The IMF as a Lender of Last Resort: Implications for Debt Structures, Pricing and Crises*

Aitor Erce-Dominguez†
Bank of Spain
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Abstract

We present a model of sovereign debt issuance with endogenous liquidity crises and maturity mismatches due to financial underdevelopment which can rationalize this observation. Within the model IMF assistance is able to catalyze flows as investors' expectations of a bail-out in case of financial troubles can facilitate debt roll-overs by reassuring private creditors. The drawback is that such assistance creates incentives to issue larger amounts of short term debt, which partly eliminates the beneficial catalytic effect as roll-over problem become potentially larger. This mechanism could help understanding why the search of a catalytic effect of IMF lending has proved elusive from an empirical point of view. We perform an structural analysis of sovereign bond issuance to test these conclusions.

Keywords: Sovereign debt, maturity mismatches, IMF lending, structural analysis.

JEL codes: F33,F34,C33

Introduction

Markets for developing countries' sovereign debt have been growing in importance since the mid-nineties. As it happened with loan-financing before, crises and restructurings have been a regularity in these markets. Prominent examples of sovereigns running into deep troubles include Russia, who defaulted on its debt in 1998; and more recently Argentina, who in 2000 declared itself unable to meet its upcoming obligations and remained on financial autarky until 2006.

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†General Directorate of International Affairs, Banco de España. Alcala 38, Madrid. e-mail: aerce@bde.es

Understanding the triggers of these problems and the pitfalls of the current crisis resolution tools is a prerequisite to avoid repetition of similar situations.

One consistent finding when analyzing developing economies' debt structure is their tendency to issue large amounts of short term debt and to then engage in continuous rescheduling of it. In the cases mentioned above, the onset of the crises came with the need for sovereign issuers to reschedule the terms of their debt, which was done by offering the creditors debt roll-overs or engagement on debt exchanges. These situations, in which debtors promise repayment profiles that do not match the revenue flow, are known in the economic literature as a maturity mismatches. These, together with currency mismatches between assets and liabilities, are at the heart of most models explaining the latest waves of financial crises.[1] If having a short maturity of the debt opens the door to roll-over crises, one may wonder why so many countries follow this approach.

During this period, as part of the crisis-exit strategy, many of these turmoil episodes have featured involvement of the IMF. The Fund has, in some instances, taken the role of an International (quasi) Lender of Last Resort (ILOLR for short), providing these economies with working capital while they attempted to solve their temporary financial problems. There are both opponents and supporters of this role of the IMF. While the first ones claim that such a policy intervention is likely to generate moral hazard both on the debtor and the creditor side, the defenders of this role have argued that, by reassuring private creditors about the existence of an early and ordered exit of the crisis, this type of intervention could act as a catalyzer of private flows at a time when are most needed. In late years an extensive literature has flourished which aimed at measuring the existence of this catalytic effect. At best the evidence is mixed, with a majority of studies putting into doubt the existence of any such positive effect. Although it may seem surprising few other venues on the impact of IMF intervention of capital flows have been explored.[2]

In this paper I present a model which tackles both issues. On one side, the model, which allows for endogenous liquidity crises, presents an explanation for the origin of the maturity mismatches, namely a lack of financial development. On the model the main determinant of the debt composition is it's cost. This cost is determined by investors' supply schedule, which in turn depends on the proposed maturity structure. Therefore, debt composition, prices and the probability of facing a liquidity crisis are determined simultaneously. On the other side, the model is used to examine a channel through which IMF interventions may have a saying on the existence and intensity of sovereign debt crisis. It is shown that, if investors have expectations that the IMF will provide liquidity assistance to mitigating the impact of a capital flight and provide working capital to the distressed economy, then they are more likely to agree on the roll-over offer. In this sense the IMF can have a catalytic effect. However, the final outcome need not be one where catalysis is actually seen as these expectations of a multilateral bail-out can alter the optimal debt structure and therefore the size of the maturity mismatch.

The model is a simple extension of the global games framework pioneered by Morris and Shin (1998). I consider this modelling strategy to be well-suited for the analysis for the two following reasons. First, there is wide agreement

[1] See for example Rodrik and Velasco (1999) or Jeanne (2001, 2004),

[2] In Broto et al. (2008) it is argued that larger availability of Fund resources, as measured by IMF quotas, is associated with a lower volatility of capital flows.

that some of these crises were not only due to fundamental problems, but were triggered by market mis-perceptions which led to panics (Eichengreen and Mody 1998, and Eichengreen et al., 2001). Asking a group of borrowers to reschedule debt that is coming to maturity forces them to play a coordination game. The actions of the rest of the investors can have critical implications on the final outcome. Uncertainty and fear about the actions of the others can, regardless of the fundamentals of the economy, generate a rush among the investors which may totally destabilize the debtor country. In this way a maturity mismatch can develop into a crisis due to both fundamental reasons or unfounded panics. Global games allow for this type of panicky-equilibria without resorting to sunspots and using the more realistic assumption of heterogeneity on information. Second, under mild conditions, the global games deliver a unique equilibrium. This allows us to perform comparative statics, which in the context of policy analysis that frames this paper is of capital importance.[3]

In the benchmark model, the maturity structure is the result of trading-off riskier short term debt, and more expensive long term debt. Shorter debt is riskier due to the revenues profile of the project which only pays in the last period, which forces the issuer to roll-over it's short term debt, opening the door to liquidity crises. This is the way in which panic-driven crises are introduced in the model. On the other hand, investors, who are subject to shocks in their discount factor, can use secondary markets to sell their long term debt holdings and hedge these shocks.[4] As secondary markets are relatively thin or illiquid, investors can only partially cover the uncertainty they face. This introduces price risk, which generates an additional premium, making long term debt more expensive and creating an incentive to issue short term debt. In this way, financial development affects the interest rates directly and indirectly through it's effect on the maturity composition and therefore on the possibility of suffering a crisis. The model is then extended, following the work by Bannier (2005), to assess how the introduction of a Lender of Last Resort can affect both the maturity structure, the price of debt and the occurrence of crises. Results show that the effect depends on the way in which IMF lending is spent, signaling to the important role of "moral hazard" in understanding the failure of official assistance to reduce the incidence of capital flights.

To contrast the results of the model, we use issuance data to perform a structural estimation of the relation between spreads and maturities and see how it is affected by the probability of an IMF bail-out. Converse to the theoretical predictions, our preliminary evidence shows that IMF's presence can represent an incentive to bend towards longer maturities.

Next two sections review previous contributions. Then we introduce and solve the benchmark model when ILOLR is absent and presents the extended model where international financial assistance is available. A section presenting some empirical evidence follows. Finally, we conclude. Tables, data sources and the more involved proofs are presented in the Appendix.

[3] In Morris and Shin (1998), the introduction of private noisy information, in an otherwise standard coordination game (Diamond and Dybvig, 1983), helps to eliminate the multiplicity of equilibria inherent to this family of games.

[4] These shocks account for the fact that investors are uncertain about their investment horizon and could be interpreted as liquidity shocks.

Sovereign Debt Structure: A Literature Overview

Theoretical general equilibrium analysis of the maturity structure and the pricing of debt, whilst allowing for endogenous probability of liquidity crises, is novel in the literature. Diamond (1991) endogenizes the debt maturity structure. In his model short term debt comes from a trade off between expected lower cost, due to expected rating improvement, and the cost of giving power to lenders to liquidate the project early, which he refers to as liquidity risk. In Shin (2001), a global game is used to analyze the yield curve. However, the maturity structure is taken as given and government and secondary markets are absent. Rodrik and Velasco (1999), Jeanne (2001, 2004), and Kharroubi (2002) are prominent examples of another view that has had much impact. From their perspective, short term debt is used by lenders as a device to force governments to commit to good policies. All of them relate the lack of perfect enforceability and the impossibility of ex-ante commitment by the borrower to the shortening of the maturity with respect to that which would be optimal in a world without these contracting problems. Our model shares the view that short term debt is preferred by investors as it allows them to better control the timing of their returns. An important difference is that secondary markets are absent in the papers above. While they rely on imperfect enforceability, we use the lack of financial development as the explanation of why investors may prefer shorter debt.[5] An even more important difference is the ability of our model to endogenize the coordination problem, and therefore the probability of a crisis, without the resorting to sunspots.[6] Chang and Velasco (2000), Broner et al. (2004), and Narag (2004) endogenize both maturity and interest rates structures. They share with us the view that countries borrow short term, as it is regarded as cheaper. Narag (2004) and Broner et al. (2004) are the closest analyses to the present one. However, Narag (2004) is a representative agent model which does not allow for liquidity crises and does not include liquidity risk. Broner et al. (2004), is an over-lapping generations model. Their modeling of the debt rescheduling process does not allow for private information, and therefore panic-based runs do not play a role.

The empirical literature is also vast. In our analysis we draw mainly from three papers, Eichengreen et al. (1998 and 2001) and Erce (2008). Eichengreen et al. (2001) present the first structural analysis of maturities and spreads. The main conclusion from their analysis (and also that from 1998) is that a large amount of the variance cannot be explained by macroeconomic fundamentals, which they argue is proof of the importance of "market sentiment". Their analysis is performed by assuming that spreads do not have a direct effect on the observed maturity. The analysis, as such, does not allow to analyze the interaction between these two characteristics. This lack of simultaneity is addressed in Erce (2008), where an identification strategy that allows for a full-fledged model of spreads and maturities is presented. That analysis shows that there exist important complementarities between domestic financial development and international financing conditions. The empirical analysis presented here follows

[5] In Caballero and Krishnamurthy (2000), the lack of development on domestic financial markets is used to explain the existence of currency mismatches. Their modeling of the secondary markets is similar to ours.

[6] Jeanne (2001) speaks of the black box determining the outcome of the coordination game. We explicitly model that box.

closely that in Erce (2008).

Catalytic Finance: A Literature Overview

There are few theoretical papers addressing the catalytic effect of IMF lending. Two outstanding examples, with whom we share theoretical methodology are Corsetti et al. (2006) and Morris and Shin (2006). In Corsetti et al. (2006) liquidity support has a catalytic effect as it helps to prevent liquidity runs by raising the number of investors willing to lend. This effect increases with the size of the interventions. Therein the issue of incentives is also addressed. It is shown that, contrary to conventional wisdom, in some stances official lending strengthens government's incentives to implement costly policies. This is so because liquidity runs may jeopardize the policy's chances of success which can prevent it's implementation. If that is the case, liquidity support, can make socially desirable policies implementable. Morris and Shin (2006) presents a similar result. They show that for catalytic finance to work it needs to be a strategic complement of the government's decision to exert effort, which only happens for intermediate values of the fundamentals. Converse to ours these two papers present a world in which there exits only short term debt. In Peñalver (2004) the behavior of long term debt holders is studied.[7] Therein it is shown that, by providing subsidized funding, IMF programs induce the borrowing country to exert effort to avoid default. This, in turn, raises future marginal rates of return on investment encouraging larger private capital flows. A somehow analogous result is presented in de Resende (2007). He presents a DSGE model within which the government can borrow from the IMF if it accepts limits on public spending (conditionality). He shows that when conditionality forces the country to save more, at a cost that does not prevent it from joining the IMF program, the resulting lower probability of default can induce private lenders to relax their borrowing constraints.

The empirical literature, in turn, hardly finds any evidence of such catalysis, either through regression analysis or case studies (Ghosh et al, 2002). This weak evidence has served the critics of the IMF to strengthen their claims: overestimation of its catalytic role has led the IMF to impose excessively contractive policies (Birds and Rowlands, 2002). There are few circumstances in which, depending on specific characteristics, some catalytic effect can be found. In line with the predictions in Peñalver (2004) and Morris and Shin (2006) there is evidence that IMF programs have a stronger catalytic effect in cases when economic fundamentals are neither too bad nor too strong (Eichengreen and Mody, 2001). However, other studies find that, for some good performers, the IMF may have conveyed a negative signal. This would imply that investors can interpret the concession of a program as evidence of unforeseen problems.

Various contributions have tested whether different types of capital flows are affected in different ways by IMF's programs. As for bond issuance, Edwards (2003) finds no catalytic effect while the opposite is true for Eichengreen and Mody (2001) and Eichengreen, Kletzer and Mody (2005). They argue that the role of the IMF as a "signalling agent" is more likely to manifest in the bond market because bondholders seldom engage in monitoring activities and can be

[7] Although Peñalver defines them as long term debt bondholders, in his model the maturity of both short and long term debt is identical, the only difference is the issuance date.

more influenced by the signal associated to the signing of an IMF program. Diaz -Cassou et al. (2006) hold a different view, and argue that it is conditionality –as opposed to signalling and liquidity– what represents the strongest channel through which IMF catalyzes private flows.

Another important factor is the size of the financial assistance associated with the program. Mody and Saravia (2003) find that larger programs are associated with stronger catalysis. In the same vein Eichengreen, Kletzer and Mody (2005) find that, in countries with high debt ratios, is the size of the assistance rather than the presence itself that attracts private capital. Finally, a continued presence of the IMF in a country seems to reinforce the attraction of capital flows (Mody and Saravia, 2003). However, if excessively lengthy, such presence comes to be perceived as a sign of failure to solve the country's problems, which weakens the catalytic effect and may even discourage capital flows.

1 A benchmark economy

There are two different actors; the Government and a continuum of measure one of investors. The Government has an investment opportunity for which it needs to raise an amount of funds, I. It can do so by issuing debt in two different maturities, a short one denoted by S and a long one L, so $I = S + L$. Define $s = \frac{S}{I}$ as the proportion of short term debt used to finance the project. The short and the long interest rates are defined by r_s and r_L respectively. It is assumed that the Government must offer investors holding the short term debt to roll-over, by which investors delay repayment until the investment becomes fully productive. Output is increasing in the size of the investment. It is further assumed that in the case of a default, the country faces a reputational cost which could otherwise be understood as sanctions. The specific functional forms are specified later in the text.

Investors, which are identical ex-ante, purchase the different bonds at prices determined by a non-arbitrage condition. In equilibrium they are indifferent between holding one asset or the other, so there will be investors holding long term debt and others holding short term debt. However, after choosing their preferred portfolio they will behave differently. Their course of action will depend on the realization of both the signal they receive summarizing the fundamentals of the economy, and that of their discount factor that pins down their desired investment horizon. After discovering their preferred investment horizon investors will consider whether to engage in transactions in the secondary market to adjust their portfolio to their investment horizon. In addition, if they are holders of short term bonds, they have to decide if they accept the roll-over proposed by the Government.

The model evolves over 3 time periods. In period 0, the Government issues debt at prices determined by market forces. In period 1, it offers a roll-over to short term debt holders. This means that it offers the investors a premium to delay repayment until the last period. Short term investors, after observing the realization of their actual discount factor and receiving the private signal, decide if they agree to roll-over or demand immediate repayment. At the same time secondary markets for long term debt open and secondary market price is determined. Finally, in the last period payments are realized.

As just mentioned, investors are subject to preference shocks. More specifically, their discount factor is unknown at time 0. Investors only know that with probability λ they will only value consumption in period 1. Conversely, with probability $(1-\lambda)$ they will derive the same utility from consumption at any point in time.[8] This is modeled by assuming that the utility function of the investors is as follows

$$U(c_1, c_2) = \begin{cases} c_1 & prob.\ \lambda \\ c_1 + c_2 & prob.\ (1-\lambda) \end{cases}$$

Before moving to the determination of the yield curve and the maturity structure, the information structure of the model and the ways in which the roll-over offer and the secondary markets work are briefly summarized.

Information Structure

In the initial period all actors hold the same information. They all believe that the fundamentals of the economy are uniformly distributed, $\theta \sim U\ [-\eta, 1+\eta]$ with $\eta \in [0, \infty)$. Also, the probability λ of receiving a liquidity shock is common knowledge.

In period 1, investors receive a private signal about the fundamental state of the economy, $x_i = \theta + \varepsilon_i$.[9] The error term is also uniformly distributed, $\varepsilon_i \sim U\ [-\varepsilon, \varepsilon]$ with the size of ε inversely related to the precision of the signal. This is also common knowledge. Only the actual value of the signals is privately known. Finally, all actors know the payoff functions of both investors and the Government.

Roll-over Game

When investors face the roll over decision their payoffs depend directly on the action taken by the rest of investors. They are engaged in a coordination game.

As stated above, the situation of the economy is summarized by θ, which defines its fundamentals. This will in turn determine the signals received by investors, $x_i = \theta + \varepsilon_i$, who will use their signal to update their beliefs, and lead them to roll-over or conversely to ask for immediate repayment (flee). Denote the proportion of investors who flee as f. The project will be successful when the economy is sound enough to cope with the sudden capital outflow that may result from the rejection by investors to roll-over.[10] Therefore, investors who decide to roll-over will be fully repaid (in period 2) if $\theta > f$.

Finding a solution to this game requires finding the value of the fundamentals, θ^*, which generates a distribution of signals among the investors such that there is a value of the signal, x^*, below which every investor prefers to withdraw their money.

First we define a "mass condition" (MC). This equation determines the value of the fundamentals which generates a selling pressure f that matches itself,

[8] We define investors who receive the shock as liquidity constrained and the ex-ante uncertainty about the discount factor as liquidity risk.

[9] This is a basic difference with Shin (2001), where only short term investors received the private information and long term investors were passive.

[10] The fundamentals could include tax revenues, reserves or any other instruments that may give liquidity to the government.

$$\theta^* = f(\theta^*) = \lambda s + (1-\lambda)s\frac{x^* + \varepsilon - \theta^*}{2\varepsilon}, \tag{1.1}$$

where $f(\theta^*)$ is the proportion of investors who choose to flee for a value of the fundamentals equal to θ^*. The condition states that there are two types of investors withdrawing their money. First, all the liquidity constrained investors will flee, which accounts for the term λs. In addition, among the non-liquidity constrained investors, only those with signals below the critical threshold will flee. This is represented by the second element on the right hand side of the equation.

Next, we set a "zero marginal profit condition" (PC). This condition implies that the marginal investor must be indifferent between rolling over or fleeing, $\Pi^{RO}(x^*, \theta^*) = \Pi^{NRO}(x^*, \theta^*)$. We assume the following payoffs:

$$\Pi^{RO} = \begin{cases} (1+r_s)\rho & if \quad \theta^* \geq f(\theta^*) \\ 0 & otherwise \end{cases}$$

in the case where an investor decides to roll-over, where $\rho > 1$ is the premium offered to investors for rolling-over. It is further assumed that in the event of a default, investors get nothing. Conversely, if an investor withdraws:

$$\Pi^{NRO} = \begin{cases} (1+r_s) & if \quad \theta^* \geq f(\theta^*) \\ (1+r_s)\beta & otherwise \end{cases},$$

where β represents the recovery rate in the event of a default in period 1.[11] Using the payoffs above, the PC can be expressed as $P(\theta \geqslant \theta^* | x^*) = \mu$, where $\mu = \frac{\beta}{\rho+\beta-1} \in (0,1)$. The Appendix shows how, using the conditional probability, this condition becomes

$$\frac{x^* + \varepsilon - \theta^*}{2\varepsilon} + 2\varepsilon\Psi(\theta^*, x^*, \eta, \varepsilon) = \frac{1+2\eta+2\varepsilon}{1+2\eta-2\varepsilon}\mu, \tag{1.2}$$

with

$$\Psi(\theta^*, x^*, \eta, \varepsilon) = \frac{(\frac{x^*+\varepsilon-\theta^*}{x^*+\varepsilon+\eta}) + (\frac{1+\eta-\theta^*}{1-x^*+\varepsilon+\eta})}{1+2\eta-2\varepsilon}.$$

Equations (1) and (2) uniquely determine θ^* and x^*.[12] However, these expressions do not deliver an analytical solution. Interestingly, as private signals become arbitrarily precise, $x^* \to \theta^*$. The rest of the analysis will focus on this case.[13] It is immediate that, when $\varepsilon \to 0$, substitution of (2) back into (1) delivers:

$$\theta^* = \lambda s + \mu s - \lambda s \mu. \tag{1.3}$$

[11] Note that the rate of recovery in the event of a default is greater for those investors fleeing. Investors who ask for their money earlier have a greater chance to get, at least, partially repaid.

[12] As shown in the Appendix, all that is needed to guarantee uniqueness is that $\frac{\varepsilon}{\eta}$ is small enough, which is a standard assumption in the global games literature.

[13] This simplification is very useful as it allows us to work with a closed form solution while the effect of the strategic uncertainty is still present.

Secondary Market for Long Term Debt

It is assumed that secondary markets open after the private information has arrived, when investors know both their types and the realization of θ.

If $\theta < \theta^*$, then, no one wants to take part in the market. The only price for which investors can sell the asset is 0. When $\theta > \theta^*$, there will be transactions in the secondary market. The liquidity shock creates an incentive to buy and sell. Sellers are those investors who were hit by the liquidity shock and do not get any utility from holding the bond to maturity. On the other side of the market are the buyers, who did not suffer a liquidity shock. Their valuation of the bond is $(1 + r_L)$. This different valuation provides a opportunity for trade. Non-arbitrage arguments imply that the price of the bond is $p_L = 1 + r_L$.

As in Caballero and Krishnamurthy (2000), it is assumed that, due to market imperfections, sellers are not able to recover the full value of the asset. A proportion $(1 - \kappa)$ of the sale price is lost.[14] This can be understood as fees to be paid to intermediaries, bid-ask spreads, or else as the cost of looking for a buyer.[15] Although the price of the asset, p_L, is fair in the sense that no-one who buys it can make extra profits above the market rate, the seller receives only part of this value, κp_L. As a result long bonds are subject to price risk.

Ex-ante interest rates

The ex-ante equilibrium interest rates will be derived using the fact that, in equilibrium, both types of bonds have to give at least the same utility as the safe asset, which is defined as an asset that guarantees one unit of consumption in any state of the world ($r^{safe} = 0$). Note that the safe asset guarantees one unit of consumption in period 1 regardless of the shock.

Short term interest rate The short term bond gives an expected return equal to

$$(1 + r_s)P(\theta \geq \theta^*)[(1 - \lambda)\rho + \lambda] + (1 + r_s)\beta P(\theta \leq \theta^*)$$

matching it to the safe return implies

$$(1 + r_s) = p_s^{-1} = \frac{1}{h[(1 - \lambda)\rho + \lambda - \beta] + \beta}$$

where $h = P(\theta \geq \theta^*) = \frac{1+\eta-\lambda s-\mu s+\lambda\mu s}{1+2\eta}$.

The effect of changes in the maturity structure, s, on p_s is

$$\frac{\partial p_s}{\partial s} = [(1 - \lambda)\rho + \lambda - \beta][\frac{-\lambda - \mu + \lambda\mu}{1 + 2\eta}].$$

As λ and μ belong to the $(0, 1)$ interval,

$$\frac{\partial p_s}{\partial s} < 0 \Rightarrow \frac{\partial r_s}{\partial s} > 0.$$

Therefore, as the maturity structure tilts to short term debt, thereby increasing the probability of a liquidity crises, the interest rate (price) offered needs to increase (decrease).

[14] A nice extension would account for the fact that κ is affected by both λ and L.

[15] The parameter κ represents the degree of development and/or liquidity of the secondary market. More developed markets are associated with a larger value of κ.

Long term interest rate Secondary markets can only partially reduce the negative effect of the liquidity shock. As a result, Investors holding long term debt and receiving a liquidity shock will suffer a loss. The expected payoff from holding long term bonds is

$$(1+r_L)P(\theta \geq \theta^*)(1-\lambda) + \kappa(1+r_L)P(\theta \geq \theta^*)\lambda.$$

The implied interest rate is

$$r_L = \frac{1}{(1-\lambda+\lambda\kappa)h} - 1.$$

More illiquid secondary markets imply larger price risk. As a result, the ex-ante return necessary to make investors be willing to hold the bonds is larger. The shorter the average maturity, the easier it is to suffer a roll-over problem, which in turn increases in long term interest rate,

$$\frac{\partial r_s}{\partial s} > 0 \ \forall s$$

The term premium The term premium, $tp = r_L - r_s$, can be written as

$$tp = \frac{1}{(1+\lambda\kappa-\lambda)h} - \frac{1}{h[(1-\lambda)\rho+\lambda-\beta]+\beta}.$$

It is straightforward to understand how the term premium is affected by changes in the debt structure. Note that $\frac{\partial(\frac{r_L}{r_s})}{\partial s} > 0$ implies $\frac{\partial tp}{\partial s} > 0$. This derivative is

$$\frac{\partial(\frac{r_L}{r_s})}{\partial s} = \frac{-\beta(\frac{-\lambda-\mu+\lambda\mu}{1+2\eta})}{(1+\lambda\kappa-\lambda)(\frac{1+\eta-\lambda s-\mu s+\lambda\mu s}{1+2\eta})^2},$$

which, as $\beta(\lambda+\mu-\lambda\mu)$ is positive and larger the larger is κ. Note that increases in the probability of a default increase the term premium, $\frac{\partial tp}{\partial h} < 0$. As the probability of default increases, the recovery rate in the case of default becomes the most relevant part of the expected payoffs. This depresses relatively more the price of the long term debt, increasing the term premium.

Government's Problem: On the Desirability of Short Term Debt

The analysis above has shown that issuing short term debt increases both rates (widening the term premium) and increases the probability of observing the investment ending in a failure by increasing the size of the coordination problem. However, as liquidity constrained investors value future payments less than the Government, from the point of view of the latter short term debt is not only contractually cheaper but also cheaper in expected terms. This trade off between risk and cost is at the root of the government's problem described below.

It is assumed that the Government's net revenue function is,

$$Y(\theta) = \begin{cases} F(I) & if \quad \theta \geq \theta^* \\ -(c_1 S + c_2 L) & if \quad \theta < \theta^* \end{cases}$$

The production function is standard: $F'(I) > 0$ and $F''(I) < 0$. The term $(c_1S + c_2L)$ collects the net losses that, after a default, the country will have due to demands by lenders.[16] The cost is an increasing function of the proportion of investors which suffer the default. Default cost is modelled in an asymmetric fashion. As default on short term debt comes first this can trigger, through acceleration or cross-default clauses, problems on other existing projects. It seems natural to assume that $c_2 < c_1$.[17] The Government problem can be summarized as follows

$$\max_s E(F(I) - DC - FC),$$

where FC stands for the financing cost, $E(F(I)) = F(I)P(\theta \geq \theta^*)$ represents the expected gain in case of success and $E(DC) = (cS + c_2I)P(\theta \leq \theta^*)$ is the expected final loss in case of default. As the existence of price risk makes short term debt cheaper, $E(FC) = S + \frac{L}{1+\lambda\kappa-\lambda} \geq I$, so that the financing cost is not independent of the maturity choice. Using the functional forms posted above the Government´s problem becomes

$$\max_s F(I)(\frac{1+\eta-\lambda s-\mu s+\lambda\mu s}{1+2\eta}) - (cS + c_2I)(\frac{\lambda s+\mu s-\lambda\mu s+\eta}{1+2\eta}) - sI - \frac{(1-s)I}{1+\lambda\kappa-\lambda}$$

$$s.t.\ \ s \geqslant 0$$
$$s \leq 1$$

Define,

$$\overline{B} = \frac{(\lambda-\lambda\kappa)I}{1+\lambda\kappa-\lambda} - \ (F(I) + 2cI + c_2I)(\frac{\lambda+\mu-\lambda\mu}{1+2\eta}) - \frac{cI\eta}{1+2\eta},$$

and

$$\underline{B} = \frac{(\lambda-\lambda\kappa)I}{1+\lambda\kappa-\lambda} - (F(I) + c_2I)(\frac{\lambda+\mu-\lambda\mu}{1+2\eta}) - \frac{cI\eta}{1+2\eta}.$$

Note that $\overline{B} < \underline{B}$.[18] The Kuhn-Tucker program for the Government gives the following solution:

$$if \quad \overline{B} > 0 \ \ then \ \ s^* = 1.$$

The last two elements on $\overline{B}$ represent both the reduction on the expected return and the increase in default costs when all the investment is financed through short term debt. The first accounts for the reduction in the financing cost when using only short term debt. The condition states that, when the reduction on the financing cost is bigger than the combined reduction/increase on the expected returns and default costs, it is optimal for the government to issue only short term debt.

In addition, when starting from a situation with $s = 0$, if the reduction of the financing cost from issuing short term debt (first, positive term in $\underline{B}$) is

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[16] Litigation costs have been widely used in the literature. See Miller and Zhang (2000), Bris and Welch (2001), Roubini and Setser (2004), or Jeanne (2004).

[17] Define $c = (c_1 - c_2)$. The term $(c_1S + c_2L)$ can be easily reexpressed as $cS + c_2I$. This assumption guarantees the existence of an interior maximum.

[18] The complete Kuhn-Tucker program for the Government can be found in the Appendix.

smaller than the reduction on the revenues (last two negative terms in $\underline{B}$), then it is optimal not to have short term debt at all:

$$if \quad \underline{B} < 0 \ \ then \ \ s^* = 0.$$

Finally, if $\overline{B} < 0$ and $\underline{B} > 0$, one gets the interior optimum,

$$s^* = \frac{(1+2\eta)(\lambda - \lambda\kappa)}{2c(1 + \lambda\kappa - \lambda)\Gamma} - \frac{F(I)}{2cI} - \frac{c_2}{2c} - \frac{\eta}{2\Gamma}, \tag{1.4}$$

with $\Gamma = (\lambda + \mu - \lambda\mu)$.

Remark 1 *Lower investment returns, lower litigation costs, higher roll over premia, lower recovery rates and less developed secondary markets make it more likely that debt structures will contain short term debt, making the economies more prone to suffer panics and liquidity crises.*

As a country increases its proportion of short term debt, it raises the possibility of suffering a sudden capital outflow that can destabilize the economy, it follows that they are more likely to suffer liquidity crises.

2 Liquidity Assistance: Lender of Last Resort

In this section, I extend the benchmark model to analyze the role of a ILOLR, it's effect on the maturity mismatch and on the behavior of the various actors. To do so the game is modified by including an additional player. As explained below, this is done in a simple way while maintaining the model's ability to highlight the major issues related with this policy tool. The model is a version of Corsetti et al. (2006), but following the symmetric approach to global games with heterogeneous players first developed in Bannier (2005). As we will see the framework allows us to tackle one of the strongest criticisms that this policy has received, that it may induce moral hazard in both lenders and borrowers. Let's move to describe our new player, the ILOLR.

It is assumed that the role of the lender of last resort (ILOLR) is to grant, conditional on it's own private information, assistance of size A. Following Corsetti et al. (2006) it is assumed that the LOLR obtains utility E when a country succeeds and there is no default. If the final outcome is a default, the LOLR obtains utility $-D$.[19] In order to make its decision, the LOLR relies on its private signal, $y \sim U(\theta - \upsilon, \theta + \upsilon)$, which, as in the case of the investors, arrives in the interim period.[20] All this means that the profit condition for the LOLR can be expressed as,

$$EP(\theta > \theta^*_A / y^*) - DP(\theta < \theta^*_A / y^*) = 0.$$

[19] As them I disregard monetary incentives from the ILOLR.

[20] Assuming. as I do, that moves occur simultaneously eliminates the possibility that the IMF can use it's lending decission to confer information about its private signal. Zwart (2006) presents this signaling device in a model without debt structure and shows that signaling is a mixed blessing as it only helps when fundamentals are strong. The same mechanism would be present in this analysis.

In turn the investors´ pay-off from fleeing now depends on the use that the sovereign makes of the liquidity assistance,

$$\Pi^{NRO} = \begin{cases} (1+r_s) \quad if \quad \theta_A^* \geq f(\theta_A^*) \\ (1+r_s)\beta(A) \quad if \quad \theta_A^* \leq f(\theta_A^*) \;\; and \;\; y \geq y^* \\ (1+r_s)\beta \;\; if \;\; \theta_A^* \leq f(\theta_A^*) \;\; and \;\; y < y^* \end{cases}. \tag{1}$$

The new PC can be obtained, as before, by equating $\Pi^{RO}(x^*, \theta_A^*) = \Pi^{NRO}(x^*, \theta_A^*)$.

Also the MC changes, as now it includes an element reflecting the possible existence of liquidity assistance. The new MC is

$$\theta_A^* + A(\frac{\theta_A^* + \nu - y^*}{2\nu}) = \lambda s + (1-\lambda)s\frac{x^* + \varepsilon - \theta_A^*}{2\varepsilon}. \tag{2.2}$$

Combining the three equations the equilibrium values for θ_A^*, y^*, x^* can be obtained.[21] Assuming as before that both ε and υ are arbitrarily small,

$$\theta_A^* = \lambda s + (1-\lambda)s\mu_{IMF} - J, \tag{2.3}$$

where $\mu_{IMF} = \frac{\beta(A)}{\rho+\beta(A)-1} \in (0,1)$ and $J = A\frac{E}{D+E}$.

In addition, the presence of the IMF also affects to the debt maturity structure preferred by the government. The optimal maturity choice changes and becomes,

$$s_{IMF}^* = \frac{(1+2\eta)(\lambda - \lambda\kappa)}{2c(1+\lambda\kappa-\lambda)\Gamma_{IMF}} - \frac{F(I)}{2cI} - \frac{c_2}{2c} - \frac{\eta}{2\Gamma_{IMF}} + \frac{J}{2\Gamma_{IMF}}, \tag{2.4}$$

where $\Gamma_{IMF} = (\lambda + \mu_{IMF} - \lambda\mu_{IMF})$.

"Catalytic" effect and the maturity mismatch

Suppose first that the recovery rate is not affected by liquidity assistance ($\beta(A) = \beta$), so that $\mu = \mu_{IMF}$ and (2.1) collapses to the original Π^{NRO}. It is immediate to see that, for a given debt structure, the presence of the LOLR decreases all thresholds, $\theta_A^* < \theta^*$ and $x_A^* < x^*$.[22] In the limit

$$\theta_A^* = \lambda s + (1-\lambda)s\mu - J < \theta^*.$$

This would the catalytic effect of the assistance. By reassuring investors, assistance avoids crises for a wider range of situations. Note also that the greater the size of the assistance, the greater this effect.

$$\frac{\partial\theta_A^*}{\partial A} < 0.$$

However, this is not the end of the story because when the LOLR is present the optimal maturity choice becomes,

$$s_{IMF}^* = s^* + \frac{J}{2\Gamma}.$$

[21] See Bannier (2005) for details on existence and uniqueness of the equilibrium.

[22] This result is analogous to that in Corsetti et al. (2006).

Not surprisingly, the proportion of short term debt increases in the presence of a LOLR, $s^*_{IMF} > s^*$. This could be seen as the moral hazard implications for the borrower. The government knows that the LOLR will probably inject some money, this creates an incentive to increase the proportion of short term debt, and profit from the lower interest rate it needs to pay.

One can check if the probability of default after taking into account changes in the optimal maturity has increased or decreased. In this example, due to the linearity of the uniform distribution, one obtains that $\theta^*_A - \theta^* = -\frac{J}{2} < 0$, and therefore the total effect is that the investors become less aggressive and the probability of default is reduced. This in turn implies that interest rates are lower, $r_i > r_i^{IMF.}$

Increased recovery rates and the "rush for the exits" problem [under construction]

Suppose now that the liquidity assistance, by raising the availability of resources, increases the recovery rate $\beta(A) > \beta$. As shown below, liquidity assistance can generate the well-know "rush for the exits" effect, with investors taking advantage of the Fund's support to flee the country. In the case in which assistance can be used by investors to get higher recovery rates the sovereign has incentives to reduce short term debt issuance and mitigate the impact of the "rush for the exits".

3 Empirical Evidence [preliminary]

In this section we present evidence on the impact that the expectation of IMF bail-outs has for the observed debt structure. Given the nature of the exercise we require the simultaneous estimation of both maturities and spreads. To do so we rely on an identification strategy based in demographics and financial conditions.[23] The analysis is done using data on primary issuance by sovereigns.

Data

We obtained data on bond characteristics from DCM Analytics (Dealogic). It includes data on maturity, spread, issued amount, credit rating and currency denomination. We had around 2000 observations of public bonds issued by developing economies from 1990 to 2005.

The macroeconomic variables reflecting both domestic and international conditions were obtained mostly from the International Financial Statistics and the World Development Indicators. T-bill rates come from Datastream. Data on public bond markets was obtained from the Financial Structure Database. Data on pensions reform comes from the U.S. Social Security Administration, which collects data from pensions reforms worldwide.[24] Data coming from both the World Bank and the Paris Club was used to construct an indicator of debt rescheduling process. It takes value one when on the specific year in which a country went through a debt rearrangement. The data about the demographic structure was obtained form the World Development Indicators. The elusive

[23] See Erce (2008) for further details.
[24] The data used is available at: http://www.ssa.gov/policy/docs/progdesc/ssptw/

concept of international liquidity is proxied by an index with base in 1990, that adds together country by country data about the ratio of M2 (or reserves when M2 was not available) to GDP.[25] Data for this index was obtained from IFS. Finally, the indicator about the quality of the legal system was obtained from the International Country Risk Guide. A full source description can be found in the Appendix.

Econometric Strategy

IMF interventions

In order to assess the impact of the likelihood of IMF interventions on the observed debt structure the first step is to estimate it's likelihood. We do so by estimating a very stylized probit model, in which the indicator, I_{it}^{IMF}, takes a value of one whenever a new IMF program has been approved.

$$I_{it}^{IMF} = \begin{cases} 1 & if \quad IMF_{it}^* > 0 \\ 0 & if \quad IMF_{it}^* \leq 0 \end{cases}$$
$$IMF_{it}^* = \Phi X_{it}^{IMF} + w_{it}$$

With this, it is straight forward to estimate the probability of the country signing a new program with the Fund, $P_{it}(IMF) = P(\Phi X_{it}^{IMF} > w_{it})$, which is the variable we will include in the analysis. To summarize the macroeconomic situation the estimation included the issuer's credit rating and, to guarantee identification, some indicators of engagement with the Paris Club.

Tacking sample selection: Modeling the Issuance Decision

It is an undisputed empirical fact that participation in international bond markets has risen over time. This could imply that OLS estimates of the relationship between specific characteristics and spreads and maturities could be biased if these characteristics not only affected the terms of the debt but also market access. This is the well known problem of sample selection. To get around it, in a first step, we use a probit model to study the issuance decision. The dependent variable is access to financial markets in a given quarter. This quarterly indicator, I_{it}, takes value one when country i tapped the market on period t. The issuance model can be represented as follows

$$I_{it} = \begin{cases} 1 & if \quad I_{it}^* > 0 \\ 0 & if \quad I_{it}^* \leq 0 \end{cases}$$
$$I_{it}^* = \Psi X_{it}^{I} + \upsilon_{it}$$

This is useful because, in addition to create the control function required to fix sample selection biases, we can make an assessment of the factors (among

[25] There are two important complications for obtaining a global measure of liquidity. First, more developed countries have higher liquidity ratios as measured by monetary aggregates to GDP. Hence, part of the change in liquidity measures for EMEs could simply indicate that they are becoming financially more sophisticated. Second, strictly speaking, one would like to have only "narrow" money, but this is often not available. However, in less developed countries the monetary base is backed by international reserves. Hence, we used developments in foreign reserves as a proxy for developments in narrow money.

them IMF prospective lending) determining the ability of EMEs to tap financial markets. From this analysis the inverse mills ratio, $\lambda_{it} = \frac{\phi(\widehat{\Psi} X_{it}^I)}{\Phi(\widehat{\Psi} X_{it}^I)}$, is obtained. It should be noted that the mills ratio collects, not only the factors that affect the issue decision of credit rationed governments, but also voluntary decisions not to access the market.[26] To guarantee identification the model contains a variable only present at this stage, the ratio of reserves to imports.

Structural model

In addition to the sample selection concerns described above, our structural model deals with two other issues. First, when estimating the maturity-spread relation, the goal is to understand how both are jointly determined. Converse to previous studies (see Eichengreen et al, 2001) which have relied on diagonalization, we provide an analytical framework which facilitates the search of the exclusion restrictions required to estimate the structural parameters. Second, the size of the issue is treated as an endogenous variable. This, on top of fixing the endogeneity concerns, will give us information on the relevance of IMF activities for the size of issued debt.

We begin by presenting the problem in terms of supply and demand equations,

$$M_{it}^{\text{demand}} = \alpha S_{it} + \Theta_M X_{it} + \omega_{it}^D, \quad (3.1)$$
$$M_{it}^{\text{supply}} = \beta S_{it} + \Theta_S X_{it} + \omega_{it}^S, \quad (3.2)$$
$$M_{it}^{\text{supply}} = M_{it}^{\text{demand}} = M_{it},$$

where S_{it} and M_{it} are the spread and maturity of a bond issued by country i at time t. These are the structural variables of the system. X_{it} is a vector containing the exogenous variables, among them our variable of interest, the likelihood of an IMF intervention, $P_{it}(IMF)$. The errors are assumed to be well behaved, $E(\omega_{it}^D) = E(\omega_{it}^S) = E(\omega_{it}^D \omega_{it}^S) = 0$. The supply equation, (3.2), explains the preferred maturity of the investors. The demand equation, (3.1), characterizes the preferred maturity for the government. As we show below, this approach makes it simpler to find the set of exclusion restrictions within Θ_S and Θ_D needed to identify the structural parameters.

Taking into consideration sample selection, simple manipulation of the system above leads to

$$Y_{it} = BY_{it} + \Gamma X_{it} + \epsilon_{it} \;\; if \;\; I_{it}^* > 0 \quad (3.3)$$
$$I_{it} = \begin{cases} 1 & if \quad I_{it}^* > 0 \\ 0 & if \quad I_{it}^* \leq 0 \end{cases}$$
$$I_{it}^* = \Psi X_{it}^I + \upsilon_{it}$$

$i \in \{1, ...N\}, t \in \{1, ...T\}$, where $Y_{it}' = (M_{it} \;\; S_{it})$ contains the structural variables, X_{it} is a $kx1$ vector containing the k exogenous variables, B is a $2x2$ non-singular matrix, Γ is a $2xk$ matrix, $\epsilon_{it} \sim N(0, \Sigma)$ are $i.i.d.$ This is the

[26] A natural extension would be to use disequilibrium models (see Maddala and Nelson, 1974) to understand when the sample selection arises due to credit rationing, and when is a voluntary decision.

model to be estimated.[27] As on each time period there are countries for which no debt was issued while others tapped the market more than once, the estimation is done by considering each issue as an individual observation and then taking care of time and spatial effects.

Endogeneity of the issued amount As mentioned above, the issue size, Q_{it}, is likely to be simultaneously determined with the other terms of the contract. To minimize endogeneity problems the size of the issue is replaced by it's estimated value obtained from an OLS regression using a set of variables presented in the Appendix,

$$Q_{it} = \theta_Q X_{it}^Q + \varepsilon_{it}^Q$$

where $P_{it}(IMF)$ and $\lambda_{it} \in X_{it}^Q$. Denote $\widehat{Q}_{it} = \widehat{\theta}_Q X_{it}^Q$ as the predicted size. In our next step, the structural estimation, $\widehat{Q}_{it} \in X_{it}$.

Identification Identification requires defining two sets of instruments. One set is needed to properly estimate the coefficient of the maturity on the spread equation and the other to identify the effect of the spread on the maturity.

The first one includes variables which directly affect the preferred maturity of the government, but only affect the investors through the spread. Two variables representing the demographic structure and one indicating reforms on the pensions system were included. As for demographics, we chose one variable collecting the proportion of the population that is above 55 and another collecting the proportion of the population with age between 35 and 55. The rationale behind their inclusion is that governments with a higher proportion of older people can have political incentives to issue longer debt to be repaid by future generations and guarantee the voting of the elder.[28] Regarding pension systems' reforms, an indicator taking a value of one up to three years after the reform was constructed.[29] We included this indicator because during the last decade, a number of EMEs financed reforms in their pension systems by issuing sovereign bonds. The maturity of these bonds could be affected by the interest of the governments in matching durations.[30]

To identify the effect of the spread on the maturity two types of variables were included. They can be summarized as variables affecting investors' wealth and variables affecting investors' outside option. Regarding the last, the 10 years U.S. T-bill rate was used. This is a standard variable in spread analyses (see Eichengreen and Mody, 1999 or Min et al., 2004). As for the first, the index of international liquidity mentioned above and it's growth rate were chosen. They reflect the wealth available for international investors. Our prior is that

[27] The relation between the coefficients in equations (3.1) and (3.2), and those in equation (3.3) is, $B = \begin{pmatrix} 0 & \alpha \\ \frac{1}{\beta} & 0 \end{pmatrix}$, $\Gamma = \begin{pmatrix} \Theta_M \\ -\frac{\Theta_S}{\beta} \end{pmatrix}$ and $\epsilon_{it} = \begin{pmatrix} \omega_{it}^D \\ -\frac{\omega_{it}^S}{\beta} \end{pmatrix}$

[28] See Perotti and Alesina (1997), Persson et al. (2005) or Bassetto and Sargent (2005) for models yielding this result.

[29] Given the high cost of these reforms, it makes sense to assume that they were financed over a number of years after the implementation.

[30] I focus in reforms that implied a change from a pay as you go system to one with individual accounts. These changes let the governments with the need of financing the retirement benefits of existing pensioners, and the ones to come in the near future, during the transtition process.

increases in this variable should make investors less concerned about liquidity issues, and hence require a lower premium.

Results

Results for the different estimation steps can be found in the Appendix. Overall, results were broadly as expected. In each of the cases the coefficients associated with the credit rating and the legal and political stability had the expected signs. Also the different identification restrictions worked properly and delivered significant coefficients. Following the model and previous contributions we controlled for the level of financial development. To do so we included a variable measuring the public bond market capitalization. It's effect was as expected, economies having a more developed financial system tend to face lower spreads. Although most of the estimation parts would deserve a longer explanation on themselves, for the sake of concreteness, we will focus here on the results regarding the IMF and those coming from the structural model, as they serve as a test for the conclusions of the model.

Let's start with the structural relation at the basis of our model. Recall that we argued that, in order to hold longer debt maturities, investors would ask for higher spreads. Additionally, the model defended that government's maturity choice depends of the cost associated with it, so that in response to higher spreads they would prefer to issue shorter debt. From Tables 4 and 5 it is straight forward to see that the structural coefficients have signs matching this story. The maturity equation (Table 4), which defines the preferred maturity of the government tells us that maturities and spreads are negatively correlated, with governments reducing their preferred maturity in response to rising spreads. The spread equation (Table 5), in turn, represents the preferred maturity of investors. The positive coefficient associated with the maturity indicates us that, as in the model, investors charge higher spreads when maturities are longer.

Regarding the impact of IMF results seem to indicate that the IMF is somehow able to catalyze flows. This can be seen from the coefficients obatined in the analysis of the issued amount (Table x), which covariates positively with the variable representing engagement on an IMF program.

The structural estimation seems to find support for the scenario in which IMF lending affects spreads and maturities, although not in the directio proposed by the theoretical analysis..

Conclusions (under construction)

In this article, the impact on IMF assistance on the simultaneous determination of a country's debt maturity structure and its cost have been analyzed. It has been shown that the absence of well-developed secondary markets, combined with investors' uncertainty regarding their preferred investment horizon, affect the debt composition by creating incentives for governments to issue larger amounts of short term debt. Then we have shown empirically, that the debt structure changes if there are expectations of an IMF bail-out in the event of a liquidity crisis. The empirical exercise shows that IMF programs associate with less issuance although individual issues have a larger size. Converese to the theoretical pedictions, evidence shows that the likelier it is to receive financial assistance from the IMF the larger the maturity of debt that is issued. Further research should be conducted to assess the robustenees of these results and to extende the analysis to other debt instruments.

Appendix I

Updated Beliefs

Recall that $\theta \sim U[-\eta, 1+\eta]$ stands for the fundamental and $x|\theta \sim U[\theta - \varepsilon, \theta + \varepsilon]$ is the private signal about θ. Here it will be shown how to determine the updating process that generates $P(\theta > \theta^*|x^*)$. It is known that $\phi(\theta) = \frac{1}{1+2\eta}$. Also that $\phi(x|\theta) = \frac{1}{2\varepsilon}$, where ϕ stands for the density function. Rational investors use Bayes rule to update beliefs according to $\phi(\theta|x) = \frac{\phi(x|\theta)\phi(\theta)}{\int_{\Delta(\theta)} \phi(x|\theta)\phi(\theta)d\theta}$, where $\Delta(\theta) = \{\theta|\theta \in [\max(x-\varepsilon, -\eta), \min(x+\varepsilon, 1+\eta)]\}$. This defines three different cases, with the signal falling in any of the extremes or falling relatively centered.

Let's start with the case in which the signal is relatively small. In this case, $\Delta(\theta) = \{\theta|\theta \in (-\eta, x+\varepsilon)\}$ and the conditional density can easily be computed to be $\phi(\theta|x) = \frac{1}{x+\varepsilon+\eta}$. Analogously, for very large signals, $\Delta(\theta) = \{\theta|\theta \in (x-\varepsilon, 1+\eta)\}$, with a density function $\phi(\theta|x) = \frac{1}{1-x+\varepsilon+\eta}$. Finally, when $\Delta(\theta) = \{\theta|\theta \in (x-\varepsilon, x+\varepsilon)\}$, the density is $\phi(\theta|x) = \frac{1}{2\varepsilon}$. The next is step is using these different densities to compute $P(\theta > \theta^*|x^*)$,

$$\begin{aligned} P(\theta &\geqslant \theta^*|x^*) = P(\theta \geqslant \theta^*|x^* < -\eta+\varepsilon)P(x^* < -\eta+\varepsilon) + \\ P(\theta &\geqslant \theta^*|x^* \in (-\eta+\varepsilon, 1+\eta-\varepsilon)P(x^* \in (-\eta+\varepsilon, 1+\eta-\varepsilon) + \\ P(\theta &\geqslant \theta^*|x^* > 1+\eta-\varepsilon)P(x^* > 1+\eta-\varepsilon). \end{aligned}$$

The first element on the right hand side is

$$(\frac{x+\varepsilon-\theta^*}{x+\varepsilon+\eta})(\frac{-\eta+\varepsilon-(-\eta-\varepsilon)}{1+2\eta+2\varepsilon}) = (\frac{x+\varepsilon-\theta^*}{x+\varepsilon+\eta})(\frac{2\varepsilon}{1+2\eta+2\varepsilon}).$$

The second,

$$(\frac{x^*+\varepsilon-\theta^*}{2\varepsilon})(\frac{1+\eta-\varepsilon-(-\eta+\varepsilon)}{1+2\eta+2\varepsilon}) = (\frac{x^*+\varepsilon-\theta^*}{2\varepsilon})(\frac{1+2\eta-2\varepsilon}{1+2\eta+2\varepsilon}).$$

Finally, the third element is,

$$(\frac{1+\eta-\theta^*}{1-x+\varepsilon+\eta})(\frac{1+\eta+\varepsilon-(1+\eta-\varepsilon)}{1+2\eta+2\varepsilon}) = (\frac{1+\eta-\theta^*}{1-x+\varepsilon+\eta})(\frac{2\varepsilon}{1+2\eta+2\varepsilon}).$$

The conditional probability is

$$P(\theta \geqslant \theta^*|x^*) = \frac{1+2\eta-2\varepsilon}{1+2\eta+2\varepsilon}(\frac{x^*+\varepsilon-\theta^*}{2\varepsilon}) + \frac{2\varepsilon}{1+2\eta-2\varepsilon}(\frac{x^*+\varepsilon-\theta^*}{x^*+\varepsilon+\eta} + \frac{1+\eta-\theta^*}{1-x^*+\varepsilon+\eta})$$

Recall the Profit condition,

$$P(\theta \geqslant \theta^*|x^*) = \mu.$$

This equation, combined with the conditional probability just derived delivers equation (2) in the text.

Uniqueness

The two equations determining the two equilibrium values, x^* and θ^* are

$$\theta^* = \lambda s + (1-\lambda)s\frac{x^* + \varepsilon - \theta^*}{2\varepsilon} = f(\theta^*), \qquad (MC)$$

and

$$P(\theta \geqslant \theta^* | x^*) = \mu. \qquad (PC)$$

Define $g(\mu, \theta(\eta, \varepsilon), x(\eta, \varepsilon), \delta, \varepsilon) = P(\theta \geqslant \theta^* | x^*) - \mu$.

The necessary condition for existence and uniqueness for θ^* and x^* is,

$$\frac{\partial x_{PC}}{\partial \theta_{PC}} \leq 1 + \frac{2\varepsilon\lambda}{(1-\lambda)s} = \frac{\partial x_{MC}}{\partial \theta_{MC}}.$$

The implicit function theorem (IFT for short) will be used to show that the solution, when the precision of the public, $\delta = \frac{1}{\eta}$, is arbitrarily small, is unique.

If at a point $(\theta(\delta_0, \varepsilon_0), x(\delta_0, \varepsilon_0), \delta_0, \varepsilon_0)$, $g(\mu, \theta(\eta, \varepsilon), x(\eta, \varepsilon), \delta, \varepsilon) = 0$, $\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial \theta} \neq 0$, and $\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial x} \neq 0$. Then, by the IFT,

$$\frac{\partial x}{\partial \theta} = -\frac{\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial \theta}}{\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial x}}.$$

First calculate the two derivatives,

$\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial x} = \frac{1}{2\varepsilon}(\frac{1+\frac{2}{\delta}-2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}) + \frac{2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}(\frac{\frac{1}{\delta}+\theta}{(x+\varepsilon+\frac{1}{\delta})^2} + \frac{1+\frac{1}{\delta}+x}{(1-x+\varepsilon+\frac{1}{\delta})^2})$, and
$\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial \theta} = -\frac{1}{2\varepsilon}(\frac{1+\frac{2}{\delta}-2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}) - \frac{2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}(\frac{1}{(x+\varepsilon+\frac{1}{\delta})} + \frac{1}{(1-x+\varepsilon+\frac{1}{\delta})})$.

In the limit, $\lim\limits_{\delta\to 0} \frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial x} = -\frac{1}{2\varepsilon}$, and $\lim\limits_{\delta\to 0} \frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial \theta} = -\frac{1}{2\varepsilon}$. It is straight forward to show that the solution is unique, $\lim\limits_{\delta\to 0} \frac{\partial x_{PC}}{\partial \theta_{PC}} = 1 \leq 1 + \frac{2\varepsilon\lambda}{(1-\lambda)s}$.

By the implicit function theorem $\frac{\partial \theta(\delta,\varepsilon_0)}{\partial \delta}$ and $\frac{\partial x(\delta,\varepsilon_0)}{\partial \delta}$ exist, so that $\theta(\delta, \varepsilon_0)$ and $x(\delta, \varepsilon_0)$ are continuous in δ. Next, by the continuity of $g(\mu, \theta(\delta, \varepsilon_0), x(\delta, \varepsilon_0), \delta, \varepsilon_0)$ in δ, there is an interval around $(\theta(\delta_0, \varepsilon_0), x(\delta_0, \varepsilon_0), \delta_0, \varepsilon_0)$ where a solution exists, and approaches to $(\theta(\delta_0, \varepsilon_0), x(\delta_0, \varepsilon_0))$ as $\delta \to \delta_0$. For arbitrarily small public precision a unique equilibrium exists. Note that $\delta_0 = 0$ implies $\frac{x^*+\varepsilon-\theta^*}{2\varepsilon} = \mu$.

For the sake of completeness, it will be shown that the result above holds without resorting to limiting arguments. This amounts to show that there is an lower bound for η and therefore an upper bound for $q = \frac{\varepsilon}{\eta}$, such that $\frac{\partial x_{PC}}{\partial \theta_{PC}} \leq 1 + \frac{2\varepsilon\lambda}{(1-\lambda)s}$. It suffices to show the existence of an upper bound on q so that, $\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial x} \neq 0$, $\frac{\partial g(\mu,\theta(\eta,\varepsilon),x(\eta,\varepsilon),\delta,\varepsilon)}{\partial \theta} \neq 0$, and,

$$\frac{\partial x_{PC}}{\partial \theta_{PC}} = \frac{\frac{1}{2\varepsilon}(\frac{1+\frac{2}{\delta}-2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}) + \frac{2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}(\frac{1}{(x+\varepsilon+\frac{1}{\delta})} + \frac{1}{(1-x+\varepsilon+\frac{1}{\delta})})}{\frac{1}{2\varepsilon}(\frac{1+\frac{2}{\delta}-2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}) + \frac{2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}(\frac{\frac{1}{\delta}+\theta}{(x+\varepsilon+\frac{1}{\delta})^2} + \frac{1+\frac{1}{\delta}+x}{(1-x+\varepsilon+\frac{1}{\delta})^2})} < 1 + \frac{2\varepsilon\lambda}{(1-\lambda)s}$$

The first two conditions are true as long as $\varepsilon \neq \frac{1}{\delta} = \eta$. For the last to hold,

$$\frac{\lambda s}{(1-\lambda)s}(\frac{1+\frac{2}{\delta}-2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon})+\frac{2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}(\frac{\frac{1}{\delta}+\theta}{(x+\varepsilon+\frac{1}{\delta})^2}+\frac{1+\frac{1}{\delta}+x}{(1-x+\varepsilon+\frac{1}{\delta})^2})(1+\frac{2\varepsilon\lambda}{(1-\lambda)s})$$
$$> \quad \frac{2\varepsilon}{1+\frac{2}{\delta}+2\varepsilon}(\frac{1}{(x+\varepsilon+\frac{1}{\delta})}+\frac{1}{(1-x+\varepsilon+\frac{1}{\delta})}).$$

As then $\frac{\partial x_{PC}}{\partial \theta_{PC}} < 1$.

Note that as $\varepsilon \to 0$ the inequality becomes $\frac{\lambda s}{(1-\lambda)s} > 0\ \forall\delta$. The same is true as $\delta \to 0$. Additionally both sides of the inequality are continuous $\forall\varepsilon$ and $\forall\delta \neq 0$. Clearly $\forall\delta\ \ \exists\, \overline{\varepsilon}\ s.t.\ \forall\varepsilon < \overline{\varepsilon}$ the above inequality holds.

The Kuhn-Tucker Program of the Government

The complementary slackness conditions for the government's problem are

$$\begin{array}{lll} \frac{\partial L}{\partial s} \leq 0 & s \geqslant 0 & s\frac{\partial L}{\partial s} = 0 \\ s \leq 1 & m^L \geqslant 0 & m^L(1-s) = 0 \end{array}$$

Substituting by the relevant functional forms this becomes,

$$-F(I)\Gamma - cI(\Gamma s + \frac{\eta}{1+2\eta}) - (cS + c_2 I)\Gamma - I + \frac{I}{1+\lambda\kappa-\lambda} - m^L \leq 0, \quad \text{(A1)}$$

$$s \geqslant 0, \quad \text{(A2)}$$

$$s[-F(I)\Gamma - cI(\Gamma s + \frac{\eta}{1+2\eta}) - (cS + c_2 I)\Gamma - I + \frac{I}{1+\lambda\kappa-\lambda} - m^L] = 0, \quad \text{(A3)}$$

and,

$$s \leq 1, \quad \text{(A4)}$$

$$m^L \geqslant 0, \quad \text{(A5)}$$

$$m^L(1-s) = 0. \quad \text{(A6)}$$

where $(\frac{\lambda+\mu-\lambda\mu}{1+2\eta}) = \Gamma$.

Using equation $(A3)$, if $s > 0$ then

$$-F(I)\Gamma - cI(\Gamma s + \frac{\eta}{1+2\eta}) - (cS + c_2 I)\Gamma - I + \frac{I}{1+\lambda\kappa-\lambda} = m^L \quad \text{(A7)}$$

If in addition, $s < 1$, then from equation $(A6)$, $m^L = 0$ must hold. This can be substituted back into $(A7)$ to give

$$-F(I)\Gamma - cI(\Gamma s + \frac{\eta}{1+2\eta}) - (cS + c_2 I)\Gamma - I + \frac{I}{1+\lambda\kappa-\lambda} = 0$$

which gives the interior solution reported in the article.

Regarding the corner solutions. Focusing first in case in which $s = 1$. Again, use $(A6)$ to get $m^L > 0$. In addition, $(A3)$ can be used after substituting $s = 1$ to get

$$m^L = -F(I)\Gamma - cI(\Gamma + \frac{\eta}{1+2\eta}) - (c + c_2)I\Gamma - I + \frac{I}{1 + \lambda\kappa - \lambda} > 0,$$

which implies

$$-F(I)\Gamma - (2c + c_2)I\Gamma + -\frac{cI\eta}{1+2\eta} + \frac{(\lambda - \lambda\kappa)I}{1 + \lambda\kappa - \lambda} > 0$$

as stated in the text.

Finally, if $s = 0$ is a solution to the government's problem then, from equation $(A1)$ it is evident that $\frac{\partial L}{\partial s}\Big|_{s=0} < 0$. Using this, and the fact that $(A6)$ implies $m^L = 0$, equation $(A3)$ becomes

$$-F(I)\Gamma - \frac{cI\eta}{1+2\eta} - c_2 I\Gamma + \frac{(\lambda - \lambda\kappa)I}{1 + \lambda\kappa - \lambda} < 0,$$

which ends the proof.

References

[1] Bannier, C. (2005), "Big Elephants in Small Ponds: Do Large Traders Make Financial Markets More Aggressive?". Journal of Monetary Economics, vol. 52(8).

[2] Bassetto, M., and T.J. Sargent, 2005. Politics and Efficiency of Separating Capital and Ordinary Government Budgets. Federal Reserve Bank of Chicago.

[3] Birds G., and D. Rowlands (2002), "“Do IMF Programmes Have a Catalytic Effect on Other International Capital Flows?”, Oxford Development Studies, Vol. 30, No. 3.

[4] Broner, F., Lorenzoni, G. and S. Schmukler (2004), "Why Do Emerging Countries Borrow Short Term?", NBER Working Papers 13076.

[5] Broto, C., Diaz-Cassou, J. and A. Erce-Dominguez (2008), "The Sources of Capital Flows Volatility: Empirical Evidence for Emerging Countries", *Forthcoming* in Money Affairs.

[6] Caballero, R., and A. Krishnamurthy (2000), "Dollarization of Liabilities: Underinsurance and Domestic Financial Underdevelopment". NBER Working Paper No. 7792.

[7] Chang, R. and A. Velasco (2000), "Banks, Debt Maturity and Financial Crises". Journal of International Economics 51.

[8] Corsetti, G., Guimaraes, B. and N. Roubini (2006), “International lending of last resort and moral hazard. A model of IMF’s catalytic finance”. Journal of Monetary Economics, vol. 53(3).

[9] de Resende, C. (2007), "IMF-Supported Adjustment Programs: Welfare Implications and the Catalytic Effect". Bank of Canada, Working Paper No. 2007-22.

[10] Diamond, D.W. and P.H. Dybvig (1983), "Bank Runs, Deposit Insurance, and Liquidity". Journal of Political Economy 91.

[11] Diamond, D. W. (1991), "Debt Maturity Structure and Liquidity Risk". Quarterly Journal of Economics, vol. 103, No. 3.

[12] Diaz-Cassou, J., Molina, L., and A. Garcia-Herrero (2006), "What Kind of Flows Does the IMF Catalyze and When?". Bank of Spain Working Paper, No. 0617.

[13] Edwards, M. (2003), "Signaling credibility? The IMF and catalytic finance", Mimeo.

[14] Eichengreen, B. and A. Mody (1998), "What Explains Changing Spreads on Emerging Market Debt: Fundamentals or Market Sentiment?". NBER Working Papers, No. 6408.

[15] Eichengreen, B. and A. Mody (2003), "Bail Ins, Bailouts, and Borrowing Costs”, Journal of Econometrics, Vol. 36.

[16] Eichengreen, B., Kletzer and A. Mody (2005), "The IMF in a World of Private Capital Markets", IMF Working Paper 05/84.

[17] Eichengreen, B., Hale, G. and A. Mody (2001), "Flight to Quality: Investors Risk Tolerance and the Spread of Emerging Market Crises", in International Financial Contagion: How it spreads and how it can be stopped, edited by Stijn Claessens and Kristin Forbes, Kluwer Academic Publishers.

[18] Erce, A. (2008). "A Structural Model of Sovereign Debt Issuance: Assessing the Role of Financial Factors". Bank of Spain Working Paper, No. 0809.

[19] Gosh, A, Lane, T. , Schultze–Gattas, M., Bulir, A., Hasmann, J. and A. Mourmouras (2002), "IMF Supported Programs in Capital Account Crises" IMF Occasional Paper No. 210.

[20] Jeanne, O. (2000), "Debt Maturity and the Global Financial Architecture". CEPR Discussion Paper No. 2520.

[21] Jeanne, O. (2004), "Debt Maturity and the International Financial Architecture". IMF Working Paper WP/04/137.

[22] Kharroubi, E. (2004), "Liquidity, Volatility and Growth". DELTA Working Papers 2004-26.

[23] Martin, B. and A. Peñalver (2002), "The Effect of Payments Standstills on Yields and the Maturity Structure of Sovereign Debt". Bank of England, Working Paper No. 184.

[24] Min, H., Lee, D., Nam, C., Park, M. and S. Nam (2003), "Determinants of Emerging Market Spreads: Cross Country Evidence". Global Finance Journal 14.

[25] Mody, A., and D. Saravia (2003) "Catalyzing Private Capital Flows: Do IMF-Supported Programs Work asCommitment Devices?", IMF Working Paper 03/100.

[26] Morris, S. and H. Shin (1998), "Unique Equilibrium in a Model of Self-Fulfilling Attacks". American Economic Review 88.

[27] Morris, S. and H. Shin (2004), "Coordination Risk and the Price of Debt". European Economic Review 48.

[28] Morris, S. and H. Shin (2006), "Catalytic Finance: When Does it Work?". Journal of International Economics, vol. 70(1).

[29] Narag, R. (2004), "The Term Structure and Default Risk in Emerging Markets". Working Paper, UCLA.

[30] Rodrick, D. and A. Velasco (1999), "Short-Term Capital Flows". Prepared for the ABCDE Conference at the World Bank.

[31] Peñalver, A. (2004), "How can the IMF catalyse private capital flows? A model". Bank of England, Working Paper No. 215.

[32] Persson, T., Roland, G., and G. Tabellini, 2005. Electoral Rules and Government Spending in Parliamentary Democracies. Mimeo.

[33] Shin, H. (2001), "Coordination and the Term Structure of Interest Rates for Defaultable Securities". Mimeo.

[34] Zwart, S. (2007), "The Mixed Blessing of IMF Intervention: Signalling versus Liquidity Support". Journal of Financial Stability, 3(2).

Appendix II: Data Sources and Estimation Results

Variables	Source	Frequency
Bonds characteristics	Bondware	-
IMF programs	IMF	-
US T-bills 10 yrs. and 1 yr. (Constant maturities-middle rate)	Datastream	Quarterly
Public bond market capitalization (% of GDP)	FSD (WB)	Yearly
GDP (current US$)	WDI (WB)	Yearly
Imports as a % of GDP	WDI (WB)	Yearly
Total reserves (current US$)	WDI (WB)	Yearly
Proportion of population above 55	WDI (WB)	Yearly
Proportion of the population between 35-55	WDI (WB)	Yearly
Total amount of debt rescheduled (US$)	GDF (WB)	Yearly
Data on pensions reform	USSSA	-
Data about debt agreements	Paris Club	-
Credit rating	S&P	-

WDI: World Development Indicators
FSD: Financial Structure Database
GDF: Global Development Finance
IFS: International Financial Statistics
USSSA: US Social Security Administration

	(1)	(2)
Ongoing Paris Club Treatment	.9798411	1.132885
	[.2602722]	[.2587525]
New PC treatment	.9406229	1.112601
	[.2163196]	[.2133118]
GDP growth	-1.937623	-1.646002
	[.211347]	[.1915341]
External debt/GDP	.0294715	
	[.0813945]	
Constant	-.4366697	-.6245141
	[.0745381]	[.0516096]
Observations	2408	2884
Standard errors in brackets		
Includes time and country dummies		

Table 1: IMF Presence: Probit Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
Global Liquidity	.0147207	.0129978	.0146026	.0147306	.0149478	.0129978
	[.006456]	[.0067818]	[.0064697]	[.0064669]	[.006462]	[.0067818]
Pr(imf)		-.7705629				-.7705629
		[.3557685]	[]	[]	[]	[.3557685]
New IMF program			.1690749	-.3689575	.1560188	
		[]	[.1414134]	[.3466259]	[.1511039]	[]
Ongoing IMF program			.1129032			
		[]	[.0673933]	[]	[]	[]
Duration new program				.0240603		
	[]	[]	[]	[.0145293]	[]	[]
Amount new program					-4.26e-06	
	[]	[]	[]	[]	[.0000252]	[]
Credit rating	-.0323539	-.0289043	-.0376948	-.0337483	-.0332713	-.0289043
	[.0086476]	[.0088508]	[.0090943]	[.0087102]	[.0087115]	[.0088508]
US yield curve (10y-1y)	-.6973785	-.6161691	-.6915991	-.728759	-.7035608	-.6161691
	[.3301781]	[.3486117]	[.3304333]	[.3307917]	[.3302429]	[.3486117]
lagresimports	.1847318	.1713322	.1986922	.1857971	.1873834	.1713322
	[.0503479]	[.0508982]	[.0508799]	[.0504124]	[.0504208]	[.0508982]
Constant	-1.209388	-.9626509	-1.187504	-1.136299	-1.221897	-.9626509
	[1.0987]	[1.108749]	[1.099358]	[1.100511]	[1.099017]	[1.108749]
Observations	2267	2171	2267	2267	2267	2171

Standard errors in brackets
Includes country dummies

Table 2: Issuance Decission: Probit Analysis

	(1)	(2)	(3)	(4)
Global Liquidity	.0286249	.0436986	.02649	.0436986
	[.0078288]	[.0137525]	[.0078664]	[.0137525]
Credit rating	-.0047324	-.0406866	-.0056702	-.0406866
	[.0223569]	[.0350299]	[.0224733]	[.0350299]
Many issues	-.2098705	-.2094876	-.2146184	-.2094876
	[.059832]	[.0598213]	[.0599413]	[.0598213]
Pr(imf)		-1.207847		-1.207847
	[]	[.9060769]	[]	[.9060769]
IMF new program			.8962129	
	[]	[]	[.3484714]	[]
IMF ongoing			.1429665	
	[]	[]	[.0724398]	[]
Amount new program			-.0000239	
	[]	[]	[.0000284]	[]
Duration new program			-.02271	
	[]	[]	[.0138037]	[]
US 10y T-Bill rate	-1.336988	-2.038757	-1.297945	-2.038757
	[.3864536]	[.6530137]	[.3886857]	[.6530137]
Debt rescheduling	-.1687938	-.1539952	-.1658276	-.1539952
	[.1105524]	[.1110874]	[.1117169]	[.1110874]
Mills ratio	2.135488	3.779134	1.834526	3.779134
	[.6009065]	[1.371579]	[.6110708]	[1.371579]
Domestic Currency	-1.203303	-1.199537	-1.219274	-1.199537
	[.1188292]	[.1188402]	[.1191411]	[.1188402]
US $ dummy	.2647612	.2688399	.2589787	.2688399
	[.089686]	[.0897211]	[.0903534]	[.0897211]
EURO dummy	.1472297	.1542801	.1427141	.1542801
	[.1075614]	[.1076709]	[.108157]	[.1076709]
Non-Investment grade	-.1669052	-.1570674	-.1638849	-.1570674
	[.0768242]	[.0771632]	[.0767674]	[.0771632]
Constant	.4030437	-1.939628	1.055252	-1.939628
	[1.530445]	[2.330181]	[1.548263]	[2.330181]
Observations	2108	2108	2108	2108
Standard errors in brackets Includes country dummies				

Table 3: Issued Amount. Regression Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Spread	-.013	-.016	-.0161	-.017	-.006	-.0106	-.010	-.0143	-.0162
	[.007]	[.008]	[.007]	[.008]	[006]	[.007]	[.007]	[.007]	[.008]
Amount	4.59	4.904	4.598	5.426	3.956	3.707	3.798	4.436	4.458
	[.872]	[.923]	[.894]	[1.039]	[.785]	[.764]	[.781]	[.884]	[.896]
Many issues	2.19	2.664	2.397	2.803	1.623	1.684	1.893	2.218	2.427
	[.875]	[.959]	[.927]	[.978]	[.802]	[.813]	[.853]	[.924]	[.940]
Pr (imf)					11.180				
	[]	[]	[]	[]	[3.942]	[]	[]	[]	
pub bond			-5.180		-4.991	-2.644	-2.961	-4.583	-4.885
	[]	[]	[2.100]	[]	[1.943]	[1.989]	[2.014]	[2.113]	2.133
Spread*P(imf)									
	[]	[]	[]	[]	[]	[]	[]	[]	[]
financ WB				-2.988					
	[]	[]	[]	[1.852]	[]	[]	[]	[]	[]
Mills ratio	-.423	-.174	-3.135	.929	-4.814	-3.059	-2.831	-2.968	-3.008
	[1.622]	[1.658]	[2.021]	[1.812]	[2.022]	[1.922]	[1.924]	[2.004]	[2.014]
Credit Rating	.179	.255	.365	.230	-.044	-.076	-.074	.229	.288
	[.331]	[.342]	[.349]	[.332]	[.280]	[.262]	[.281]	[.349]	[.361]
Old pop.	-.174	-.232	-.322	-.345	-.215	-.320	-.351	-.310	-.331
	[.162]	[.171]	[.178]	[.196]	[.158]	[.184]	[.192]	[.176]	[.178]
Adult pop.	-.501	-.542	-.476	-.493	-.463	-.402	-.416	-.451	-.477
	[.163]	[.168]	[.167]	[.171]	[.154]	[.159]	[.160]	[.166]	[.167]
Pensions ref.		-5.824	-6.411	-5.356	-4.261	-1.388	-4.189	-5.861	-6.360
	[]	[2.882]	[2.885]	[2.841]	[2.538]	[1.852]	[2.561]	[2.856]	[2.915]
IMF						2.546			
	[]	[]	[]	[]	[]	[1.178]	[]	[]	[]
IMF new							2.833	5.810	-13.037
	[]	[]	[]	[]	[]	[]	[1.446]	[6.215]	[7.036]
IMF ongoing							1.975		
	[]	[]	[]	[]	[]	[]	[1.174]	[]	[]
Duration new								-.124	
								[.226]	
Amount new								-.00008	
								[.0003]	
interac_sp-F									.0315
									[.014]
Constant	15.885	16.636	18.083	9.281	20.512	20.637	21.140	18.040	19.681
	[10.094]	[10.208]	[10.039]	[11.678]	[9.201]	[9.385]	[9.397]	[9.879]	[9.934]
observations	400	400	400	400	400	400	400	400	400
Standard errors in brackets									

Table 4: Maturity: Structural estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Maturity	7.22	10.25	13.28	11.12	11.26	14.23	15.02	14.45	15.96
	[5.34]	[5.2]	[5.43]	[5.24]	[5.4]	[5.5]	[5.49]	[5.76]	[5.33
Est. amount	40.52	33.82	21.74	42.46	12.78	-.42	-5.65	16.87	17.78
	[18.4]	[18.74]	[19.86]	[20.43]	[18.37]	[19.29]	[19.69]	[20.81]	[20.6
Many issues	45.906	39.734	38.447	39.648	35.138	31.255	31.522	38.33	37.13
	[14.76]	[15.29]	[15.91]	[15.46]	[15.07]	[15.59]	[15.8]	[16.2]	[16.71
Pr (imf)					330.718				
	[]	[]	[]	[]	[108.719]	[]	[]	[]	[]
pub bond			230.64		197.805	271.8	268.77	224.477	238.4
	[]	[]	[115.23]	[]	[111.240]	[112.78]	[114.13]	[117.22]	[120.6
pub bond sq			-264.32		-248.143	-213.84	-211.99	-254.46	-268.1
	[]	[]	[125.34]	[]	[119.546]	[123.71]	[125.23]	[127.71]	[131.8
financ WB				-47.43					
	[]	[]	[]	[32.06]	[]	[]	[]	[]	[]
Mills ratio	-22.39	-16.36	-42.85	-5.84	-72.81	-19.35	-11.36	-29.62	-45.3
	[42.51]	[44.16]	[52.99]	[45.71]	[51.14]	[52.31]	[53.24]	[54.23]	[55.84
Credit Rating	45.79	46.62	49.44	45.88	48.6	41.16	42.2	50.46	50.9
	[3.68]	[3.733]	[3.965]	[3.87]	[3.82]	[4.52]	[4.73]	[4.38]	[4.42
US T-bill 10	-78.67	-79.89	-79.81	-79.72	-93.72	-85.16	-84.55	-81.25	-80.5
	[11.86]	[12.16]	[12.71]	[12.3]	[12.41]	[12.43]	[12.59]	[12.96]	[13.3
IMF new							23.17	-326.86	-19.1
	[]	[]	[]	[]	[]	[]	[34.18]	[145.7]	[34.2
IMF ongoing							96.324		
	[]	[]	[]	[]	[]	[]	[17.87]	[]	[]
IMF						93.69			
						[18.72]	[]	[]	[]
Amount new								-.001	
						[]	[]	[.008]	[]
Duration new								10.78	
						[]	[]	[5.19]	[]
						[]	[]	[]	[]
						[]	[]	[]	[]
liqr	-3.352	-3.38	-3.83	-3.51	-3.571	-3.53	-3.39	-3.78	-4.05
	[.81]	[.83]	[.86]	[.83]	[.848]	[.88]	[.88]	[.877]	[.887
liqacc		-454.07	-429.113	-450.56	-358.84	-228.5	-182.43	-464.73	-410.7
	[]	[254.38]	[266.36]	[257.02]	[254.09]	[263.81]	[268.81]	[273.16]	[281.6
Constant	469.81	488.75	574.801	424.9	624.53	698.11	677.07	568.12	597.9
	[192.6]	[196.7]	203.614]	[208.24]	[190.49]	[198.41]	[200.26]	[206.45]	[211.1
observations	400	400	400	400	400	400	400	400	400

Standard errors in brackets

Table 5: Spread: Structural estimation