Financial Architecture in Emerging Market Economies*

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This Draft July 24 2006

Abstract

This paper analyzes the determinants of the composition of sovereign bond, corporate bond and bank financing in a general equilibrium model of the financial sector of an emerging market economy (EME). We model an EME as an economy with a shortage of capital, weak debt enforcement institutions and potential government overborrowing, which may expose the country to sovereign default risk. As in Bolton and Freixas (2005) we model banks as having a comparative advantage in restructuring debt of financially distressed firms, but their lending is constrained by capital adequacy requirements. Corporate bond financing is a less flexible form of financing but is unconstrained by any capital adequacy requirements.This framework allows us to determine when it is efficient to create a bond market and which types of loans can be securitized in an EME.

*The authors have benefit from comments by the attendants of the II workshop of the Latin American Research Network. They also acknowledge the excellent research assistantship work of Milos Bozovic. The usual disclaimer applies.

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1 Introduction

The issue this paper is concerned with is whether the creation of a corporate bond market in emerging market economies (EMEs) should be encouraged. In the last decade and especially in the years following the Asia crisis we have seen important changes in the Financial architecture of EMEs. An especially noteworthy development has been the rapid growth in corporate bond markets in EMEs especially in Malaysia and South Korea, which mirrors the explosion of debt securitization around the world. This growth in corporate bond financing has not been even across all EMEs or for that matter across mature economies. In particular, only EMEs that have been able to overcome potential sovereign debt crises seem to have been able to significantly expand their corporate bond markets. At the same time a developed government bond market seems to have facilitated the development of the corporate bond market. Indeed, the cross-country evidence suggests that countries with larger outstanding government debt securities tend to have larger corporate bond markets. Which raises the question of the optimal composition of debt financing in EMEs. In other words, whether the shift towards corporate bond financing and securitized debt is a welcome development from an economic efficiency point of view.

To address these questions we develop a model of financial architecture in EMEs which allows for both bank lending and bond issues at the corporate level. We model an EME as an economy with a shortage of capital and, most importantly for our purposes, potential government overborrowing which may expose the country to government debt default risk. To introduce the possibility of government debt default we extend our model in Bolton and Freixas (2000, 2005) by explicitly modeling a government sector with government expenditures, tax revenues and government debt. We also need to

allow for aggregate shocks to the economy that could give rise to government debt default.

As in our earlier papers, we model banks as having a comparative advantage in restructuring debt of financially distressed firms, but having their lending constrained by capital adequacy requirements. Corporate bond financing, on the other hand, is a less flexible form of financing but is not constrained by any capital adequacy requirements.

Thus, the central issue we are concerned with is how a government debt crisis affects the financial sector. If government debt is primarily bank debt, then a default on government debt is likely to trigger a banking crisis. This is indeed a main feature of our model. Specifically, we set the model up so that there is always a joint government debt and banking crisis. In this context a corporate bond market will provide a basic benefit, which is to shield the bond issuing firms from the consequences of government debt defaults. This is what we refer to as the "spare tire" benefit of bond financing. An added benefit of the creation of a corporate bond market is that it also induces the government to shift away from bank debt to government bond issues. This in turn, may reduce the banking sector's exposure to government debt if the government bonds are ultimately held by private investors and not the banks. We refer to this latter effect as the benefit of "decoupling" banking activities from public finances, a benefit that may require regulatory intervention in the form of separation of commercial banking from the financing of government debt.

Our paper is related to two separate strands of literature. One is the literature on financial architecture, which includes Besanko and Kanatas (1993), Hoshi, Kashyap and Scharfstein (1993), Holmstrom and Tirole (1994), Chemmanur and Fulghieri (1994), Repullo and Suarez (1994) and Boot and Thakor

(1997) among others. We contribute to this literature by introducing risky government debt and aggregate shocks. The other strand of literature is concerned with emerging market crises and includes Caballero and Krishnamurthy (2001), Corsetti, Pesenti and Roubini (1999), Chang and Velasco (1998), Diamond and Rajan (2000) and Schneider and Tornell (2004). In contrast to this literature, which emphasizes the so-called twin crises, characterized by the simultaneous balance of payments and banking crises, we emphasize government debt crises in conjunction with banking crises.

The remainder of our paper is organized as follows: section 2 is devoted to the description of the model. Section 3 characterizes the general equilibrium in closed economies where only bank financing is available. Section 4 turns to the analysis of the equilibrium when a bond market coexists with a banking sector. Section 5 looks at the equilibrium in an open economy. Section 6 is devoted to the effect of liberalization on the bond market. Section 7 presents a numerical example. Finally, section 8 concludes.

2 The model

To begin with we consider a highly simplified, two-period, real economy with a single consumption or production good.

2.1 Corporate investment and financing

We follow Bolton and Freixas (2005) and model firms as requiring an initial investment 1 at date $t = 0$ and yielding an expected after-tax return of $E[V](1-\tau) > 1$ when they are successful. Firms can fail and when they do they only generate a value v, as long as they are restructured efficiently. If a firm cannot be restructured its value is zero. Firms differ in the observable probabilities p of success. We shall assume that p is a uniformly distributed

random variable on the interval $[\pi, 1]$.

We assume that firms are also exposed to an aggregate shock. This shock affects the value V of the firm when successful. If we let $V = v + \Delta$, we shall assume that $\Delta = \mu + \delta + (1 - \delta)\phi$ with $0 \leq \delta < 1$ and where ϕ is also a uniformly distributed random variable on the interval $[0, 1]$.

In the full model firms can choose to finance their project by either issuing bonds or by means of a bank loan. Under bond financing the firm faces a time $t = 1$ repayment obligation of $R(p)$. If the firm is unable to meet this repayment the firm is declared bankrupt and is liquidated.

Under bank financing, on the other hand, if the firm defaults on its repayment obligation $\widehat{R}(p)$, the bank may be able to restructure the firm's debts and thus realize an additional restructuring value v. Basically, we think of bonds as long term finance while bank lending takes the form of short term revolving credit.

This restructuring service, however, does not come for free. Indeed, whenever a firm borrows from a bank it incurs a unit intermediation cost $\rho > 0$ (see Bolton and Freixas, 2000). This cost reflects the costs of maintaining a branching network, employing loan officers, the costs of meeting capital adequacy requirements (see Bolton and Freixas, 2005), and the costs of establishing a good reputation. Consequently, in order to finance an investment with an initial outlay of 1, the firm is forced to borrow $1 + \rho$ from a bank, or an amount of $1 + g$, where g are the costs bond issuing in equilibrium and will be defined later on.

As shown in Bolton and Freixas (2000, 2005), in equilibrium firms will be segmented by risk classes in their choice of funding, with all firms with $p \in (\widehat{p}, 1]$ choosing bond financing and all firms with $p \in [0, \widehat{p}]$ preferring a bank loan. Bond financing is preferred by low risk firms (with a high p)

because these firms are less likely to fail at date $t = 1$ and therefore have less of a need for the costly debt restructuring services provided by banks.

Having described the demand side for capital by firms we now turn to a description of the supply side.

2.2 Households

The EME is composed of a continuum of risk-neutral households represented by the unit interval $[0, 1]$, each with savings $s, 1 > s > 0$. In the full model households can invest their savings either in bank deposit accounts, in bonds issued by firms, in government bonds, or in bank equity. At time $t = 0$ households decide on how to allocate their savings. At time $t = 1$ they have a choice whether to keep their money in the bank or whether to withdraw it. At time $t = 2$ they realize their investments and consume their accumulated wealth. We will denote by r_D the nominal repayment on deposits and by r_F the expected yield per unit invested.

2.3 Banks

We follow Bolton and Freixas (2000) and model banks as facing an intermediation cost ρ, which we take to be exogenous. Otherwise, the banking sector is assumed to be competitive. Banks obtain funding from households by offering liquid deposit contracts and they lend these funds either to the corporate sector or to the government. Consequently banks are subject to runs. Still, we abstract from purely speculative bank runs and focus on bank runs that are related to sovereign risk. Thus, our model focuses on the case where a government debt default triggers a bank run. For the sake of simplicity, we assume that bank runs occur exclusively as a result of a government default. Indeed, exogenous, or sun-spot based bank runs, could be introduced into

our model, and this change would not affect our main qualitative results.

As we have argued above, a major drawback of bond issues over bank loans is that bonds from financially distressed firms cannot be as easily or efficiently restructured as bank loans. On the other hand, in the event of a bank run, bond financed firms are shielded from a sudden stop in credit flows to banks. In contrast bank financed firms are fully exposed to the risk of bank runs. It is as if bank loans had acceleration clauses that trigger a default in the event of a government debt default.

2.4 Government

In a closed EME the role of the government is reduced to providing public goods. Any amount G spend on public goods provides a consumption benefit to households of ΓG at time $t = 2$, where $\Gamma > 1$. To pay for this public good provision the government must borrow at date $t = 0$. The government will repay its debts at date $t = 2$ out of tax receipts levied on the successful firms, if it is able to raise sufficient tax revenues.

To simplify our analysis we shall assume that the government always sets the tax rate $\tau > 0$ on corporate profits at the maximum feasible rate $\widehat{\tau} < 1$. Implicit in this assumption is the idea that many EME governments face serious obstacles in collecting taxes and that beyond the maximum rate $\widehat{\tau}$ there would be substantial tax evasion. We are also implicitly assuming here that at $\tau = \widehat{\tau}$ the government has not yet reached the peak of the Laffer curve. In other words, if it were able to relax the constraint on $\widehat{\tau}$ it would be able to increase its tax revenues.

In the event that total tax receipts exceed total government debt obligations we assume that the government balances the budget by providing a lump-sum transfer to households equal to the amount of excess tax receipts.

The government takes into account the possibility of default when it determines the level of public spending and it could avoid default altogether by sufficiently limiting public spending. Generally, however, it will be optimal to choose levels of spending which induce a strictly positive sovereign default risk.

The government is only able to repay its debt obligations if there is a sufficiently large mass of successful firms and if the aggregate shock that firms are exposed to is sufficiently favorable. Thus, in the event of a negative aggregate shock, tax receipts may be so low that the government has no choice but to default on its debts. In the event of such a default we assume for simplicity that the holders of the government debt receive nothing.

Note that our modeling assumptions do not allow for any mismanagement of public finances. We only assume that for some parameter values welfare maximizing levels of public spending may be such that there is a positive risk of default. Our model, therefore, cannot shed any light on crises brought about by public overspending.

In an open EME, the government may be able to borrow on world markets as well as domestically and may not just confine itself to public good provision. It may also play the role of financial intermediary if it has a superior debt-collection technology to domestic banks, or equally plausible if foreign investors are less well informed about firms' underlying risks that domestic investors, but are symmetrically informed on sovereign default risk.

3 Equilibrium in a closed EME with bank debt only

We begin our analysis by characterizing the equilibrium financial structure in a closed EME. As a first step we only allow households to deposit their

savings in banks. These savings in turn are channelled to the corporate sector or the government. We shall assume that Γ and μ are large enough that in equilibrium all household savings get deposited in the banking sector and get productively invested, so that the following equation always holds in equilibrium:

$$\frac{s}{1+\rho} = 1 - p_B + G \tag{1}$$

where G represents the amount of funds borrowed by the government and $(1 - p_B)$ is the amount of lending to the corporate sector.[1]. The cost of banking is expressed as a percentage of total savings channeled through the banking sector, so that, in order to finance an investment I, the amount $I(1 + \rho)$ is required. The amount $\frac{s}{1+\rho}$ is therefore the net amount of savings available for investments. Because s is less than 1, p_B is always positive.

Recall that each firm requires one unit of investment to get started. Also, observe that the firms with the highest probability of success p are the most profitable investments for banks. Therefore, the banking sector will lend to all firms above a cut-off probability of success p_B, so that the mass of lending to the corporate sector is given by $(1 - p_B)$.

To be able to raise the debt G the government must promise a sufficiently attractive interest payment on government debt of r_G and in $t = 2$ the government is able to repay its debt obligation $G(1+r_G)$ only if it has sufficiently high tax receipts. Ex-post, for any realization of ϕ all the successful firms get a return $V(\phi) = v+\mu+\delta+(1-\delta)\phi$ and pay taxes $\widehat{\tau}V(\phi)$ to the government,

[1]Note that we have assumed here that bank financing involves a unit deadweight cost of ρ for the savings s that get channelled through the banking sector.

so that the total ex-post tax receipts ς are

$$\varsigma = (1-p_B)\widehat{\tau}V(\phi)\int_{p_B}^{1}\frac{p}{1-p_B}dp$$

$$= (1-p_B)\widehat{\tau}V(\phi)(\frac{1+p_B}{2})$$

We shall assume that the government will repay the debt if and only if $V(\phi)$ is sufficiently high that

$$(1-p_B)\widehat{\tau}V(\phi)(\frac{1+p_B}{2}) \geq G(1+r_G) \tag{2}$$

Other things equal, for any increase in the amount of government spending G, there will be a higher probability of default ex post. The reason is simply that the RHS of (2) is then higher, while the LHS is lower since any increase in government spending crowds out lending to the corporate sector by an equal amount and raises p_B. Furthermore, given that the probability of default is higher the government must promise a higher interest rate r_G to compensate for the higher risk.

For any given overall debt obligation $G(1+r_G)$ there is an associated ex-ante probability of default given by the probability that the aggregate shock ϕ falls below the cut-off $\overline{\phi}$ defined by

$$(1-p_B)\widehat{\tau}[\mu+\delta+(1-\delta)\phi](\frac{1+p_B}{2}) = G(1+r_G) \tag{3}$$

if $\overline{\phi} > 0$, and by $\overline{\phi} = 0$ otherwise. Rearranging, the cut-off $\overline{\phi}$ is given by:

$$\overline{\phi} = \frac{1}{1-\delta}[\frac{2G(1+r_G)}{\widehat{\tau}(1-p_B^2)} - (\delta+\mu)]. \tag{4}$$

And since ϕ is uniformly distributed on the interval $[0,1]$ the probability of default is simply given by $\overline{\phi}$.

We confine our analysis here to the characterization of a financial market equilibrium where a government debt crisis in turn triggers a banking crisis and leads to a run on banks. The link between a government default and a banking crisis is often observed in practice. Banks may fail because they hold, or are perceived to hold, too much worthless government paper. In addition, as a government debt default is triggered by an adverse aggregate shock to the economy, this event in itself will signal to depositors a deterioration of the value of banks' loans to the corporate sector.

Concretely, we shall assume that depositors learn the realization of the aggregate shock ϕ at date $t = 1$, and if $\phi < \overline{\phi}$ they foresee the government default and the fall in bank assets. Under some conditions (that we determine below) total bank liabilities $s(1 + r_D)$ are then expected to exceed total bank assets following a default on government debt. In that case, a run on the banks is triggered at $t = 1$, which precipitates a banking crisis. On the other hand, if the realization of the aggregate shock ϕ is such that the government is able to honor its debts, bank assets are expected to exceed bank liabilities and there is no run. In sum, the probability of a banking crisis is the same in our equilibrium as the probability of default on government debt. Again for simplicity we shall assume that when there is a banking crisis all assets held by banks become worthless. In other words, in the heat of the run all bank assets get dissipated and depositors recover nothing.

Under these assumptions, at time $t = 0$ the equilibrium in the financial sector can be characterized as follows:

1. The marginal firm p_B to get funding must pledge its entire value to the bank, so that, conditional on the government and bank's solvency, the expected gross return on a loan to that firm is given by:

   Given that all loans must yield the same expected return, in a compet-

itive banking market equilibrium, the ex-ante expected value of bank loans to the corporate sector, conditional on the bank's solvency, is thus given by:

$$(1-p_B)[p_B(1-\widehat{\tau})(\mu+\delta+(1-\delta)\frac{1+\overline{\phi}}{2})+v]$$

In equilibrium it must also be the case that the return to the bank on the marginal dollar lent to the government must be the same as the return on the marginal dollar lent to the corporate sector. So that we must also have

$$(1+r_G)=[p_B(1-\tau)(\mu+\delta+(1-\delta)\frac{1+\overline{\phi}}{2})+v] \tag{5}$$

Notice that this equality is based on the assumption that the bank's cost of granting a loan, ρ, is the same whether it lends to the government or to the marginal firm. This is consistent with the fact that in our setup, the risk of government securities and of bank loans is precisely the same, as banks have perfectly diversified portfolios, so that their bankruptcy can only be triggered by a government debt default.

2. In a competitive banking equilibrium, the zero profit condition on government loans implies:

$$1+r_G=(1+r_D)(1+\rho)$$

and the expected yield is

$$1+r_F=(1+r_D)(1-\overline{\phi})$$

So that we must have r_F set such that

$$(1+r_F)=\frac{(1-\overline{\phi})(1+r_G)}{(1+\rho)} \tag{6}$$

Notice that $r_F \geq -1$ implies $\overline{\phi} < 1$, so that the corner solution $\overline{\phi} = 1$ can be disregarded.

3. Finally, the optimal level of government spending G is determined by the government's optimization of social welfare problem:

$$\max_G \Gamma G + \int_{\overline{\phi}(G)}^{1} \Delta(\phi) d\phi \int_{p_B}^{1} p dp + (1 - \overline{\phi})(1 - p_B(G))v \tag{7}$$

where Γ is a weighting parameter determining of the value of public good consumption relative to private good consumption. Note that the social welfare function (7) reflects our simplifying assumption that private good consumption only occurs in the event of no twin crises. Should a crisis occur then all output is wiped out. As should be clear, this assumption can be seen as just a convenient normalization. For later reference we characterize the optimal level of government spending G^* by the solution to the first-order condition:

$$\Gamma = -\frac{\partial H(G)}{\partial G}, \tag{8}$$

where

$$H(G) = \int_{\overline{\phi}(G)}^{1} \Delta(\phi) d\phi \int_{p_B}^{1} p dp + (1 - \overline{\phi})(1 - p_B(G))v \tag{9}$$

or, equivalently,

$$H(G) = (1 - \overline{\phi})(1 - p_B(G)) \left\{ \left[\mu + \delta + (1 - \delta) \frac{(1 + \overline{\phi})}{2} \right] \frac{(1 - p_B(G))}{2} + v \right\} \tag{10}$$

This is a necessary and sufficient condition for an optimum if $H(G)$ is concave, which we shall assume throughout this paper.

To summarize, in a closed economy, our equilibrium jointly determines the variables $G, r_G, \overline{\phi}$ and p_B through equations (1), (4),(5) and condition

(7). From these, r_D is immediately obtained by replacing their values in equation (6).

It is interesting to note that our formulation gives rise to a form of "Laffer curve" but with government spending G instead of the tax rate τ as the variable: for low values of G a marginal increase in government spending has no effect on tax revenues, but as G increases, government spending crowds out corporate investment and gives rise to an increased risk of a debt default crisis, which in turn decreases expected tax revenues, $\int_{\bar{\phi}(G)}^{1} \Delta(\phi) d\phi$.

4 Bank debt and Bond Markets: the "spare tire" effect

We now explore the costs and benefits of developing corporate bond financing.

In comparing bonds and loans, we will emphasize the fact that the bond financed firms are shielded from panic runs. This will be one of the main features of the bond market.

Note that who is holding the corporate bonds is irrelevant if we assume that only a government default triggers a banking crisis. Even if banks are shut down firms that have issued bonds remain unaffected. It is of course possible that in the midst of a banking crisis corporate bonds might sell at a discount in the secondary market, but the only effect in our model of this discount is a redistribution among agents in a zero sum game.

In a closed economy, bond financing by domestic firms requires the creation of a bond market. Although with technological progress it has been possible to substantially lower the costs of creating and administering primary and secondary bond markets, the fixed costs of kick-starting such a market remain substantial. We shall denote by F the fixed cost of setting up a bond market. In addition, each bond issue involves issuing and marketing

costs which we denote by f. For simplicity we shall take $f = 0$.

The fixed costs of the bond market, F, have to be shared among all the issuers, which are all the firms who choose to issue bonds, and the government. Generally, one reason why the issuance of government bonds facilitates the emergence of a corporate bond market is simply that the government then shares part of the fixed cost F.[2]

As we shall establish below, when firms have a choice between taking out a bank loan or issuing bonds, the equilibrium financial structure will take the form that all firms with low default risk ($p \geq \widehat{p}$) will issue bonds and all other firms that can obtain financing take out a bank loan ($p \in (p_B, \widehat{p})$). If it is optimal for the government to kick-start a corporate bond market it is also efficient to raise all public debt in the form of government bonds. Indeed, by maximizing the share of bond financing the government thereby helps minimize the cost of bond issues for corporations. In sum, when a bond market is set up and bond issues are a source of funding for corporations then the total equilibrium volume of bond issues is given by $(1 - \widehat{p}) + G$ and the total unit cost of a bond issue is given by $F/((1 - \widehat{p}) + G)$, where, of course, $\widehat{p}$ and G are endogenously determined variables.

The repayments on a bank loan R_L and on a bond R_B can therefore be determined as follows

$$(1 - \overline{\phi}) \left[pR_L + (1 - p)v \right] = (1 + r_F)(1 + \rho)$$

$$pR_B = (1 + r_F)(1 + \frac{F}{(1 - \widehat{p} + G)})$$

[2] As Dittmar and Yuan (2005) show, another benefit for corporate bond issuers of the presence of a government bond market is that it allows investors in corporate bonds to hedge country macroeconomic risks and thus lowers the cost of capital for corporate bond issuers.

The firm with probability of failure $(1-\widehat{p})$ is by definition indifferent between bond and bank financing, so that $\widehat{p}$ is given by the solution to the following equation:

$$\widehat{p}\left[(1-\tau)(\mu+\frac{1+\delta}{2}+v)\right]-\left[(1+r_F)\left(1+\frac{F}{(1-\widehat{p}+G)}\right)\right]=$$

$$=(1-\overline{\phi})\widehat{p}\left[(1-\tau)(\mu+\delta+(1-\delta)\frac{1+\overline{\phi}}{2})+v\right]-\left[(1+r_F)(1+\rho)-(1-\overline{\phi})(1-\widehat{p})v\right] \tag{11}$$

The *LHS* of this equation is the return obtained under bond financing. A bond-financed firm only repays its debts when it is successful and is otherwise unaffected by any crisis resulting from a government debt default. Such a firm must offer in expected terms $(1+r_F)$ to its investors and it must cover the cost of the bond issue $F(1+r_F)/(1-\widehat{p}+G)$.

The *RHS* is the return obtained under bank financing. A bank-financed firm only obtains a return and repays its debts when there is no sovereign debt crisis and when it is successful. This happens with probability $(1-\overline{\phi})\widehat{p}$. Again, such a firm must offer in expected terms $(1+r_F)(1+\rho)$ to the bank. Still, the bank obtains some form of repayment from the firm whenever there is no crisis: with probability $(1-\overline{\phi})(1-\widehat{p})$, it obtains v if the firm is unsuccessful which is to be subtracted from the previous term.

Simplifying equation (11) we obtain:

$$(1+r_F)\left[\frac{F}{(1-\widehat{p}+G)}-\rho\right]+(1-\overline{\phi})(1-\widehat{p})v=\widehat{p}\overline{\phi}\left[(1-\tau)(\mu+\delta+\frac{\overline{\phi}}{2}(1-\delta))+v\right] \tag{12}$$

Also, for any firm p, define $\omega(p)$ as the difference between the net return of borrowing through a bank loan and through issuing a bond. This is given

by

$$p\omega(p) = (1-\overline{\phi})(1-p)v - p\overline{\phi}\left[(1-\tau)(\mu+\delta+\frac{\overline{\phi}}{2}(1-\delta))+v\right] + (1+r_F)\left[\frac{F}{(1-\widehat{p}+G)}-\rho\right]$$

Since, by definition, $\widehat{p}\omega(\widehat{p}) = 0$, this can be rewritten as,

$$\begin{aligned} p\omega(p) &= p\omega(p) - \widehat{p}\omega(\widehat{p}) \\ &= (\widehat{p}-p)(1-\overline{\phi})v - (p-\widehat{p})\overline{\phi}(1-\tau)(\mu+\delta+v+\frac{\overline{\phi}}{2}(1-\delta)) \end{aligned}$$

which is decreasing in p given that v and $\overline{\phi}(\mu+\delta+v+\frac{\overline{\phi}}{2}(1-\delta))$ are positive.

Therefore, it follows that if a firm with probability of success $\widehat{p}$ is indifferent between bond and bank financing then any firm with probability of success $p > \widehat{p}$ strictly prefers issuing bonds.

Notice that the expression for $p\omega(p)$ has a natural interpretation. The first term on the *RHS* represents the benefit of flexible financing offered by bank lending. That is, banks are able to appropriate a salvage value of v even when the firm is not successful, provided there is no financial crisis. The second term, which can be written more transparently as $\overline{\phi}p(E[V(\phi) \mid \phi < \overline{\phi}])$, represents the banking financed firms loss generated by a financial crises.

The optimal level of G will now be determined, with a different constraint regarding total savings, as, instead of (1), we have:

$$F + G + 1 - \widehat{p} + (\widehat{p} - p_B)(1+\rho) = S \tag{13}$$

Also, constraint (5) is slightly modified, and becomes

$$(1+r_D)(1+\rho) = [p_B(1-\tau)(\mu+\delta+(1-\delta)\frac{1+\overline{\phi}}{2}) + v] \tag{14}$$

Notice also that equation (12) is quadratic in $\widehat{p}$. Thus, for any given amount of government expenditure G, the question whether it is feasible to

kick-start a bond market at all reduces to the question whether the relevant root to equation (12) lies in the interval $(p_B(G), 1)$.

4.1 A special case: No fixed costs of issuing bonds

Although it is clearly unrealistic to assume no fixed costs for creating a bond market and issuing bonds, it is still worth analyzing as a benchmark the special case where $F = 0$, as this is a particularly simple case. When $F = 0$ we can see from equation (12) that the marginal firm is given by

$$\widehat{p} = \frac{(1-\overline{\phi})v - (1+r_F)\rho}{\overline{\phi}((1-\tau)(\mu+\delta+\frac{\overline{\phi}}{2}(1-\delta)) + v}.$$

Thus, in this case, provided $(1-\overline{\phi})v - (1+r_F)\rho > 0$, there will always be a domestic bond market and it will be larger the more inefficient the banking sector is, as measured by the difference between $(1-\overline{\phi})v$ and $(1+r_F)\rho$. In the limit, for large values of ρ and small values of v, the banking sector vanishes.

When $F = 0$ the objective function of the government becomes:

$$\max_G \Gamma G + \int_{\overline{\phi}(G)}^{1} \Delta(\phi)d\phi \int_{p_B}^{\widehat{p}} pdp + (1-\overline{\phi})(\widehat{p} - p_B(G))v + \qquad (15)$$
$$+(\mu + v + \frac{1+\delta}{2}) \int_{\widehat{p}}^{1} pdp$$

The third term in (15) is due to the fact that when the government defaults on its debt and thereby pulls down the banking sector, the firms that financed themselves with bonds are shielded from the crisis. Thus, this term reflects the benefits of bond markets that have been referred to as the "spare tire" benefit.

Note that it is implicit in our formulation that a government default reduces to zero the output of those firms that are bank financed, while it does not affect the output of firms funded by the issue of bonds. This is

an extreme assumption, which provides a stark illustration of the potential benefits of bond financing. Alternative assumptions will be discussed below.

It is easy to see from the objective (15) that the presence of a bond market reduces the opportunity cost of government spending and thus increases the incentives of the government to set a higher level of sovereign risk,$\overline{\phi}$, than would be the case in the absence of a bond market.

Still, there are three elements that might compensate for this.

First, notice that the net amount of savings is increased. Thus, for the optimal level of government spending G^*, equation (13) implies a lower p_B. The fact that a larger population of firms invests implies a larger amount of tax revenues.

Second, for the optimal level of government spending G^*, interest rate will fall as a result of a decrease in p_B in equation (14), reflecting the increase in the net supply of savings.

Third, the more efficient funding of the government, through the bond market implies that the total cost of government spending, $G(1 + \frac{G}{1-\widehat{p}+G})$ is lower than under bank finance, $G(1 + \rho)$.

The change in equilibrium of these variables will compensate the incentives to increase risk.

4.2 The general case with positive bond issuing costs: when is it desirable to create a bond market?

When the creation of a bond market involves a positive cost $F > 0$ it is not always welfare improving to create a bond market, simply because the incremental transactions costs may be larger the "spare tire" benefits. In this section we provide a sufficient condition under which the creation of a bond market is welfare improving. Specifically, we show that the following

proposition holds:

Proposition 1: It is always desirable to introduce a bond market when there exists a cutoff $\widehat{p} \in (p_B(G), 1)$ for which,

$$\int_{\widehat{p}}^{1} p\omega(p)dp \geq (1-\overline{\phi}(G^*)) \left[\int_{p_B(G^*)}^{\widehat{p}_B(G^*)} pdp \int_{\overline{\phi}(G^*)}^{1} \Delta(\phi)d\phi + v(1-\overline{\phi}(G))(\widehat{p}_B(G^*) - p_B(G^*))\right] \quad (16)$$

where $\widehat{p}_B(G))$ is given by the solution $\widehat{p}_B$ to (13).

Remark: Note that when

$$\frac{F}{1-\widehat{p}+G} - \rho < 0$$

the switch to bond financing for the government 'releases' new resources for investment, so that $\widehat{p}_B(G) < p_B(G)$. The *RHS* of condition (16) is then negative, and Proposition 1 is always fulfilled.

Proof: If $G(\frac{F}{1-\widehat{p}+G} - \rho) < 0$, the proof is obvious, so we will focus on the case $G(\frac{F}{1-\widehat{p}+G} - \rho) > 0$. Assume first that $G = G^*$ following the introduction of a bond market. Three types of agents are affected by the introduction of a bond market. The firms issuing bonds (with $p \in (\widehat{p}, 1)$), the government who switches from bank financing to bond financing, and credit rationed firms with $p \in (p_B(G), \widehat{p}_B(G))$ that the introduction of a bond market deprives from credit. Collectively these three types of agents benefit from the introduction of a bond market when condition (16) holds. Bond-issuing firms benefit by revealed preference, and (16) states that these benefits outweigh the potential social costs of increased borrowing costs for the government of $G(\frac{F}{1-\widehat{p}+G} - \rho)$, which results in increased credit rationing of firms from

$[0, p_B(G))$ to $[0, \widehat{p}_B(G))$. Finally, observe that when the government introduces a bond market it will also adjust G to a new optimal level G^{**} and thus obtains a further increase in social welfare. ■

Namely, the welfare function becomes:

$$\max_G \Gamma G + \int_{\overline{\phi}(G)}^{1} \Delta(\phi) d\phi \int_{p_B}^{\widehat{p}} p dp + (1 - \overline{\phi})(\widehat{p} - p_B)v +$$
$$+(1 - \widehat{p}) \left[(\mu + v + \frac{1+\delta}{2}) \int_{\widehat{p}}^{1} \frac{p}{1 - \widehat{p}} dp \right]$$

It is easy to check that welfare improves by the creation of a bond market, as every firm on the interval $(\widehat{p}, 1)$ simply internalize the direct welfare gains obtained by switching to a cheaper source of funds. This increases welfare by the amount $\int_{\widehat{p}}^{1} \omega(p) dp$. But there is also an additional indirect welfare gain that stems from the spare tire effect.

To summarize, there are two benefits of the existence of a bond market:

1) the classical effect of providing lower cost financing to the safest firms

2) the insulation of the safest part of firms from the cost of a bank crisis.

Interestingly, the benefit of creating bond financing in EME is thus even greater than in advanced economies, where the risk of a banking crisis is negligible. However, there are fixed cost to setting up a bond market and there is a fixed costs for firms in issuing bonds (which are related to the size of the bond issues). So, government intervention might be welcome to kick start the bond market.

Because of the fixed costs, it is clear that large EMEs will benefit from the creation of a domestic corporate bond market while for the smaller EMEs, the economy may be too small to benefit from it. For these smaller economies, the alternative is either to turn to an international bond market, with the

drawback of exposing the country to currency risk, or else to develop securitization and the CDO market, which involves smaller fixed costs per issue, because of the pooling of smaller loans in a unique issue.

On the other hand, as we have shown above, the emergence of a bond market comes at the cost of an increase in the risk of government debt default.

4.3 Securitization

Our model allows us to distinguish between debt securities issued directly by firms through bond issues and debt securities issued indirectly by loan-originating banks against bank loan assets, the so-called collateralized debt obligations (CDOs). The main features of securitization we stress are the following:

1. Securitization involves duplication of transactions costs: to produce a one dollar CDO a bank must first incur a transaction cost ρ by extending a loan to a firm; second to "securitize" that loan the bank must incur bond issuing costs $F/(1-\widehat{p}+G)$.

2. The benefit of securitization relative to a direct bond issue is that it preserves the flexibility of bank financing, as the originating bank continues to play its restructuring role.

3. In the event of a banking crisis the trust issuing the CDOs is shielded from the recovery actions of depositors running on the bank.

There are several other aspects of securitization that our model abstracts from, however. In particular, we do not model tax and bank equity-capital savings, the risk-diversification benefits of loan pooling, adverse selection issues, and credit enhancement.

This simplified model of securitization allows us to compare the relative performance of bonds, bank loans, and securitized bank loans. Concretely,

a marginal firm $\widehat{p}$ that is indifferent between bank lending (without securitization) and bond financing, strictly prefers securitized bank lending if and only if $(1-\widehat{p})v-\rho(1+r_F)>0$. Indeed, by choosing a securitized bank loan over a bond issue this firm incurs an additional transactions cost ρ but also obtains an additional benefit from flexible financing of $(1-\widehat{p})v$. Remarkably, in order to determine the effects of securitization in our model we only need to focus on this marginal firm, which leads us to obtain the following result.

Proposition 2: For F sufficiently small equilibrium where $\widehat{p}<1$, and therefore a bond market exists, all firms with $p\in(p_B,\underline{p}_S)$ are financed through (non-securitized bank loans), all firms with $p\in(\underline{p}_S,\overline{p}_S)$ are financed through securitized bank loans, and all firms with $p\in(\overline{p}_S,1)$ are financed by issuing bonds, where $\underline{p}_S<\widehat{p}<\overline{p}_S\leq 1$.

Proof: For $F=0$, $\widehat{p}=\frac{(1-\overline{\phi})v-\rho(1+r_F)}{\overline{\phi}((1-\tau)(\mu+\delta+\frac{\overline{\phi}}{2}(1-\delta))+v}$. On the other hand, $\overline{p}_S$ is defined as the indifference point between bond financing and securitized bank lending. As a consequence, it is defined by $(1-\overline{\phi})(1-\overline{p}_S)v-\rho(1+r_F)=0$, implying $\overline{p}_S=\frac{(1-\overline{\phi})v-\rho(1+r_F)}{(1-\overline{\phi})v}$. Thus, $\widehat{p}<\overline{p}_S$, as $\overline{\phi}.>0$.

Since at point $\widehat{p}$ bank loan financing and bond financing are indifferent, by transitivity, securitized bank lending also strictly dominates bank lending at $\widehat{p}$. Consequently $\underline{p}_S$, the indifference point between on-balance bank lending and securitized bank lending has to satisfy $\underline{p}_S<\widehat{p}$.■

Note that the interval $(p_B,\underline{p}_S)$ and $(\overline{p}_S,1)$ might be empty, which corresponds, respectively, to the case of securitization of all the portfolio of loans and to the case where the bond market disappears.

Thus, our proposition establishes that, whenever a bond market exists, securitization will emerge, reducing the volume of direct bond issues. Still, even when the bond market does not exist, that is, where $\widehat{p}>1$, securitization may be feasible. This will be the case whenever $\underline{p}_S\leq 1\leq\overline{p}_S$.

4.4 The benefits of decoupling

As noted above, one of the benefits of the existence of a bond market is that it shields bond financed firms from government debt default crises. In addition, by shifting government debt away from banks and into the hands of bond holders, the creation of a bond market also makes possible the decoupling of banking from public finances. That is, more specifically, it makes possible the removal of government debt from the balance sheet of banks, and thus reduces the exposure of banks to government debt default crises. This opens the door for the possibility that banks themselves may be able to survive a government debt crisis. The extent to which this benefit can be reaped may require regulatory intervention.

Currently, under Basle I regulations, banks have incentives to hold government debt as it is considered a safe asset and therefore requires no equity capital. However, as Basle II acknowledges, in EMEs government debt is typically risky and should require capital. Our analysis suggests that it might be desirable to completely prevent banks from holding their country's government debt, whether it takes the form of bank loans or Treasury bonds and, by the same token, banks should not be in the business of underwriting government bond issues, as is generally the case. Banks would then be maximally shielded from a government debt default crisis. In practice, this is generally not the case, as banks typically invest a large fraction of their portfolios in Treasuries[3]. Thus, for banks to be shielded from a government default, the existence of a corporate bond market is necessary but not sufficient.

Still, it may be argued that even if banks are theoretically decoupled from government debt, this will not be sufficient to prevent government debt

[3]In some countries, like India or Colombia, Treasuries represent a large percentage of the banks' portfolio. In some cases, this may be mandatory. If this is the case, decoupling is not feasible, except if banks hold a sufficient amount of capital.

default to trigger a banking crisis through indirect channels.

4.5 The Implications of Indirect Contagion

In a purely banking economy, banks have to finance the government, and thus a government debt default immediately triggers a bank crisis. When government issues debt directly through the bond markets, a bank run develops or not depending on the portfolio of banks. While these are clear channels of direct contagion, there are, nevertheless reasons to believe that a government default has an effect on the country's overall economic performance. We therefore define *indirect contagion* to refer to the impact of a government debt default on the performance of successful firms, $V(\phi)$, and, as a consequence on the profitability of the banking industry. While it is plausible that some degree of contagion always exists, the magnitude of contagion depends on the specific characteristics of the country. In particular, whether the country is a large exporter or not may be a key issue in determining the level of indirect contagion. For example, for large exporters like Korea there may be relatively low contagion and the spare tire role of corporate bond markets may be fully effective, while for low exporters like Argentina contagion may be so high that the spare tire effect may not be present.

The first and main channel for indirect contagion is the very effect of a government default on firms profits. One possible reason, although clearly not the only one, occurs in financially open countries, in case economic sanctions are imposed. Again, the effect may be different depending on whether the firm is bond financed or bank financed. Regarding banks, a lower return on firms will increase banks loan losses, which in turn may trigger their failure. On the other hand, a lower return on bond financed firms will only

affect investors.

Our modelling of a firm's output allow us to introduce the effect of indirect contagion in a very simple way, by assuming that μ is lost whenever there is a government debt default. This introduces the following changes into our model:

1) Because of this effect, banks may fail even if they do not hold government bonds. In other words, decoupling is ineffective.

2) in this case, if there is no decoupling, so that government debt default triggers a banking crisis anyway, then the only visible effect of the creation of a bond market is limited as the benefits of avoiding the effects of a bank run are reduced because of indirect contagion.

Hence, in order to reap the benefits of decoupling μ has to be sufficiently small, so that indirect contagion does not undermine the banking system.

5 Equilibrium in an open economy

Liberalization implies access to new markets for funds, thus lowering the cost of capital to the international level, r_F. This means that the equality between domestic investment and savings, formalized by equation (1), is replaced by

1.

$$1 + r_F = (1 + r_{GI})(1 - \overline{\phi}_I) \tag{18}$$

and the equilibrium jointly determines the variables $G, r_G, \overline{\phi}$ and p_B through equations (18), (4),(5) and condition (7).

The benefits of financial openness are obvious, as a higher access to finance at a lower cost of funds increases the number of projects that are implemented in equilibrium, which in our model is captured by an increase in the number of operating firms $1 - p_B$.

Still, there are several dimensions to be considered in the effect of liberalization that depends on a country's financial architecture. To analyze them, we consider a scenario of full liberalization where both domestic banks and domestic bond markets compete in order to obtain foreign funds, deposits or investment, where the government is able to get funding either from foreign banks or by tapping the foreign bond market. We disregard here the fact that domestic depositors can diversify their savings by opening deposit accounts in both domestic and foreign banks, as this does not appear to be a critical issue.

5.1 Effect of liberalization on decoupling

As it is obvious, liberalization will allow an increase in the equilibrium level of public expenses, G. Nevertheless, this need not imply that it will lead, per se to a higher level of sovereign risk. Indeed, the larger level of expenses could be compensated by the increase of the tax base driven by the decrease in p_B.

Our model allow us to examine several issues depending on the extent of decoupling and contagion.

5.1.1 Direct contagion and decoupling effect

Foreign investment can take several forms depending on whether a bond market exists or not. Indeed, if a bond market exists, it allows for additional channels of foreign investment

1. Bank debt only

   In this case, foreign investors, and specially foreign banks, can either lend directly to the government or they can lend to the domestic banks

that will channel the funds thus borrowed internationally to the government. In our framework this two forms of funding the government will have different effect.

In the first case, direct lending by foreign investors, the effect is to obtain decoupling. This is the case as foreign banks are well diversified, so that a government debt default will not trigger their bankruptcy, and, even so, the foreign bank's bankruptcy will not affect the EME firms.

In the second case, domestic banks will go bankrupt and therefore will "pull the plug" on domestic firms.

2. Coexistence of banks and a corporate bond market

In the presence of a bond market, the Government will issue Treasury bonds, and, in equilibrium these will also be held by foreign investors. Consequently, decoupling will be here obtained much more easily.

Thus to summarize, except for the case where foreign banks lend to EME banks that, in turn, lend to government, financial openness will foster decoupling of government debt default and banking crises. One very important reason why we should expect no decoupling effect is that, because of monitoring reasons akin to those modelled in Bolton and Scharfstein (1990),foreign lending to the government through the domestic banking system is short-term liquid lending, while direct lending by foreign banks to the government is generally longer-term illiquid lending, which means that foreigners lending directly to the government could be disadvantaged in the event of a crisis. This may be one important reason why foreigners may choose to channel their funds to the government through the domestic banking system, thus limiting the possibilities of decoupling.

5.1.2 Indirect contagion

When indirect contagion stems from the effect of debt default on economic growth, it is clear that the presence of foreign investors with well diversified portfolios will reduce the impact of a government debt default. Still, as mentioned before, a government debt default may imply economic sanctions or other measures that will lead to a reduction of economic growth. In this case, obviously, indirect contagion will be increased by financial openness.

5.1.3 Sudden stop

To cope with the phenomenon of sudden stop, our model has to be extended so as to allow for runs by foreigners. This implies that, in addition to government debt default, sudden stop could also trigger a banking crisis. This "sudden stop" is known to be a key issue in EMEs financial fragility (Guillermo Calvo, Becker, T. and P. Mauro (2006). The risk of a "sudden stop" is directly related to EMEs banks being funded through short term deposits.

6 Effect of Liberalization on the Bond Market

A second point that our model allows to study is the effect of financial openness on the bond market. Because of our assumption on the distribution of fixed costs among the different issuers, when we consider two countries, the efficient solution requires coordination of all countries, so as to issue in a unique market. To the extent that this leaves intact the possibilities of firms to issue bonds, that is, in terms of our model, if $\widehat{p}$ is unaffected or decrease, this should be beneficial for the country. Still, if there are additional costs,

(such as regulatory, auditing and disclosing costs) that makes it difficult for some of the firms to issue bonds abroad, then there is a cost duplication, as firms issuing bonds in the domestic market will have to share the burden of the aggregate cost F, while EME firms issuing bonds in the international market will also pay a cost without generating any externality to domestic potential issuers. The interpretation of this cost of duplications in terms of liquidity is straightforward: liquidity is obviously decreased when firms issue in different markets.

7 A numerical illustration

The following numerical example illustrates the importance of financial architecture on the level of default risk the government is willing to take.

We have set the model's parameters as follows:

Γ= 1.3; $\nu = 0.7$;

μ= 0.2;

$\delta = 0.3$;

$\tau = 0.2$;

$\rho = 0.05$;

$F = 0.01$

In the case of a closed economy, the level of savings, s, in the first line of the first two tables, takes values between 0.20 and 0.60. In the case of an open economy, the level of international interest rates, r_F, in the first line of the last two tables, takes values between 1% and 10%.

The striking result we obtain is that, for the parameter constellation we have chosen, financial market is more important in determining the value of the probability of default, $\overline{\phi}$, than the degree of openness of the economy. Absent bond markets, the cost of systemic risk is too high for the government

of bear any default risk. Yet, when a bond market exist, the government has incentives to increase its indebtedness and therefore its probability of default.

Closed Economy. No Bond Market

s	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
G^*	0.0129	0.0161	0.0193	0.0225	0.0257	0.0289	0.0321	0.0356	0.0434
$\overline{\phi}$	0	0	0	0	0	0	0	0	0
p_B	0.8224	0.7780	0.7335	0.6891	0.6447	0.6003	0.5559	0.5118	0.4719
r_G	0.2592	0.2290	0.1988	0.1686	0.1384	0.1082	0.0780	0.0486	0.0297
r_F	0.2592	0.2290	0.1988	0.1686	0.1384	0.1082	0.0780	0.0478	0.0176

Closed Economy. Bond Market

s	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
G^*	0.0143	0.0177	0.0210	0.0244	0.0277	0.0340	0.0416	0.0495	0.0576
$\overline{\phi}$	0.1139	0.1067	0.1017	0.0976	0.0938	0.0822	0.0874	0.0636	0.0542
p_B	0.8249	0.7813	0.7375	0.6935	0.6494	0.6094	0.5618	0.5296	0.4901
$\widehat{p}$	0.8375	0.8544	0.8660	0.8751	0.8832	0.9175	0.8973	0.9320	0.9396
r_G	0.2260	0.1949	0.1643	0.1338	0.1035	0.0786	0.0958	0.0319	0.0092
r_F	0.0864	0.0673	0.0458	0.0232	0	0	0	0	0

Open Economy. No Bond Market

r_F	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
G^*	0.0339	0.0328	0.0317	0.0306	0.0295	0.0284	0.0272	0.0261	0.0250	0.0239
$\overline{\phi}$	0	0	0	0	0	0	0	0	0	0
p_B	0.5301	0.5456	0.5610	0.5765	0.5919	0.6074	0.6228	0.6382	0.6537	0.6691
r_{GI}	0.0605	0.0710	0.0815	0.0920	0.1025	0.1130	0.1235	0.1340	0.1445	0.1550

Open Economy. Bond Market

r_F	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
G^*	0.0263	0.0249	0.0235	0.0221	0.0207	0.0193	0.0178	0.0164	0.0150	0.0135
$\overline{\phi}$	0.0914	0.0926	0.0939	0.0951	0.0964	0.0976	0.0989	0.1001	0.1014	0.1027
p_B	0.6621	0.6804	0.6988	0.7172	0.7356	0.7541	0.7726	0.7912	0.8098	0.8284
$\widehat{p}$	0.9082	0.9064	0.9046	0.9028	0.9010	0.8992	0.8974	0.8956	0.8938	0.8919
r_{GI}	0.1116	0.1241	0.1367	0.1493	0.1620	0.1747	0.1874	0.2002	0.2130	0.2258

8 Conclusion

This paper models an EME characterized by an endogenous level of public expenditure and a corresponding risk of sovereign default, where the extent of finance to the private sector is jointly determined by government expenditure, sovereign risk and the availability of external funding. The main conclusion of our paper is that financial architecture will play a key role in economic development for several reasons: one, as it happens in developed economies, because it decreases the cost of funds to firms by allowing them to choose between bond finance and bank finance; the other, because it provides the economy with a "spare tire", as the corporate bond market need not be affected by a banking crisis. This is so because a well-developed corporate bond market may partially insulated firms against sovereign default risk and the associated bank credit crunch risk. This effect can even have a greater

impact if it allows to increase the banking sector resilience by insulating it from government debt crises. This can happen because government debt is held outside the banking sector, either domestic non-bank investors or foreign bank or non-bank ones.

Still, there are important limits to this effect when government debt default has an impact on firms' profitability. If this is the case, although theoretically at arm's length from a government debt crisis, because this affects firms, it leads to an increase in banks loan losses and thus creates an indirect contagion channel, making banks vulnerable to government debt default.

The financial openness of a EME will help development not only by providing access to international financial markets with lower rates, but also by allowing to take government debt out of banks portfolio, and consequently will allow for decoupling. Still, the risk of "sudden stop" with foreign depositors running the bank should be accounted for as a possible negative effect. From this perspective, accessing the international financial market through a bond market which is not vulnerable to "sudden stop" makes it all the more attractive to create a bond market.

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