta=0} < \left. \frac{\partial \alpha^{\max}(\beta)}{\partial \beta} \right|_{\beta=0},$$

which would guarantee the sustainability of debt for low levels of  $\beta$ .

From Equation (16), we can obtain,

$$\alpha^{\min}(\beta) = \frac{1 + (A-1)\beta}{A + \frac{(A-1)\beta}{1-\omega_0} \Omega\theta}, \quad (27)$$

and

$$\left. \frac{\partial \alpha^{\min}(\beta)}{\partial \beta} \right|_{\beta=0} = \frac{(A-1)}{A^2} \left[ A - \frac{\Omega\theta}{1-\omega_0} \right]. \quad (28)$$

We assume throughout that  $(A + \Omega)(1 - \omega_0) < \Omega\theta$ , which in particular guarantees that Equation (28) is negative. On the other hand, Equation (8) yields,

$$\alpha^{\max}(\beta) = \frac{(1-\beta)(\omega_0 - 1 + \theta p)}{A(\omega_0 - 1 + p\theta\Omega) + (1-p)\beta\Omega\theta},$$

and

$$\left. \frac{\partial \alpha^{\max}(\beta)}{\partial \beta} \right|_{\beta=0} = \frac{1}{A} \left[ -1 - \frac{Ap\theta(\Omega - 1) + (1-p)\theta\Omega}{A(\omega_0 - 1 + p\theta)} \right].$$

Hence, a sufficient condition for debt to be sustainable for some combination  $(\alpha, \beta)$  is that

$$A - 1 - \frac{\Omega\theta}{1 - \omega_0} \frac{(A - 1)}{A} < -1 - \frac{Ap\theta(\Omega - 1) + (1-p)\theta\Omega}{A(\omega_0 - 1 + p\theta)},$$

which reduces to

$$p > p^* = \frac{A(1 - \omega_0)}{\theta(A - 1)} \left[ \frac{\Omega\theta - (1 - \omega_0)A}{\Omega\theta - (1 - \omega_0)(A + \Omega)} \right].$$

#### 7.1.4 Proof of Proposition 2

From Equation (19) we obtain

$$\alpha_{open}^{\min}(\beta) = \frac{1 + (A - 1)\beta}{A - \frac{(A\alpha_{open}^{\min}(\beta) - 1)}{1 - \omega_0}\bar{\Omega}\theta + \frac{(A - 1)}{1 - \omega_0}\beta\Omega\theta}, \quad (29)$$

which defines values of  $\alpha$  above which public debt is sustainable in the open economy. Note that we have not fully solved for  $\alpha$  in order to keep the expression simple. A comparison of Equations (27) and (29) reveals that, insofar as  $\alpha < 1/A$ ,  $\alpha_{open}^{\min}(\beta) < \alpha^{\min}(\beta)$ .

#### 7.1.5 Proof of Proposition 3

From Equation (19) we obtain

$$\alpha_{open}^{\min}(\beta, r_1^*) = \frac{r_1^* + (A - r_1^*)\beta}{A - \frac{(A\alpha_{open}^{\min}(\beta, r_1^*) - r_1^*)}{1 - \omega_0}\bar{\Omega}\theta + \frac{(A - r_1^*)}{1 - \omega_0}\beta\Omega\theta}, \quad (30)$$

from which it can be verified that  $\alpha_{open}^{\min}(\beta, r_1^*)$  is increasing in  $r_1^*$ . In particular, when  $r_1^* \rightarrow 1$ ,  $\alpha_{open}^{\min}(\beta, r_1^*) < \alpha^{\min}(\beta)$ : this follows from comparing Equations (30) and (27) and noting that, in the closed economy,  $r_1 \geq 1$ . When  $r_1^* \rightarrow A$ , on the other hand, Equation (30) implies that  $\alpha_{open}^{\min}(\beta, r_1^*) \rightarrow 1$  so that it is necessarily higher than  $\alpha^{\min}(\beta)$ . Therefore, there exists a value  $r^* \in (1, A)$  for which  $\alpha_{open}^{\min}(\beta, r^*) = \alpha^{\min}(\beta)$ .

## 7.2 Empirics

**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).  |
| 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 than 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).  |
| Inflation             | Annual percentage inflation, GDP deflator, 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<br>Debt       | Private<br>Debt     | Private<br>Credit   | Sovereign<br>Default | Creditor<br>Rights  | GDP                 | GDP p.c.            |
|----------------------|----------------------|---------------------|---------------------|----------------------|---------------------|---------------------|---------------------|
| Private Debt         | -0.0943***<br>0.0000 |                     |                     |                      |                     |                     |                     |
| Private Credit       | -0.1431***<br>0.0000 | 0.2165***<br>0.0000 |                     |                      |                     |                     |                     |
| Sovereign<br>Default | 0.2861***<br>0.0000  | -0.0079<br>1.0000   | -0.254***<br>0.0000 |                      |                     |                     |                     |
| Creditor<br>Rights   | -0.0303<br>1.0000    | 0.0451<br>1.0000    | 0.2491***<br>0.0000 | -0.1424***<br>0.0000 |                     |                     |                     |
| GDP                  | -0.4884***<br>0.0000 | 0.0800<br>1.0000    | 0.4477***<br>0.0000 | -0.0606<br>1.0000    | -0.1048**<br>0.0292 |                     |                     |
| GDP p.c.             | 0.0321<br>1.0000     | 0.2408***<br>0.0000 | 0.5735***<br>0.0000 | -0.1845***<br>0.0000 | 0.1182***<br>0.0058 | 0.5108***<br>0.0000 |                     |
| GDP p.c.<br>growth   | -0.2232***<br>0.0000 | -0.0207<br>1.0000   | -0.0286<br>1.0000   | -0.1000**<br>0.0171  | 0.0307<br>1.0000    | 0.1179***<br>0.0004 | 0.1017***<br>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**<br>(0.007)         | -0.017<br>(0.014)   |                      | -0.008**<br>(0.003)       | -0.015**<br>(0.006) |                      |
| (Sovereign Default)*(2000-2004)     |                             |                     | -0.058***<br>(0.010) |                           |                     | -0.027***<br>(0.008) |
| (Sovereign Default)*(1995-1999)     |                             |                     | -0.023<br>(0.041)    |                           |                     | -0.020*<br>(0.011)   |
| (Sovereign Default)*(1990-1994)     |                             |                     | 0.018<br>(0.013)     |                           |                     | -0.007<br>(0.005)    |
| (Sovereign Default)*(1985-1989)     |                             |                     | -0.033**<br>(0.013)  |                           |                     | -0.018*<br>(0.009)   |
| (Sovereign Default)*(1980-1984)     |                             |                     | -0.038***<br>(0.014) |                           |                     | -0.008<br>(0.017)    |
| GDP per capita growth               |                             | -0.171<br>(0.113)   | -0.198<br>(0.111)    |                           | 0.076**<br>(0.031)  | 0.076**<br>(0.035)   |
| Inflation                           |                             |                     | 0.000<br>(0.001)     |                           |                     | 0.000<br>(0.000)     |
| Constant                            | 0.019*<br>(0.010)           | 0.029***<br>(0.009) | 0.028***<br>(0.009)  | 0.006*<br>(0.003)         | -0.005<br>(0.005)   | -0.001<br>(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)                 |
|---|---------------------|---------------------|
| (Sovereign Default)*(Private Debt to GDP) | -0.209**<br>(0.097) | -0.141<br>(0.090)   |
| (Sovereign Default)*(Creditor Rights)     |                     | -0.011**<br>(0.004) |
| Creditor Rights                           |                     | 0.081*<br>(0.046)   |
| Private Debt to GDP                       | -0.149<br>(0.077)   | -0.147<br>(0.085)   |
| Sovereign Default                         | 0.001<br>(0.013)    | 0.023<br>(0.015)    |
| GDP per capita growth                     | -0.036<br>(0.111)   | -0.122<br>(0.117)   |
| Inflation                                 | 0.000<br>(0.001)    | 0.004<br>(0.008)    |
| Constant                                  | 0.014<br>(0.016)    | -0.052<br>(0.042)   |
| Time dummies?                             | Yes                 | Yes                 |
| Country dummies?                          | Yes                 | Yes                 |
| SE Robust and clustered by country?       | Yes                 | Yes                 |
| Observations                              | 417                 | 349                 |
| Number of countries                       | 21                  | 21                  |
| Adjusted R-squared                        | 0.063               | 0.079               |

**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***<br>(1.090) |                     | -3.733***<br>(1.265) |                      | -3.743***<br>(1.141) |
| Creditor Rights                     |                      |                     |                      | -0.023<br>(0.026)    | 0.004<br>(0.057)     |
| GDP per capita growth               |                      | -0.430**<br>(0.222) | -0.976**<br>(0.492)  | -0.504***<br>(0.257) | -1.198**<br>(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                |