Bank loans versus bond finance: implications for sovereign debtors

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Abstract

This paper develops a model to analyse the optimal choice between bank loans and bond finance for a sovereign debtor. We show that if banks have better information about their borrowers compared to bondholders, only the least risky sovereigns issue bonds. But if borrowers can be 'publicly monitored' by an outside agency that disseminates the information about their creditworthiness, their choice between bank loans and bond finance is determined endogenously by the trade-off between two deadweight costs: the crisis cost of a sovereign default and the cost of debtor moral hazard. In equilibrium, sovereigns use bank loans for financing short-term projects and bond issuance for projects with uncertain timing of cash flows if crisis costs are large. We also demonstrate that state-contingent debt and IMF intervention can improve welfare.

Key words: Crisis management, international financial architecture, sovereign debt, state-contingent debt.

JEL classification: F33, F34, G15, G21.

Summary

Since the 1990s, syndicated bank lending to emerging market sovereigns has declined steadily, while eurobond issuance has increased. This paper tries to explain why these countries have recently shifted towards bond finance and considers the implications.

In this model, sovereigns' incentive to repay their debt arises from their desire to avoid a financial crisis which could be triggered by a default. Sovereigns have different risk characteristics, and the information about their creditworthiness can only be obtained through costly monitoring. Whereas banks can monitor their borrowers directly, the cost of monitoring is too high for small individual bondholders. But sovereigns wishing to issue bonds can hire a credit rating agency to monitor them and publish its assessment. Therefore, the critical difference between bank lending and bond finance is that banks act as *private monitors* and keep their assessment of the borrower private, whereas rating agencies act as *public monitors* and disseminate this information not only to the existing bondholders but also to third parties – ie potential future creditors. Consequently, bank loans are non-transferable whereas public monitoring makes bonds transferable by eliminating the information asymmetry between the existing creditors and potential future creditors.

When the timing of cash flow is uncertain, borrowers prefer long-term financing because short-term credit entails a risk of interim debt restructuring and crisis. Transferability makes bonds cheaper for long-term financing compared to bank loans, given that it is costly for banks to commit to holding a claim for multiple periods. Thus, when the cost of information dissemination is low and crisis costs are large, borrowers issue long-term bonds for financing projects with uncertain timing of cash flows, and use bank loans only for financing strictly short-term projects.

Our analysis shows that there are two inefficiencies in the current international financial system which is dominated by long-term bond financing. First, although the possibility of a financial crisis is necessary to prevent strategic defaults, it is *ex post* a deadweight cost if a default is unavoidable. Second, long-term bond issuers are subject to moral hazard, because the fear of a financial crisis prevents them from restructuring their unsustainable debt at an early stage. We demonstrate that state-contingent debt and IMF intervention to prevent a crisis conditional on the restructuring of an unsustainable debt are both welfare improving.

1 Introduction

International bonds have rapidly replaced syndicated bank lending as the main source of finance for emerging market economies (EMEs). Eurobonds now account for close to 90% of new international debt issuance by EME sovereigns, up from only 4% in 1980 (Chart 2, Appendix 1). Moreover, whereas only a handful of the most creditworthy sovereigns were able to issue eurobonds in the 1980s, an increasing number of low-rated EMEs have gained access to the international bond market during the 1990s. Another stylised fact is that eurobonds are also the preferred source of long-term financing for EME sovereigns. Whereas the average maturity of syndicated loans granted to EME sovereigns during 2000-03 was 5.3 years, eurobonds issued by the same group had an average maturity of 10.0 years (Chart 3, Appendix 1).(1)

How do sovereigns with external financing requirements choose between bank debt and bond issuance? This paper tries to address this question by developing a model to analyse the optimal choice between bank loans and bond finance for a sovereign debtor. In our model, both debt maturity and default risk are endogenously determined. Our analysis suggests that the increased proportion of bond finance and the longer maturity of bond debt are closely related. We show that EME sovereigns prefer long-term debt over short-term debt because they want to minimise the risk of a potential crisis, and bonds are cheaper for long-term financing since they are 'publicly monitored' and therefore more easily transferable. We also evaluate the welfare costs associated with each type of finance and consider policies to mitigate these costs.

This paper is related to the existing corporate finance literature on a firm's choice between bank loans and bond finance. One strand of this literature focuses on the difference in the information available to banks and bondholders. In Rajan (1992), an informed bank makes the efficient decision of terminating projects with negative net present value at the interim stage, whereas uninformed bondholders let all projects continue. But the bank also demands a surplus from the project and this causes the borrower to reduce effort *ex ante*. So the choice between bank debt and bond finance depends on whether the *ex-post* continuation inefficiency with bondholders outweighs the possible distortion to effort incentives with the bank debt.

An alternative strand of this literature emphasises the difference in the number of creditors.

(1) The average maturity is weighted by the size of the issue.

Whereas syndicated bank loans are typically managed by one or two banks, bonds are held by a large number of anonymous creditors. Bolton and Scharfstein (1996) show that the number of creditors affects the creditors' and the firm manager's pay-offs at default if a firm's creditors are secured on different assets, and the assets are worth more combined than separated. Consequently, the number of creditors also determine the liquidation value of the firm and the probability of its liquidation. It turns out that the optimal number of creditors is determined by the trade-off between deterring strategic defaults and minimising the *ex-post* inefficiency of liquidation. The optimal contract involves less risky firms borrowing from multiple lenders to prevent strategic default, whereas the more risky ones borrow from one lender to minimise the inefficiency of liquidation.

Information and the number of creditors also turn out to be crucial in understanding a sovereign's choice between bank loans and bond finance, but these corporate finance models are not directly applicable for analysing sovereign borrowing. Unlike in the case of corporate financing, banks do not have obvious informational advantage over bondholders in all areas of sovereign lending. For instance, governments typically publish information related to their financial positions – such as fiscal and macroeconomic figures – in order to explain their budgets to taxpayers, whereas only listed companies are obliged to disclose information about their accounts. Similarly, Bolton and Scharfstein's (1996) argument does not apply in this context since sovereign lending is usually not collateralised.

The model in this paper instead suggests that one of the key differences between the two types of sovereign debt is that bank loans are based on *private monitoring* whereas bond finance relies on *public monitoring* by credit rating agencies. A role for monitoring arises despite the plethora of publicly available information, because making an assessment of a borrower's creditworthiness based on this information is costly. Whereas banks normally keep their credit assessments private, a sovereign issuing bonds usually obtains a credit rating from a rating agency, which acts as a *public monitor* and publishes their assessments about the borrower's creditworthiness to the market. The public monitoring therefore makes bonds more easily transferable compared to bank loans by eliminating the information asymmetry between the existing creditors and third parties.

Another important difference between bank lending and bond finance is that the former is financed by a few, identifiable creditors, whereas the latter is held by a large number of anonymous and dispersed creditors. Consequently, rolling over bank loans is easier compared to bonds. We will show that these two differences make bank loans cheaper for short-term financing, whereas bonds are more attractive for long-term financing.

Any analysis of sovereign borrowing also needs to address the question of why sovereigns repay their debt despite the absence of a collateral or a bankruptcy procedure. Eaton and Gersovitz (1981) argue that a sovereign's incentive to repay debt arises from their desire to maintain a good reputation in order to secure future access to credit markets. But Bulow and Rogoff (1989) have subsequently shown that this desire to maintain future market access provides an insufficient motivation for a country to repay if cash-in-advance contracts, fully indexed to the same states of nature as the debt contract, are available to a debtor that reneges on its debts. In this view, sovereign lending is possible only if creditors have either political rights which enable them to threaten the debtor's interests outside its borrowing relationships, or legal rights to impede its trade or to seize its financial assets abroad. But in practice, creditors have rarely been able to use such sanctions against a sovereign in default.

This paper therefore follows Dooley (2000) in which the desire to avoid a financial crisis acts as an incentive for sovereigns to repay their debt. In our model, the threat of a costly crisis is necessary to rule out strategic defaults and enable international lending, but output loss following an inevitable and involuntary default is inefficient. As an extension, we also consider how an international financial institution (IFI) could reduce these inefficient crisis costs without encouraging strategic defaults. Our analysis focuses on policies for resolving solvency crises rather than liquidity crises, since there is already a rich set of papers which analyse sovereign liquidity crises.[2]

In our paper, EME sovereigns favour long-term debt over short-term debt because they want to minimise the risk of a crisis. Since bonds are 'publicly monitored' and therefore transferable, they are cheaper for long-term financing. We believe that rating agencies have played a catalytic role as 'public monitors' in enabling the EMEs to issue bonds once a liquid market was created by the Brady Deal – which converted defaulted bank loans into tradable bonds. This view is consistent with the evidence that the number of rated EMEs increased rapidly in tandem with EME bond

(2) Morris and Shin (2004) use a global game set-up to show that if bondholders receive noisy information, a small change in the debtor's creditworthiness can trigger an inefficient liquidity crisis. For applications of this method to sovereign debt crises, see *inter alia* Chui *et al* (2002) and Haldane *et al* (2005).

issuance in the 1990s. Between 1990 and 2002, the number of EME sovereigns rated by Moody's rose from 8 to 65, and the same by S&P's increased from 11 to 68 (Chart 4, Appendix 1).[3]

This explanation differs from Bolton and Jeanne (2005), who argue that bond finance may have increased in the 1990s since bonds are more difficult to restructure and hence perceived to be *de facto* senior to bank loans. The evidence supporting their hypothesis is inconclusive, since bond debt restructurings in the 1990s and 2000s were very rapid (with the exception of Argentina), compared to the protracted negotiations over defaulted bank debt in the 1980s. Indeed, none of the bond renegotiations in Pakistan, Ukraine, Ecuador, Russia and Uruguay took more than two years.[4]

The rest of the paper is organised as follows. Section 2 first presents a model in which the difference between bank lending and bond finance is that of *monitored* and *non-monitored* lending. In this set-up, banks can observe the financial state of the borrower in the interim at some cost and renegotiate the repayment terms, whereas bondholders simply stop lending to all borrowers facing repayment difficulties since obtaining information and renegotiating the contract is too costly for them. This stylised set-up clarifies the precise role of monitoring in a debt contract, and shows that if only banks can monitor their borrowers, only the least risky borrowers issue bonds. Section 3 then develops a more realistic model, in which bank loans are provided by a single lender using *private monitoring*, whereas bond debts are financed by multiple lenders using *public monitoring*. In this modified set-up, sovereign borrowers can pay a credit rating agency to publicise information about their creditworthiness. We show that the debtor's choice between bank and bond finance and their respective maturity are determined endogenously by the trade-off between two deadweight costs: output loss caused by sovereign default and the cost of debtor moral hazard. Section 4 considers whether state-contingent debt and IMF intervention can improve welfare, and Section 5 concludes.

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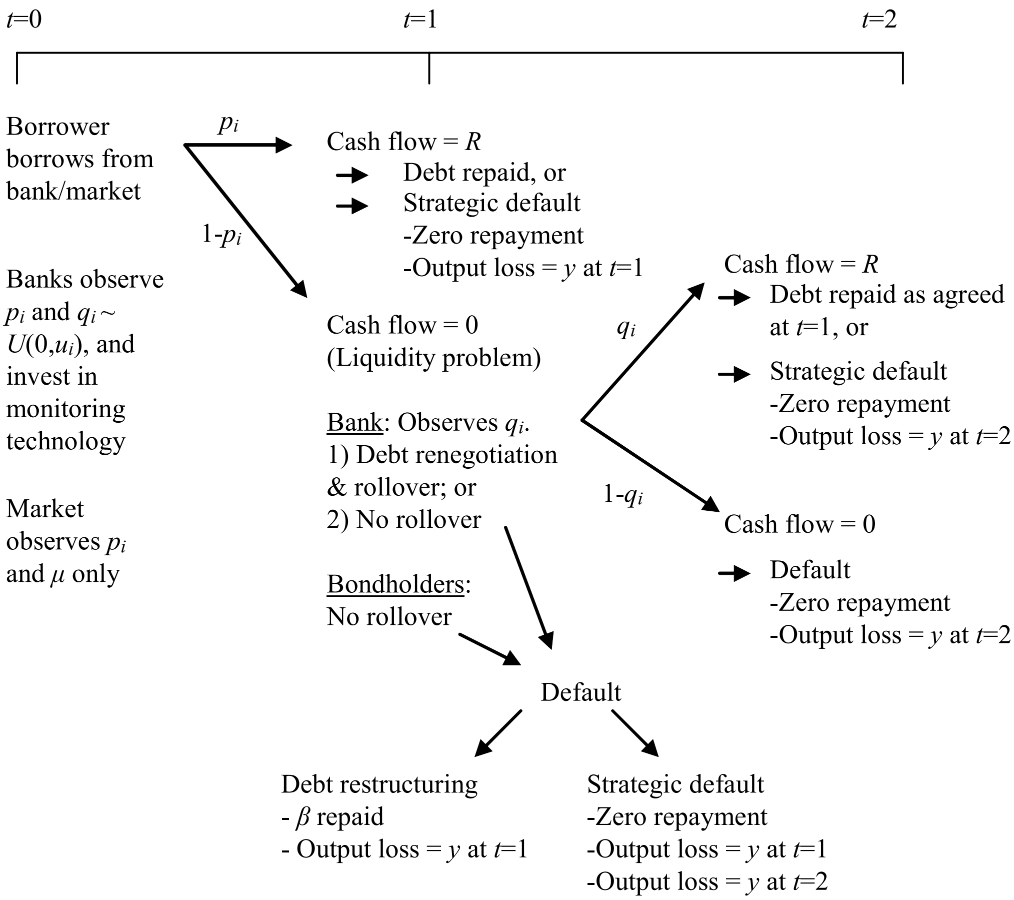
(3) Moody's (2003) and S&P's (2002).

(4) Sturzenegger (2002) speculates that the presence of a large number of diverse players in the financial market today makes it more likely that lending can resume quickly after debt restructuring, giving debtors a strong incentive to negotiate with the creditors. However, Roubini and Setser (2004) argue that these bond restructurings were relatively easy because of the small number of bonds outstanding, and the debt renegotiation in Argentina – which defaulted with 90 bonds outstanding – proved to be much more difficult.

2 The model

Consider a three-period game ($t = 0, 1, 2$), with $i = 1..N$ sovereigns (see Chart 1). At $t = 0$, each sovereign has one unit of external financing need and can either borrow from a bank or issue bonds. Assume that banks and bondholders are risk-neutral and face an opportunity cost ρ per unit of lending, which can be interpreted as the global (safe) interest rate.

Chart 1: Timing of the game



Sovereign borrowers differ in risk characteristics, parameterised as p_i and q_i. With probability p_i, the sovereign i receives a cash flow $R > \rho$ at $t = 1$ and has the ability to fully service its debt. But with probability $1 - p_i$, the sovereign faces a *liquidity problem* at $t = 1$, and receives a zero cash flow. If the creditors roll over their lending to a sovereign facing a liquidity problem at $t = 1$, the sovereign receives a cash flow equal to R with probability q_i, and zero with probability $1 - q_i$ at $t = 2$. But if creditors do not roll over at $t = 1$, the debtor is forced to default and can pay out a maximum of $\beta < \rho$ to the creditors. The debtor could, for example, make this partial repayment β by raising funds through sales of government assets.

The game ends at $t = 1$ if the cash flow is R and the debt is fully repaid, or if the creditors refuse to roll over following a liquidity problem and the debtor agrees to repay β. But it continues if creditors decide to roll over the credit to a borrower facing a liquidity problem at $t = 1$. We assume that if the cash flow at $t = 2$ is again zero, the sovereign can pay out nothing to the creditors. This captures the possibility that an early debt restructuring might be desirable and delaying a default can be costly. We now define the concept of *sovereign insolvency* and *default.*

Definition 1 At $t = 1$, a sovereign is *illiquid but solvent* if $q_i > \frac{\beta}{R}$, but it is *insolvent* if $q_i \leq \frac{\beta}{R}$.

Definition 2 At $t = 1$, a sovereign is in default whenever it fails to meet its contractual debt obligation as agreed at $t = 0$ in full and its creditors refuse to roll over the debt. At $t = 2$, a sovereign is in default whenever it fails to meet its contractual debt obligation as agreed at $t = 1$ in full.

Thus, creditors are collectively better off by agreeing to an early debt restructuring and receiving β at $t = 1$ if the debtor is insolvent, whereas they are better off by rolling over if it is illiquid. However, an illiquid but solvent debtor may also be forced to default if creditors refuse to roll over the debt at $t = 1$.

Given the absence of a sovereign bankruptcy court, the debtor could default strategically. A *strategic default* is said to occur either when the realised cash flow is R but the debtor refuses to service its debt in full, or when creditors do not roll over at $t = 1$ and the debtor does not repay the maximum possible amount β. However, if the sovereign defaults at any point, the domestic economy experiences output loss equal to y – a 'crisis cost' – during the same period. In addition, we assume that if the sovereign in default fails to reach a debt restructuring agreement with its creditors within one period, the economy experiences output loss in the subsequent period as well.

The maximum possible contractual debt repayment, denoted r, depends on whether the incentive constraint not to default strategically ($r \leq y$) or the cash-flow constraint ($r \leq R$) binds first. If $y < R$, the borrower cannot credibly pledge the maximum cash flow R towards debt repayment given its incentive to default strategically whenever $r > y$. If, on the other hand:

$$y > R \quad \textbf{(1)}$$

then the cost of a strategic default is sufficiently large so that the borrower can pledge a maximum of R towards the debt repayment. In what follows, we assume that **(1)** holds for expositional simplicity.

2.1 No public monitoring

We first consider the case in which only banks have access to a monitoring technology that allows them to verify the financial state of the borrower in the interim. Thus, the difference between bank lending and bond finance here is that of monitored and non-monitored finance. Assume that p_i $(0 \leq p_i \leq 1)$ is common knowledge, interpreted as publicly available information about the sovereign's *ex-ante* creditworthiness. However, banks and bondholders differ in their ability to observe q_i. In particular, banks have access to a monitoring technology which requires an investment c per unit of lending and allows them to observe the *ex-ante* distribution of q_i at $t = 0$. We assume that *ex ante*, q_i is uniformly distributed with $q_i \sim U[0, u_i]$ where $\frac{\beta}{R} \leq u_i \leq 1$ and $\bar{q}_i = \frac{u_i}{2}$. In addition, the monitoring technology allows banks to observe the actual realisation of q_i at $t = 1$.

If the sovereign issues bonds, it will need to borrow from multiple small investors. Assume that monitoring is too expensive for individual investors, so that bondholders do not monitor their borrowers. Without monitoring, bondholders can only observe the population mean of $\bar{q}_i$, denoted $\mu \equiv \frac{1}{N} \sum_1^N \bar{q}_i$, at $t = 0$, and cannot verify the realisation of q_i at $t = 1$. We assume that $\mu < \frac{\beta}{R}$, so that it is optimal for bondholders not to roll over the credit to any borrower that is in a liquidity problem at $t = 1$ given their limited knowledge about the latter's financial state.

For simplicity, the following analysis will focus exclusively on short-term lending where the contractual repayment is due at $t = 1$. We will consider the possibility of long-term finance in Section 3. The analysis in this section also assumes that contracts are incomplete, so that the repayment cannot be made contingent on cash flow. The implications of state-contingent debt will be considered in Section 4. We assume that both credit markets are perfectly competitive, and that neither the borrowers nor lenders discount the future. For expositional simplicity, the subscript i is dropped from subsequent discussions whenever possible.

2.1.1 *Short-term bank finance*

The equilibrium pricing of bank loans is derived using the backwards induction. If the realised cash flow is R at $t = 1$ and **(1)** holds, the sovereign repays its debt in full and the game ends. If the cash flow is zero at $t = 1$, the bank verifies q and decides whether to roll over the loan. Assume that if the bank decides to roll over, it enters into Nash bargaining with the borrower over the terms of repayment. But since the borrower suffers a crisis if the bargaining fails, it has no bargaining power *vis-à-vis* the creditors. Hence, it can be shown that rollover occurs if and only if the sovereign is solvent ($q > \frac{\beta}{R}$), and that the bank captures all of the $t = 2$ cash flow R following a rollover if **(1)** holds (see Appendix 2).[5]

Assuming perfect competition among banks, the interest rate charged on bank loans, r_B, is determined by the zero profit condition:

$$pr_B + (1 - p)Z = \rho + c$$

where

$$Z \equiv \int_{\frac{\beta}{R}}^{u} qRf(q)dq + \int_{0}^{\frac{\beta}{R}} \beta f(q)dq \qquad \textbf{(2)}$$

Z is the net worth of a borrower facing a liquidity problem at $t = 1$, conditional on the lending being terminated if and only if it is insolvent. The equilibrium interest rate is therefore given by:

$$r_B^* = \frac{\rho + c - (1 - p)Z}{p} \qquad \textbf{(3)}$$

Under the assumption **(1)**, the maximum risk level at which the bank is willing to lend is determined by the cash-flow constraint, $r_B^* \leq R$. Banks are therefore willing to lend if and only if $p > \hat{p}_B$, where:

$$\hat{p}_B \equiv \frac{\rho + c - Z}{R - Z} \qquad \textbf{(4)}$$

2.1.2 *Short-term bond finance*

Suppose that the borrower instead issues bonds with the repayment due at $t = 1$. Bondholders will not roll over credit to borrowers facing liquidity problems at $t = 1$, since $\mu < \frac{\beta}{R}$. Hence, they are willing to lend at a contractual interest rate r_b, which solves the zero profit condition:

$$pr_b + (1 - p)\beta = \rho$$

(5) Nash bargaining can be viewed as a reduced-form sequential bargaining game. See Binmore, Rubinstein and Wolinsky (1986).

The equilibrium bond rate is therefore given by:

$$r_b^* = \frac{\rho - (1-p)\beta}{p} \quad \textbf{(5)}$$

Given the cash-flow constraint, the bond market is willing to lend to any borrower with $p \geq \hat{p}_b$, where:

$$\hat{p}_b \equiv \frac{\rho - \beta}{R - \beta} \quad \textbf{(6)}$$

2.1.3 Equilibrium financing

In equilibrium, borrowers choose the type of finance that maximises their expected pay-off, given that the financing costs are determined by perfect competition. A sovereign's expected pay-off from borrowing from a bank (denoted $V_B(p)$) and from the bond market (denoted $V_b(p)$) are given by:

$$V_B(p) = p(R - r_B) - (1-p)Y_B = pR + (1-p)(Z - Y_B) - \rho - c \quad \textbf{(7)}$$

$$V_b(p) = p(R - r_b) - (1-p)y = pR + (1-p)(\beta - y) - \rho \quad \textbf{(8)}$$

where Y_B is the expected crisis cost under bank finance, defined as:

$$Y_B \equiv y\left(\int_{\frac{\beta}{R}}^{u} (1-q)f(q)dq + \int_0^{\frac{\beta}{R}} f(q)dq\right) \quad \textbf{(9)}$$

Borrowers prefer bond finance over bank lending as long as $V_b(p) \geq V_B(p)$.

Proposition 1 If only banks can monitor their borrowers, bank lending and bond finance coexist if and only if $0 < c < \frac{(R-\rho)(Z-\beta+y-Y_B)}{R-\beta+y}$. Under this condition, borrowers with $p \in [p_b^*, 1]$ issue bonds, whereas those with $p \in [p_B^*, p_b^*)$ borrow from banks and those with $p \in [0, p_B^*)$ will not borrow, where $p_b^* \equiv 1 - \frac{c}{(Z-\beta+y-Y_B)}$, $p_B^* \equiv \frac{\rho+c+Y_B-Z}{R+Y_B-Z}$, and $p_B^* < p_b^*$. In equilibrium, no credit rationing occurs since $p_b^* > \hat{p}_b$ and $p_B^* > \hat{p}_B$ as long as $0 < c < \frac{(R-\rho)(Z-\beta+y-Y_B)}{R-\beta+y}$.

Proof. See Appendix 2.

The condition for the coexistence of bank lending and bond finance, given by $0 < c < \frac{(R-\rho)(Z-\beta+y-Y_B)}{R-\beta+y}$, has an intuitive interpretation. The term $(Z - \beta + y - Y_B)$ is the net benefit of monitoring the borrower and rolling over the debt if and only if it is solvent, instead of terminating lending to all borrowers facing liquidity problems at $t = 1$. Thus, bank lending strictly dominates bond finance when monitoring is costless ($c = 0$). But if the cost of monitoring is high ($c \geq \frac{(R-\rho)(Z-\beta+y-Y_B)}{R-\beta+y}$), no country borrows from banks and only those with the lowest default probabilities ($p > \frac{\rho-\beta+y}{R-\beta+y}$) issue bonds.

Hence, the borrower's choice between bank loans and bond finance is determined by the relative cost and benefit of monitoring. The benefit of monitoring is small for borrowers facing a low-risk of liquidity problems, whereas it is large for high-risk borrowers who value the option of renegotiating the contract in the interim. This may explain why only low-risk EMEs issued bonds during the 1980s.

Credit rationing does not occur because borrowers internalise crisis costs, whereas creditors do not. So sovereigns stop borrowing when the probability of receiving a positive cash flow at $t = 1$ is below p_B^*, even though banks are willing to finance some of these risky borrowers. Thus, all sovereigns that want to borrow are able to obtain credit. The expressions **(3)** and **(5)** show that both the loan and bond rates rise by $\frac{1}{p}$ in response to a marginal rise in the global safe rate, ρ. This is consistent with the observation that spreads tend to rise especially sharply for risky (low p) borrowers when the risk-free rate increases.

3 Allowing for public monitoring

The assumption that banks have better information about the borrower compared to the market, however, may not be valid in the context of sovereign lending. While small, unlisted companies often don't publish information about their accounts, governments normally publish information about their financial states. Moreover, bond issuers are typically also 'monitored' by credit rating agencies which publish their assessments of the issuers' creditworthiness. In practice, it is virtually impossible for EME sovereigns to issue bonds in the international market without having a credit rating.

Thus, we now modify the model to allow an outside agency to monitor the borrower and publish its credit assessments to the bond market. This means that bondholders now have access to the same information and assessment about the borrower's creditworthiness as banks. But bank loans and bonds differ in two important ways. First, bank lending relies on *private monitoring*, which keeps the assessment of the borrowers private to the creditor bank, whereas bond finance is based on *public monitoring*, which makes this information publicly available.[6] Thus, public monitoring makes bonds transferable by eliminating the information asymmetry between the existing creditors and the third parties – ie future potential creditors. Second, bonds are typically held by a large number of dispersed creditors, whereas syndicated bank lending is usually managed by one or two institutions. Thus, even if banks and bondholders have exactly the same information about the borrower's financial state, co-ordinating a rollover in the interim may be much more difficult with bond finance.

In this modified set-up, each borrower has the option of paying a 'public monitor' – eg a credit rating agency – to publish the *ex-ante* distribution of q_i at $t = 0$, and the realisation of q_i at $t = 1$ if it enters into a liquidity problem. Public monitors incur a small 'announcement cost' ε in disseminating this information to the market, in addition to the monitoring cost c. Assuming that the market for public monitoring is perfectly competitive, a public monitor charges $c + \varepsilon$ to their clients and earns zero profit. It is straightforward to demonstrate that if public monitors care about their reputation, they have the incentive to report the truth about their clients' creditworthiness as long as bondholders can detect false reports with a small probability.

This section will also analyse whether borrowers use different types of credit depending on the maturity of their projects. Thus, we now assume that each borrower indexed by p has two types of projects – Project U and Project S. The timing of cash flow for Project U is uncertain, as described in the previous section (see Chart 1), whereas Project S is strictly short term and generates a cash flow R with probability p and zero with probability $1 - p$ at $t = 1$ but nothing at $t = 2$. Project S can be thought of as a special case of Project U, where q is always equal to zero. Both bank loans and bond finance are now available at different maturities. As before, short-term credit is repayable at $t = 1$ but can be rolled over in the interim. In addition, we introduce long-term credit which is repayable at $t = 2$.

(6) Our analysis implicitly assumes that loans are provided by a single bank, or a syndicate which acts like a single bank. In the case of syndicated bank lending, the information obtained by the syndicate manager is shared within the syndicate only. In this sense, syndicated lending also relies on private monitoring, constraining the transfers of claims to parties outside the syndicate. Although some bondholders holding a large stake in one sovereign may monitor it privately, those that hold dispersed portfolio are likely to rely on public monitoring service provided by rating agencies.

3.1 Short-term bank finance

The previous section already described short-term bank loans, which are repayable at $t = 1$ with the possibility of a rollover for an additional period. Hence, the contractual rate of return and the cut-off risk level at which the bank stops lending are given by **(3)** and **(4)**, respectively.

3.2 Long-term bank finance

If the bank lends long term with the repayment due at $t = 2$, it cannot interfere with an insolvent borrower at $t = 1$. It can be shown that borrowers will never opt for an early debt restructuring at $t = 1$ when the payment is due at $t = 2$. This is because for the borrower, the cost of defaulting and restructuring the debt at $t = 1$ is always larger than the cost of waiting until $t = 2$, since:

$$q(R - r) - (1 - q)y > -y \qquad \textbf{(10)}$$

where r is the contractual repayment due at $t = 2$. The left-hand side of **(10)** is the borrower's expected pay-off from waiting until the $t = 2$ cash flow is realised, while the right-hand side is its pay-off from defaulting and seeking a debt restructuring at $t = 1$. This is a form of an *ex-post* debtor moral hazard – often called 'gambling for resurrection' – and it is costly for creditors who prefer an early debt restructuring at $t = 1$ whenever $q < \frac{\beta}{R}$.

Suppose that it is costly for banks to continue holding claims that are effectively in default ($q < \frac{\beta}{R}$) at $t = 1$. This may be the case, for instance, if banks face a regulatory requirement to make specific provisions against individual loans that are identified to have become impaired in the interim. Specifically, assume that banks face a regulatory requirement to provision against expected losses for all loans with $q < \frac{\beta}{R}$ at $t = 1$, and the cost of provisioning per unit of loan is given by k.[7] Since q_i is a private information to the bank, banks cannot sell their long-term claims to a third party in the interim due to the adverse selection problem. Thus, the contractual repayment of long-term bank loans, denoted $r_{B,l}$, is determined by the following zero profit

(7) This provisioning cost is introduced to capture the cost of committing to hold non-transferable claims for two periods. The qualitative results of our analysis do not change as long as the non-transferability of claims is costly for banks, which we believe to be a realistic assumption. Moreover, this provisioning requirement implies that banks have to monitor their long-term loans even though they cannot interfere with the borrowers in the interim.

condition (the subscript i is dropped for expositional simplicity):

$$pr_{B,l} + (1-p)\left(\bar{q}r_{B,l} - k\int_0^{\frac{\beta}{R}} f(q)dq\right) = \rho + c$$

where $\bar{q} = \bar{q}_i = \frac{u_i}{2}$. Solving for $r_{B,l}$, the equilibrium loan rate is given by:

$$r^*_{B,l} = \frac{\rho + c + (1-p)k\int_0^{\frac{\beta}{R}} f(q)dq}{p + (1-p)\bar{q}} \quad \textbf{(11)}$$

Given the cash-flow constraint, banks are willing to lend as long as $p > \hat{p}_{B,l}$, where:

$$\hat{p}_{B,l} = \frac{\rho - \bar{q}R + k\int_0^{\frac{\beta}{R}} f(q)dq}{(1-\bar{q})R + k\int_0^{\frac{\beta}{R}} f(q)dq} \quad \textbf{(12)}$$

3.3 Short-term bond finance

Suppose that the borrower issues short-term bonds repayable at $t = 1$ as before, but it now hires a public monitor to publish its assessment of the borrower's creditworthiness so that the market can observe q_i. If bondholders can observe q_i at $t = 1$, they might be willing to participate in a debt exchange to extend the maturity should the borrower face a liquidity problem. Consider a distressed debt exchange at $t = 1$, in which the borrower facing a liquidity problem offers bondholders the option of exchanging their claims for a new debt paying the original contractual rate at $t = 2$ with probability q. If the debt exchange fails, the borrower is forced to default and the bondholders receive a repayment equal to β.

Suppose that a fraction γ of the bondholders participate in the debt exchange at $t = 1$. If an early partial debt repayment is costly – for instance, because it requires a premature liquidation of public sector projects – the debt exchange reduces $t = 2$ cash flow to $\lambda(\gamma)\gamma R$. The variable $\lambda(\gamma)$ captures the cost of disruption caused by repaying some investors at $t = 1$, where $\frac{\partial\lambda}{\partial\gamma} > 0$, $\lambda(0) = 0$ and $\lambda(1) = 1$. Under these assumptions, none of the bondholders will agree to a swap ($\gamma = 0$) if $q \leq \frac{\beta}{R}$, and there are multiple equilibria if q is in the range of $\frac{\beta}{R} < q < u$: given the strategic complementarity in the rollover game, either all of the bondholders agree to a swap, or none of them do so. Thus, bondholders will never extend the debt maturity if the sovereign is insolvent. But even if it is solvent, co-ordination failure can force a sovereign into an inefficient default.

For simplicity, let π be the probability of co-ordination failure when q is in the range of

$\frac{\beta}{R} < q < u$. The zero profit condition for bondholders is given by:

$$r_{b,s}\left(p + (1-p)(1-\pi)\int_{\frac{\beta}{R}}^{u} qf(q)dq\right) + \beta(1-p)\left(\pi\int_{\frac{\beta}{R}}^{u} f(q)dq + \int_{0}^{\frac{\beta}{R}} f(q)dq\right) = \rho$$

Thus, the equilibrium short-term bond rate is:

$$r_{b,s}^{*} = \frac{\rho - (1-p)\beta\left(\pi\int_{\frac{\beta}{R}}^{u} f(q)dq + \int_{0}^{\frac{\beta}{R}} f(q)dq\right)}{p + (1-p)(1-\pi)\int_{\frac{\beta}{R}}^{u} qf(q)dq} \quad \textbf{(13)}$$

The bond market is willing to lend only to a borrower with $p > \hat{p}_{b,s}$, where:

$$\hat{p}_{b,s} = \frac{\rho - Z + \pi\int_{\frac{\beta}{R}}^{u}(qR-\beta)f(q)dq}{R - Z + \pi\int_{\frac{\beta}{R}}^{u}(qR-\beta)f(q)dq} \quad \textbf{(14)}$$

where Z is given by **(2)**. A comparison of **(14)** with **(6)** shows that $\hat{p}_{b,s} < \hat{p}_{b}$, so that the observability of q_i makes bondholders willing to lend to riskier borrowers *ex ante*.

3.4 Long-term bond financing

Consider a long-term bond with the contractual repayment due at $t = 2$. Like long-term bank loans, such bonds are subject to debtor moral hazard and thus will not be restructured in the interim. But public monitoring eliminates the adverse selection problem: since the rating agency publishes the information about q_i, long-term bonds can be traded in the secondary market at $t = 1$. The transferability implies that bondholders facing a provisioning rule – such as banks – can sell the claim in the interim to another party which is not subject to this regulation – such a hedge fund – so that the cost of provisioning need not be priced in.

Hence, the long-term bond rate, $r_{b,l}$, is determined by the zero profit condition:

$$pr_{b,l} + (1-p)\bar{q}r_{b,l} = \rho$$

where $\bar{q} = \bar{q}_i = \frac{u_i}{2}$. Solving for $r_{b,l}$,

$$r_{b,l}^{*} = \frac{\rho}{p + (1-p)\bar{q}} \quad \textbf{(15)}$$

Given the resource constraint, investors are willing to buy long-term bonds as long as $p > \hat{p}_{b,l}$, where

$$\hat{p}_{b,l} = \frac{\rho - \bar{q}R}{(1-\bar{q})R} \quad \textbf{(16)}$$

3.5 The choice between bank loans versus bond finance

The borrower's expected pay-off from obtaining short-term and long-term bank loans – denoted $V_{B,s}$ and $V_{B,l}$, respectively – are given by:

$$V_{B,s}(p) = pR + (1-p)(Z - Y_B) - \rho - c \quad \textbf{(17)}$$

$$V_{B,l}(p) = pR + (1-p)\left(\int_0^u (qR - y(1-q)) f(q)dq - k\int_0^{\frac{\beta}{R}} f(q)dq\right) - \rho - c \quad \textbf{(18)}$$

where Z is given by **(2)**, and $V_{B,s}$ is the same as **(7)**. Since borrowers issuing bonds pay a fee equal to $c + \varepsilon$ to a rating agency, their expected pay-off from issuing short-term bond ($V_{b,s}$) and long-term bond ($V_{b,l}$), are given by:

$$V_{b,s}(p) = pR + (1-p)(Z - Y_B) - (1-p)\pi\int_{\frac{\beta}{R}}^u (y + qR - \beta) f(q)dq - \rho - c - \varepsilon \quad \textbf{(19)}$$

$$V_{b,l}(p) = pR + (1-p)\int_0^u (qR - y(1-q)) f(q)dq - \rho - c - \varepsilon \quad \textbf{(20)}$$

The derivations of **(18)** and **(20)** are shown in Appendix 2. Using the above expressions, we can state the following about the borrower's choice between bank loans and bond finance when public monitoring is available:

Proposition 2 When public monitoring is available, borrowers prefer bank loans over bond finance for financing short-term projects. If ε is small and the crisis cost y is large, borrowers issue long-term bonds to finance projects with uncertain timing of cash flows.

Proof. The expressions **(17)** and **(19)** show that short-term bank lending strictly dominates short-term bond finance, since $V_{b,s}(p) < V_{B,s}(p)$ for all $\pi > 0$ and $\varepsilon > 0$. Thus, borrowers always use bank loans to finance Project S.

Project U can be financed by short-term or long-term credit. We first show that long-term bond issuance dominates long-term bank loans if ε is small. From **(18)** and **(20)**, $V_{b,l}(p) > V_{B,l}(p)$ if and only if:

$$\varepsilon < (1-p)k\int_0^{\frac{\beta}{R}} f(q)dq$$

Thus, borrowers prefer long-term bonds over long-term bank finance for a small ε.

Next, we must show that long-term bonds dominate short-term bank loans. From **(17)** and **(20)**, borrowers choose long-term bond finance over short-term bank loans when $V_{b,l}(p) > V_{B,s}(p)$, ie if:

$$\varepsilon < (1-p)\left[\int_0^{u} (qR - y(1-q))\, f(q)dq - (Z - Y_B)\right] \qquad \textbf{(21)}$$

The right-hand side of **(21)** is positive as long as:

$$\int_0^{\frac{\beta}{R}} (\beta - qR) f(q)dq < y\int_0^{\frac{\beta}{R}} qf(q)dq$$

The left-hand side is the benefit of restructuring the debt of all insolvent borrowers at $t = 1$, whereas the right-hand side is the crisis cost of implementing this rule. Using $q_i \sim U[0, u_i]$, this inequality can be expressed as $\frac{R+y}{2R} > 1$, which holds under the assumption **(1)**. Thus, if the crisis costs are large and the announcement cost is small, borrowers issue long-term bonds to finance Project U (QED).

Proposition 2 is consistent with the empirical observations that syndicated bank loans to EME sovereigns tend to have shorter maturity compared to eurobonds. Borrowers use bank loans for short-term financing since the announcement cost makes bonds more expensive and their rollover is subject to co-ordination failures. But long-term bonds are preferred over long-term bank loans if the benefit of transferability outweighs the announcement cost.

If ε is small, borrowers' choice between short-term bank loans and long-term bond issuance for financing projects with uncertain timing of cash flows (Project U) is determined by the trade-off between two deadweight costs: the cost of debtor moral hazard versus the crisis cost of a default at $t = 1$. Short-term bank lending eliminates debtor moral hazard by ensuring that unsustainable debt is restructured early, but only at the cost of causing a crisis at $t = 1$. Long-term bond finance is subject to debtor moral hazard and delays the restructuring of an unsustainable debt, but it has the advantage of allowing borrowers to avoid a costly default with some probability. So if the crisis costs are large and the announcement cost ε is small, all those with $p > p^*_{b,l}$ issue bonds to finance project U, where:

$$p^*_{b,l} = \frac{\rho + c + \varepsilon - \int_0^u (qR - y(1-q))\, f(q)dq}{R - \int_0^u (qR - y(1-q))\, f(q)dq}$$

Our analysis provides one explanation as to why eurobond issuance has overtaken syndicated bank lending to EMEs during the 1990s. Given that the crisis cost of a default is large, borrowers prefer to obtain long-term credit when the timing of cash flow is uncertain, and issuing long-term bonds is cheaper than obtaining long-term bank loans since public monitoring makes bonds transferable.

We have assumed that countries cannot issue bonds at $t = 1$ after q is realised in order to avoid default on short-term bank loans or bonds. In Appendix 2, we demonstrate that sovereigns that are insolvent at $t = 1$ cannot issue bonds, even if we relax this assumption and allow bond issuance at $t = 1$.

3.6 Endogenous default risk

So what is the impact of the recent shift from short-term bank loans to long-term bond financing on debtors' default probabilities? To answer this question, we must analyse how different types of finance affects the borrower's risk-taking behaviour. Suppose now that borrowers are able to increase p by exerting some effort $e(p)$ at $t = 0$, where $e'(p) > 0$ and $e''(p) > 0$. Assuming that creditors can observe $e(p)$ before they make their lending decisions, borrowers using short-term bank loans and long-term bonds choose p that maximises $V_{B,s}(p) - e(p)$ and $V_{b,l}(p) - e(p)$, respectively.

Proposition 3 Long-term bond financing has two opposing effects on the debtor's default probability, so that the overall impact is ambiguous. Relative to short-term bank loans, long-term bond finance increases the probability of interim liquidity problem by reducing the debtor's effort *ex ante*, but it also reduces the default probability of those entering into a liquidity problem.

Proof. From the first-order conditions, borrowers using bank finance will choose p which solves:

$$e'(p) = R - (Z - Y_B) \qquad \textbf{(22)}$$

whereas those using long-term bond finance choose p which solves:

$$e'(p) = R - \left(\int_0^u (qR - y(1-q)) f(q) dq \right) \qquad \textbf{(23)}$$

Denoting the solutions to **(22)** and **(23)** as $\tilde{p}_B$ and $\tilde{p}_b$, $\tilde{p}_b < \tilde{p}_B$ as long as the right-hand side of **(21)** is positive, which has already been proven. The default probabilities under bank finance (δ_B)

and bond finance (δ_b) are therefore given by:

$$\delta_B = (1 - \tilde{p}_B)\left(\int_{\frac{\beta}{R}}^{u}(1-q)f(q)dq + \int_0^{\frac{\beta}{R}} f(q)dq\right)$$

and

$$\delta_b = (1 - \tilde{p}_b)\int_0^{u}(1-q)f(q)dq$$

It is clear that $(1 - \tilde{p}_B) < (1 - \tilde{p}_b)$, but $\int_{\frac{\beta}{R}}^{u}(1-q)f(q)dq + \int_0^{\frac{\beta}{R}} f(q)dq > \int_0^{u}(1-q)f(q)dq$. Thus, δ_b could be larger or smaller than δ_B (QED).

Since creditors cannot interfere with their borrowers in the interim, long-term bond finance could lower their default probabilities by allowing those borrowers facing liquidity problems to avoid a default at $t = 1$. However, the absence of interim creditor intervention lowers the debtor's *ex-ante* effort to reduce the risk of an interim liquidity problem, so that the overall effect on default probability is ambiguous. But long-term bonds unambiguously entail higher loss at default for creditors compared to short-term bank loans, since an unsustainable debt is not restructured early to maximize the recovery rate.

4 Policy options

Our analysis shows that there are two inefficiencies in today's international financial system in which long-term bond financing dominates. First, although the possibility of a financial crisis is necessary to prevent strategic defaults, it is *ex post* a deadweight cost if a default is unavoidable. Second, long-term bond issuers do not have the incentive to restructure their unsustainable debt at an early stage, making the eventual size of their defaults large.

We now consider how these two deadweight costs might be eliminated while maintaining the borrowers' incentives not to default strategically. There are two possible approaches to improve welfare. The first possibility is to redesign the bond contract. In this context, we discuss whether state-contingent debt can be a solution. The second possibility is to design a mechanism through which an international financial institution – such as the IMF – might intervene to prevent a crisis. Thus, we also consider how IMF lending conditional on an early debt restructuring might improve welfare. Since creditors always earn zero profit in equilibrium, any policy that improves the debtor's welfare is Pareto improving as long as the cost of its implementation does not exceed the improvement in the debtor's welfare it achieves.

4.1 Can state-contingent debt help?

State-contingent debt – such as bonds with coupon payments indexed to GDP growth or commodity prices – has recently received a renewed interest. Borensztein and Mauro (2002) argue that GDP-indexed bonds have the advantage of adjusting the value of debt to the borrower's repayment capacity, and thus help countries preserve their debt sustainability.

Although a full welfare assessment of GDP-linked debt is outside the scope of this paper, our analysis suggests that it could have the same disadvantage as long-term bonds. Consider a debt contract which is contingent on the realisation of R, which could be interpreted as the country's GDP. Specifically, the borrower agrees to repay r at $t = 1$ when the cash flow is R and nothing when it is zero, and to repay r at $t = 2$ if the cash flow at $t = 2$ is R. As before, the borrower defaults if the realised cash flow at $t = 2$ is zero. Since such a contract allows the borrower to avoid a default in the interim, it has no incentives to initiate an early debt restructuring even if it is insolvent ($q < \frac{\beta}{R}$) in the interim. Thus, like long-term bonds, GDP-linked debt fails to give the borrower an adequate incentive to initiate an early debt restructuring:[(8)]

But a different type of state-contingent debt, which makes the country's repayment at $t = 1$ contingent on its *expected* $t = 2$ cash flow qR – which can be interpreted as the 'GDP forecast' – can potentially be beneficial.

Proposition 4 A long-term debt contract under which the borrower repays an amount β at $t = 1$ if the expected $t = 2$ cash flow qR falls below β achieves the Pareto optimal outcome. Such a state-contingent debt contract also improves bond market access for relatively risky borrowers.

Proof. Consider a long-term bond with a contractual repayment r_{sc} which is due at $t = 2$. Suppose that the bond contract includes a clause that obliges the debtor to repay β to its creditors at $t = 1$ if the expected $t = 2$ cash flow qR falls below β, instead of repaying r_{sc} at $t = 2$. The equilibrium bond rate r^*_{sc} is determined by the zero profit condition for the creditors:

$$pr_{sc} + (1 - p)\left[\int_{\frac{\beta}{R}}^{u} qr_{sc}f(q)dq + \int_{0}^{\frac{\beta}{R}} \beta f(q)dq\right] = \rho$$

(8) In our simple set-up in which neither investors nor borrowers discount the future, state-contingent debt achieves exactly the same outcome as long-term bonds.

Thus, the equilibrium bond rate is given by:

$$r_{sc}^{*} = \frac{\rho - (1-p)\int_0^{\frac{\beta}{R}} \beta f(q)dq}{p + (1-p)\int_{\frac{\beta}{R}}^{u} q f(q)dq}$$

Given the cash-flow constraint, the bond market is willing to lend if and only if $p > \hat{p}_{b,sc}$, where $\hat{p}_{b,sc} \equiv \frac{\rho - Z}{R - Z}$. The borrower's utility is given by:

$$\begin{aligned} V_{b,sc}(p) &= p(R - r_{sc}) + (1-p)\int_{\frac{\beta}{R}}^{u} (qR - r_{sc}) - \rho - c - \varepsilon \qquad \textbf{(24)} \\ &= pR + (1-p)Z - \rho - c - \varepsilon \end{aligned}$$

Thus, all borrowers with positive net present values *ex ante* ($pR + (1-p)Z > \rho + c + \varepsilon$) will obtain financing. Comparing **(24)** with **(20)**, it can be shown that $V_{b,sc}(p) > V_{b,l}(p)$. Thus, this state-contingent debt is Pareto optimal.

Since borrowers issue state-contingent bonds as long as $V_{b,sc}(p) > 0$, all those with $p > p_{b,sc}^{*}$ will access the market, where $p_{b,sc}^{*} = \frac{\rho + c + \varepsilon - Z}{R - Z}$. Since $p_{b,sc}^{*} > \hat{p}_{b,sc}$, borrowers do not face a credit constraint. Comparing **(20)** and **(24)**, and using the fact that $\int_0^u (qR - y(1-q)) f(q)dq < Z$, it can be shown that the necessary and sufficient condition for $p_{b,sc}^{*} < p_{b,l}^{*}$ to hold is $\rho + c + \varepsilon < R$, which is a necessary condition for lending to occur in the first place. Hence, state-contingent debt improves market access for relatively risky borrowers (QED).

Thus, in theory, such a state-contingent debt contract can eliminate both the crisis cost and the debtor moral hazard by automatically reducing (and accelerating) the debt repayment whenever the default probability rises above a certain threshold. But such a state-contingent contract might not be possible in practice, unless all of q, R, and β are observable and verifiable. Although the debt could be linked to forecasts published by an independent body, such as credit rating agencies or the IMF, debtors may be tempted to pressure it to revise their GDP forecasts downwards in order to reduce their debt repayment.

4.2 IMF intervention conditional on early debt restructuring

We now consider how IMF intervention can achieve Pareto improvement by giving the insolvent borrowers the incentive to restructure their unsustainable debt early. From **(10)**, an early debt restructuring is incentive compatible if it gives the insolvent borrower a pay-off which is larger or equal to z, where:

$$z \equiv q(R-r) - (1-q)y \tag{25}$$

The level of z such that the borrower has the incentive to opt for an early debt restructuring if and only if $q \leq \frac{\beta}{R}$ is given by:

$$z^* = \left(\frac{\beta}{R}\right)(R-r) - \left(1-\frac{\beta}{R}\right)y \tag{26}$$

Suppose that the crisis cost y is sufficiently large so that $z^* \leq 0$, and that the IMF can eliminate y through its crisis prevention facilities at $t = 1$.(9) Depending on the nature of the crisis, the IMF might be able to prevent a crisis relatively cheaply. For instance, suppose that a crisis is caused by a run triggered by the sovereign's default on an otherwise solvent domestic financial sector. If so, providing a credit line which enables the debtor government to credibly guarantee the financial sector liability can stem such a run, so that this policy should be costless in equilibrium.(10)

Proposition 5 If $z^* \leq 0$, IMF intervention to prevent a crisis conditional on the insolvent borrower reaching a debt restructuring agreement with its creditors at $t = 1$ can lead to Pareto improvement. This policy also improves bond market access for relatively risky borrowers.

Proof. Suppose that the IMF commits to prevent a crisis and eliminate y at $t = 1$, if and only if the borrower is insolvent ($q \leq \frac{\beta}{R}$) and conditional on its reaching a debt restructuring agreement with its creditors. This policy involves setting $z = 0$ in the incentive constraint **(25)**. If the borrower and the creditors' representative enter into a Nash bargaining over the terms of restructuring, creditors will receive β as long as $\beta \leq y$, which is always satisfied under the assumption **(1)**. This policy induces all insolvent debtors to agree to an early debt restructuring and repay β to the creditors at $t = 1$ in equilibrium. The expectation of IMF intervention implies that the interest rate charged on a long-term bond is determined by the zero profit condition:

$$pr_{imf} + (1-p)Z = \rho$$

Hence:

$$r^*_{imf} = \frac{\rho - (1-p)Z}{p}$$

Given the cash-flow constraint, the bond market is willing to lend if and only if $p > \hat{p}_{b,imf}$, where $\hat{p}_{b,imf} \equiv \frac{\rho - Z}{R-Z}$. The borrower's utility under this policy is given by:

$$V_{b,imf}(p) = p(R - r_{imf}) = pR + (1-p)Z - \rho - c - \varepsilon \tag{27}$$

(9) If $z^* > 0$, an insolvent borrower will restructure its debt at $t = 1$ if and only if it receives a subsidy.
(10) Diamond and Dybvig (1983) show that a credible deposit insurance can eliminate depositor runs.

Thus, all borrowers with positive net present values *ex ante* ($pR + (1 - p)Z > \rho + c + \varepsilon$) will obtain financing. Comparing **(27)** with **(20)**, it can be shown that $V_{b,imf}(p) > V_{b,l}(p)$. Hence, this policy is Pareto improving as long as the cost of this policy does not exceed the benefit given by $V_{b,imf}(p) - V_{b,l}(p)$.

Under this IMF policy, borrowers issue bonds as long as $V_{b,imf}(p) > 0$: thus all those with $p > p^*_{b,imf}$ will access the market, where $p^*_{b,imf} = \frac{\rho+c+\varepsilon-Z}{R-Z}$. Since $p^*_{b,imf} > \hat{p}_{b,imf}$, borrowers do not face a credit constraint. Comparing **(20)** and **(27)**, and using the fact that $\int_0^u (qR - y(1-q))\, f(q)dq - Z < 0$, it can be shown that the necessary and sufficient condition for $p^*_{b,imf} < p^*_{b,l}$ to hold is $\rho + c + \varepsilon < R$, which is a necessary condition for lending to occur in the first place. Hence, this policy improves bond market access for relatively risky borrowers (QED).

Hence, IMF assistance conditional on an early debt restructuring when the debt is unsustainable can potentially eliminate the two inefficiencies associated with bond financing. Our model also shows that the IMF intervention can increase the financing available to EMEs *ex ante* by ensuring an efficient debt restructuring *ex post*. The actual IMF intervention that is closest to the one described here was seen in Uruguay in July 2003, when the third review of the stand-by arrangement was made conditional on a successful debt exchange, which extended the debt maturity and imposed some losses on creditors in net present value terms.(11)

But contrary to Roubini and Setser (2004), who have also argued in favour of IMF support for countries restructuring their debt, we emphasise that an effective intervention must satisfy several stringent criteria. First, the IMF should not stand ready to help every sovereign which defaults, since this will encourage strategic defaults. Second, the IMF should ideally support a country with an unsustainable debt only after it has reached a debt restructuring agreement with its creditors, as it did in Uruguay 2003. If IMF assistance is desperately needed to stem an imminent crisis while the debtor negotiates with its creditors, a support should be provided on a strictly temporary basis, and it ought be withdrawn should the debtor fail to reach an agreement with its creditors within a given time period; otherwise, the debtor will have no incentives to negotiate with its creditors, and the resulting fall in the *ex-post* recovery rate reduces international lending to

(11) Uruguay extended debt maturities at interest rates simliar to those in existing bond agreements but significantly below the market rate at that time. In addition, bondholders choosing not to participate became subordinated to the new issues.

EMEs *ex ante*. Third, although the elimination of crisis costs after a sovereign default at $t = 2$ is welfare improving relative to non-intervention, such a guarantee would render the type of intervention described in Proposition 5 unworkable: the debtor will always have the incentive to delay the default if it does not suffer from such a delay.

Hence, effective IMF intervention must satisfy a minimum of two conditions. First, the IMF must have accurate *information* about the borrower's financial state. The IMF must be able to distinguish between strategic and liquidity defaults, and to determine whether a country is illiquid or insolvent.(12) This implies that an effective and accurate surveillance is essential for enabling the IMF to intervene effectively in crisis countries. Second, the IMF must be able to keep its *commitment* not to support any borrowers that have defaulted strategically, including those that have sustainable debt ($q_i > \frac{\beta}{R}$) but seek to restructure their debt in order to reduce the repayment.(13)

4.3 IMF intervention with endogenous default risk

The above analysis of the IMF intervention assumes that the borrower's credit risk is exogenous. Would IMF intervention be beneficial even if the credit risk is endogenous?

Proposition 6 IMF assistance conditional on an insolvent debtor reaching a debt restructuring agreement with its creditors at $t = 1$ reduces the debtor's effort *ex ante* and thus increases its default probability. However, such an intervention is still welfare improving as long as the cost of the intervention is sufficiently small.

Proof. As before, suppose that borrowers are able to increase p by exerting some effort $e(p)$ at $t = 0$, where $e'(p) > 0$ and $e''(p) > 0$, so that long-term bond issuers choose p that maximises $V_{b,l}(p) - e(p)$ in the absence of any IMF assistance, and $V_{b,imf}(p) - e(p)$ if the IMF were to intervene as previously described. In the absence of any IMF assistance, borrowers choose p

(12) Gai *et al* (2004) also show that IMF intervention can improve welfare if it can distinguish between a strategic and an unavoidable liquidity default and reduce output loss in the case of liquidity defaults. In a different set-up, Spiegel (2005) shows that the IMF can prevent liquidity crises by offering a lending package that induces a separating equilibrium in creditors' behaviour, even if it cannot distinguish between liquidity and solvency crises. But Spiegel does not consider the possibility of *ex-post* debtor moral hazard, which is why the IMF needs information about the debtor's financial state in our approach.

(13) The IMF might be subject to a time-inconsistency problem if its utility function is closely aligned with that of the debtor.

which solves **(23)**, whereas in the presence of IMF assistance, borrowers choose p which solves:

$$e'(p) = R - Z \tag{28}$$

Thus, $\tilde{p}_{imf} < \tilde{p}_b$, where $\tilde{p}_b$ and $\tilde{p}_{imf}$ are the solutions to **(23)** and **(28)**, respectively. Thus, the presence of IMF assistance reduces the debtor's effort and increases its probability of default. But since $V_{b,imf}(p) - e(p) > V_{b,l}(p) - e(p)$ for all $0 \leq p \leq 1$, IMF intervention is still welfare improving as long as the cost of intervention does not exceed the benefit given by $\left[V_{b,imf}(\tilde{p}_{imf}) - e(\tilde{p}_{imf})\right] - \left[V_{b,l}(\tilde{p}_b) - e(\tilde{p}_b)\right]$ (QED).

This analysis shows that IMF crisis prevention facilities can cause debtor moral hazard *ex ante* by lowering its effort to reduce the default risk. But such crisis prevention facilities still have the benefits of mitigating the post-default crisis costs and the *ex-post* debtor moral hazard. Hence, the overall welfare implication is ambiguous, and depends on whether the latter benefits outweigh the cost of intervention, including its impact on *ex-ante* debtor moral hazard.

5 Conclusion

This paper is perhaps the first to shed a light on the implications of the recent shift to bond finance by EME sovereigns. Our analysis shows how the borrower's choice between bank loans and bond finance, and the maturity of the two types of debt, are endogenously determined. We show that the ease of rollover makes bank loans more attractive for short-term borrowing, whereas the transferability makes bonds cheaper for long-term financing. In addition, we show that if the crisis cost of a default is large and the cost of information dissemination is small, long-term bond finance dominates short-term bank loans for financing projects with an uncertain timing of cash flow. Thus, the large crisis costs together with the reduced cost of information dissemination may explain the recent shift towards bond finance by EME sovereigns.

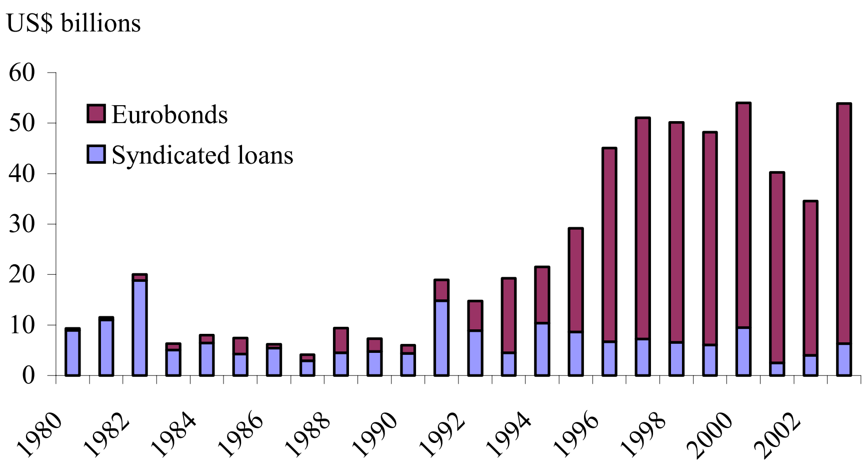
We have shown that there are two inefficiencies that arise in a world where long-term bond financing dominates: the crisis cost of a default when a default is inevitable and the *ex-post* debtor moral hazard which delays restructuring of an unsustainable debt. State-contingent debt which is linked to the debtor's GDP forecast could potentially eliminate these two inefficiencies, but such a contract may not be feasible in practice unless there are reliable GDP forecasts which debtors are unable to manipulate. We have also shown that IMF intervention to prevent a crisis conditional on an early debt restructuring can improve welfare. But such interventions can be effective only if the

IMF has an accurate information about the borrower's financial state, and it can credibly commit not to rescue strategic defaulters. Moreover, such an IMF intervention is welfare improving if and only if the benefits of mitigating the crisis costs and the *ex-post* debtor moral hazard outweigh the cost of intervention, including its implication for the *ex-ante* debtor moral hazard.

Our paper explains how the shift to long-term bond finance may delay debt restructuring. However, it abstracts away from the issue of how the process of renegotiating bond contracts may differ from that of restructuring bank debt. Similarly, we have not dealt with the question of how the conflict of interest between different classes of creditors might affect the debt renegotiation. These are both important areas for possible future research, which would help to disentangle the full implications of the rising sovereign bond finance on international financial stability and policy design.

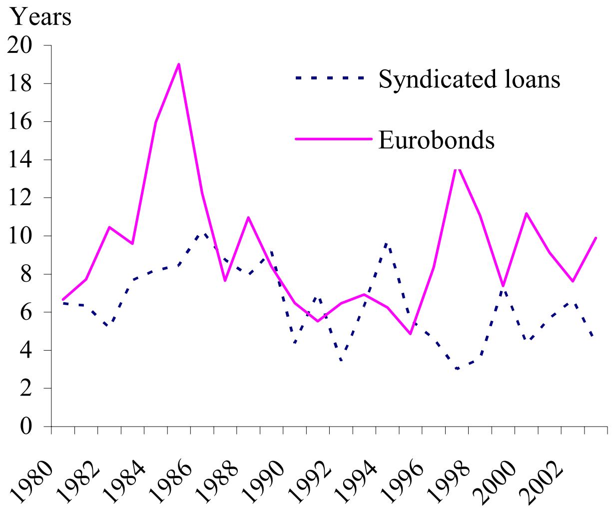
Appendix 1: Charts

Chart 2: New issuance of eurobonds and syndicated loans by emerging market sovereigns, 1980-2003



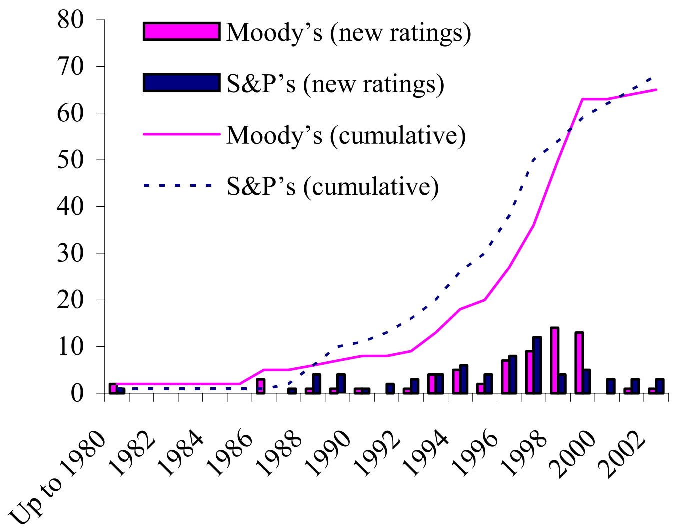
Sources: Bondware and Loanware.
Note: The chart plots the amount of new issuance.

Chart 3: Issue-weighted average maturity of syndicated loans and eurobonds issued by EME sovereigns, 1980-2002



Sources: Bondware and Loanware.

Chart 4: The number of emerging market sovereigns with credit ratings, 1980-2002.



Sources: Moody's (2003) and S&P's (2004).

Appendix 2: Proofs

Nash bargaining outcome between the bank and the borrower at $t = 1$:

Suppose that if the cash flow is zero at $t = 1$, the bank and the borrower enter into Nash bargaining over the share of cash flow R received by each party at $t = 2$. The borrower's equilibrium share of cash flow, denoted α^*, solves:

$$\max_{\alpha} N = \left[\alpha q R - (-y)\right] * \left[(1-\alpha) q R - \beta\right] \qquad \textbf{(B-1)}$$

where $\alpha q R - (-y)$ and $(1-\alpha) q R - \beta$ are the net gains for the borrower and the bank from reaching an agreement, respectively. The solution to the first-order condition is given by:

$$\alpha^* = \frac{qR - y - \beta}{2qR}$$

The expression shows that when $R < y$, $\alpha^* = 0$ so that the bank captures all of the $t = 2$ cash flow. Similarly, bargaining is not possible whenever $q < \frac{\beta}{R}$, since there is no $\alpha \in [0, 1]$ that solves the first-order condition of **(B-1)** (QED).

Proof of Proposition 1:

Borrowers prefer bond financing over bank loans if and only if $V_b > V_B$, which requires:

$$(1-p)(\beta - y) > (1-p)(Z - Y_B) - c$$

This can be rewritten as:

$$p\left[(Z-\beta) - (Y_B - y)\right] > \left[(Z-\beta) - (Y_B - y)\right] - c$$

It can be shown that $(Z-\beta)-(Y_B-y)>0$ since:

$$
\begin{aligned}
Z-\beta &= \int_{\frac{\beta}{R}}^{u} qRf(q)dq+\int_{0}^{\frac{\beta}{R}} \beta f(q)dq-\int_{0}^{u} \beta f(q)dq \\
&= \int_{\frac{\beta}{R}}^{u} (qR-\beta)f(q)dq>0
\end{aligned}
$$

and

$$
\begin{aligned}
Y_B-y &= y\left(\int_{\frac{\beta}{R}}^{u} (1-q)f(q)dq+\int_{0}^{\frac{\beta}{R}} f(q)dq-1\right) \\
&= y\left(\int_{0}^{u} f(q)dq-\int_{\frac{\beta}{R}}^{u} qf(q)dq-1\right) \\
&= y\left(-\int_{\frac{\beta}{R}}^{u} qf(q)dq\right)<0
\end{aligned}
$$

Hence, borrowers prefer bond finance over bank loans as long as $p>p_b^*\equiv 1-\frac{c}{[(Z-\beta)-(Y_B-y)]}$.

The two necessary conditions for bank loans and bond finance to coexist are (i) $0<p_b^*<1$ and (ii) $V_b(p)>0,\forall p\geq p_b^*$. The condition (i) can be expressed as:

$$0<c<(Z-\beta)-(Y_B-y) \quad \textbf{(B-2)}$$

The condition (ii) is satisfied as long as $p_b^*>\frac{\rho-\beta+y}{R-\beta+y}$, which can be rewritten as:

$$c<\frac{(R-\rho)(Z-\beta+y-Y_B)}{R-\beta+y} \quad \textbf{(B-3)}$$

Using the fact that $\frac{R-\rho}{R-\beta+y}<1$, the necessary and sufficient condition for coexistence of bank loans and bond finance can be summarised as:

$$0<c<\frac{(R-\rho)(Z-\beta+y-Y_B)}{R-\beta+y} \quad \textbf{(B-4)}$$

Those with $p \leq p_b^*$ borrow from banks as long as the participation constraint $V_B(p) > 0$ is satisfied. Hence, sovereigns with $p_B^* < p < p_b^*$ borrow from banks where $p_B^* \equiv \frac{\rho+c+Y_B-Z}{R+Y_B-Z}$.

It is straightforward to demonstrate that $p_B^* < p_b^*$ as long as the condition **(B-4)** holds. Note that $p_B^* < p_b^*$ if:

$$\frac{\rho + c + Y_B - Z}{R + Y_B - Z} < \frac{(Z - \beta + y - Y_B) - c}{(Z - \beta + y - Y_B)}$$

Solving the above for c:

$$c < \frac{(R - \rho)(Z - \beta + y - Y_B)}{R - \beta + y}$$

which is exactly the same as **(B-3)**. Hence, $p_B^* < p_b^*$ as long as bank loans and bond finance coexist.

Credit rationing does not occur in the bond market as long as $p_b^* > \hat{p}_b$, which can be reorganised as:

$$c < \left(\frac{R - \rho}{R - \beta}\right)(Z - \beta + y - Y_B) \qquad \textbf{(B-5)}$$

Since $\frac{R-\rho}{R-\beta} > \frac{R-\rho}{R-\beta+y}$, **(B-4)** is a sufficient condition for **(B-5)** to hold. Similarly, credit rationing does not occur in bank lending as long as $p_B^* > \hat{p}_B$, which can be expressed as $\frac{\rho+c-Z+Y_B}{R-Z+Y_B} > \frac{\rho+c-Z}{R-Z}$. This holds as long as $c < R - \rho$, which is satisfied under **(B-4)** since $\frac{Z-\beta+y-Y_B}{R-\beta+y} < 1$ (QED).

Derivation of (18):

Given **(10)**, the expected pay-off of the borrower from using long-term bank loans is given by:

$$V_{B,l} = p(R - r_{B,l}^*) + (1 - p)\int_0^u \left(q(R - r_{B,l}^*) - y(1 - q)\right) f(q) dq$$

Substituting **(11)** for $r^*_{B,l}$ and using $\bar{q} = \int_0^u f(q)dq$, the above can be expressed as:

$$\begin{aligned} V_{B,l} &= pR - (p + (1-p)\bar{q}) \left(\frac{\rho + c + (1-p)k \int_0^{\frac{\beta}{R}} f(q)dq}{p + (1-p)\bar{q}} \right) + (1-p) \int_0^u (qR - y(1-q)) f(q)dq \\ &= pR + (1-p) \left(\int_0^u (qR - y(1-q)) f(q)dq - k \int_0^{\frac{\beta}{R}} f(q)dq \right) - \rho - c \end{aligned}$$

The expression **(17)** can be derived using a similar method.

Derivation of (20):

Since the borrowers issuing bonds pay monitoring and announcement cost $c + \varepsilon$ to the public monitor, the expected pay-off of the borrower using long-term bank loans is given by:

$$V_{B,l} = p(R - r^*_{b,l}) + (1-p) \int_0^u \left(q(R - r^*_{b,l}) - y(1-q) \right) f(q)dq - c - \varepsilon$$

Substituting **(15)** for $r^*_{b,l}$ and using $\bar{q} = \int_0^u f(q)dq$, the above can be expressed as:

$$\begin{aligned} V_{B,l} &= p(R - r^*_{b,l}) + (1-p) \int_0^u \left(q(R - r^*_{b,l}) - (1-q)y \right) f(q)dq - c - \varepsilon \\ &= pR - (p + (1-p)\bar{q}) \left(\frac{\rho}{p + (1-p)\bar{q}} \right) + (1-p) \int_0^u (qR - y(1-q)) f(q)dq - c - \varepsilon \\ &= pR + (1-p) \int_0^u (qR - y(1-q)) f(q)dq - \rho - c - \varepsilon \end{aligned}$$

The expression **(19)** can be derived using a similar method.

Proof that insolvent borrowers cannot issue bonds at $t = 1$:

It can be shown that under a reasonable set of assumptions, insolvent debtors with $q_i < \frac{\beta}{R}$ cannot issue new debt at $t = 1$, even if we allow for the possibility of new debt issuance at $t = 1$.

Suppose that the debtor has obtained 1 unit of short-term bank loan at $t = 0$ at interest r_B, which is due at $t = 1$. Suppose the debtor learns at $t = 1$ that $q < \frac{\beta}{R}$, so that the bank is unwilling to roll over its debt. Suppose now that the debtor tries to issue bonds to repay r_B to the bank at $t = 1$ and avoid default. Assuming that the bondholders' opportunity cost at $t = 1$ for new lending per unit is also given by ρ and the borrower has to pay the public monitor c per unit of borrowing, the interest rate that bondholders charge at $t = 1$, denoted r_1, is determined by the condition:

$$q r_1 r_B = (\rho + c) r_B$$

so that at $t = 1$, bondholders are willing to lend r_B to the debtor at an interest given below:

$$r_1 = \frac{\rho + c}{q}$$

The resource constraint implies $r_1 < R$. For this inequality to hold, it must be that:

$$q > \frac{\rho + c}{R}$$

Since $\frac{\rho+c}{R} > \frac{\beta}{R}$, none of the insolvent borrowers with $q < \frac{\beta}{R}$ are able to issue bonds at $t = 1$ to avoid default on bank loans obtained at $t = 0$, even if we allow bond issuance at $t = 1$.

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