BONDS OR LOANS?
THE EFFECT OF MACROECONOMIC FUNDAMENTALS

By

Galina Hale

February 2003

COWLES FOUNDATION DISCUSSION PAPER NO. 1403

COWLES FOUNDATION FOR RESEARCH IN ECONOMICS

YALE UNIVERSITY

Box 208281

New Haven, Connecticut 06520-8281

http://cowles.econ.yale.edu/

Bonds or Loans? The Effect of Macroeconomic Fundamentals

Galina Hale*

Yale University

February 2003

Abstract

The lending boom of the 1990s witnessed considerable variation over time and across countries in the ratio of international bonds to foreign bank loans used as debt instrument by emerging market borrowers. Why some issuers float international bonds while others borrow from international banks has received little if any systematic attention. This paper tests how macroeconomic fundamentals affect the choice of international debt instrument available to emerging market borrowers. As a stepping stone for empirical analysis, a model with asymmetric information is presented. Empirical results show that macroeconomic fundamentals explain a significant share of variation in the ratio of bonds to loans for private borrowers, but not for the sovereigns.

JEL classification: F34

Key words: emerging markets, foreign debt, debt composition, country risk

*Department of Economics, Yale University. Contact: Department of Economics, Yale University, PO Box 208268, New Haven CT 06520-8268, galina.hale@yale.edu. I am most grateful to Barry Eichengreen for guidance and encouragement. Eduardo Engel, Sean Flynn, Donato Gerardi, William Greene, Bronwyn Hall, Olivier Jeanne, Chad Jones, Richard Lyons, Marcelo Moreira, Maury Obstfeld, Peter Phillips, David Romer, Paul Ruud, Kenneth Train and many seminar and conference participants provided most helpful comments and suggestions. This research would have been impossible without Ashoka Mody's generosity in providing bond and loan data, and without the instrumental help of Himmat Khalsi and E.J. Kim. Oxana Marmer provided excellent research assistance. I am grateful to the Department of Economics at UC Berkeley and the Berkeley Program for Soviet and Post–Soviet studies for financial support. All errors are mine.

1 Introduction

During the lending boom of the 1990s, unlike in the past, emerging market borrowers — public as well as private — borrowed heavily from foreign banks and also actively issued international bonds. The decade witnessed considerable variation over time and across countries in the ratio of these two debt instruments, as can be seen in Figure 1. Why some issuers float international bonds while others borrow from international banks has received little if any systematic attention.

This paper tests how macroeconomic fundamentals affect the choice of international debt instrument available to emerging market borrowers. The analysis confirms that macroeconomic factors such as the foreign debt to GDP ratio, the debt service to exports ratio, the real exchange rate appreciation, the real interest rate, the history of sovereign debt rescheduling, and political risk, among others, affect the choice of debt instrument in a direction predicted by the model. The effects are economically significant: for example, Brady–type debt rescheduling increases the probability of issuing junk bond (rather than taking a loan or issuing investment grade bond) by at least 0.16 for private and 0.45 for sovereign borrowers; an increase in the debt service to export ratio by one standard deviation raises the probability of issuing a junk bond by about 0.07 for private and 0.1 for sovereign borrowers.

The results also show that macroeconomic fundamentals explain 27% of the cross-country variation and 10% of the time variation in the ratio of bonds to loans for private borrowers,[1] but do not explain well this variance for sovereign borrowers, suggesting that other effects are more important in determining the choice of debt instrument for sovereigns.

These findings are important for two reasons. First, it is necessary to understand the current determinants of borrowers' choice between bonds and loans in order to determine the future importance of bank and bond finance, something that matters for planning by lenders, borrowers and policymakers alike. From the point of view of policy, international capital flows mediated by banks and by the bond market pose different systemic risks. Countries that rely on bank loans for external finance face a greater risk of liquidity crises, since banks can discontinue their financing on relatively short notice. Bonds, while having a longer tenor, are harder to restructure, both because the

[1]The numbers reported are the ratios of regression sum of squares to the total sum of squares in the ordinary list square regression of actual bond–loan ratios to predicted bond–loan ratios.

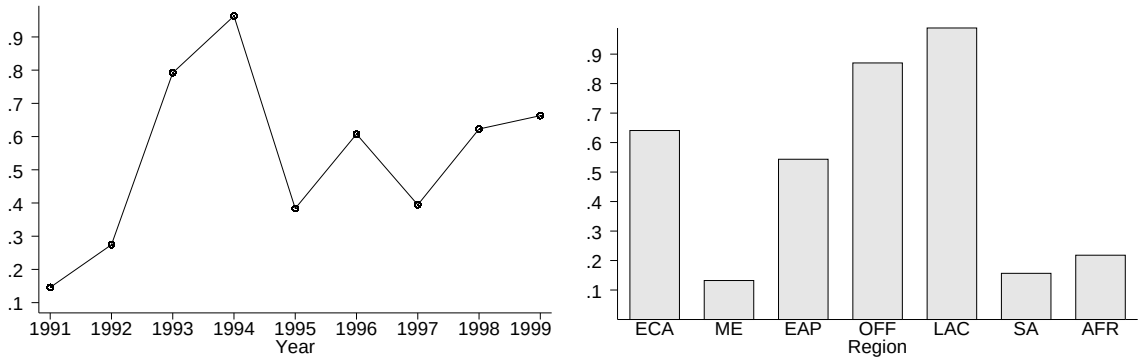

Figure 1: The ratio of bonds to loans
Regions are: ECA = East Europe and Central Asia, ME = Middle East, EAP = East Asia and Pacific, OFF = Offshore zones, LAC = Latin America, SA = South Asia, AFR = Africa.

number of holders of a bond issue is much larger than the number of banks in a loan syndicate, and because bonds do not typically include the sharing clauses that feature prominently in syndicated loan agreements. Second, one needs to know how macroeconomic fundamentals affect the ratio of bonds to loans in order to be able to analyze the two markets in an integrated fashion.

Since the relationship between macroeconomic fundamentals and the debt instrument is not an obvious one, the paper first presents a model that builds on Diamond (1991) framework, as a stepping stone for the empirical analysis. Diamond (1991) suggests that the choice of debt instrument is, among others, a function of a borrower's creditworthiness. In particular, as creditworthiness improves, borrowers are likely to switch from junk bonds (bonds that are associated with a high level of risk and therefore bear high risk premia) to bank loans. As creditworthiness improves further, borrowers switch back to the bond market, this time issuing investment grade bonds, reflecting the now lower level of risk. This result hinges on the fact that a good reputation induces borrowers to choose safe projects and thus eliminates the need for monitoring, while a bad reputation makes it impossible to provide incentives to ensure the choice of the safe project via monitoring.

The model presented in this paper shows that even without differentiated reputation costs, the above result holds as long as there is a fee for banking intermediation (monitoring cost in Diamond's framework). This model is static and thus assumes exogenous costs of default and loan cancellation that are the same for all borrowers and are not necessarily linked to reputation, but have to be positive to sustain borrowing (See, for example Dooley (2000)). This simplification allows to extend

the model to allow for strategic default (repudiation), and to formulate testable implications.

These implications are used to analyze data on bond issues and loan contract by developing country public and private borrowers during the 1990s, using discrete choice models. Not all the bonds in the data set are individually rated, thus various techniques are used to classify them as investment grade or junk. The analysis concentrates on the country–specific (not individual borrower's) component of the risk, thus linking macroeconomic fundamentals to the choice of debt instrument through their effect on country risk.[2]

The predictions of Diamond's model have been tested empirically for the US corporate debt markets (Datta, Iskandar-Datta, and Patel 1999, Krishnaswami, Spindt, and Subramaniam 1999). These studies found support for the reputation-building predictions of Diamond's model and moral hazard, but only limited evidence of adverse selection. This paper finds some support for both moral hazard and adverse selection in international capital markets.

There are two other corporate finance papers directly related to the choice between bonds and loans. Rajan (1992) emphasizes a different trade–off in the choice of debt instrument. Monitoring allows the bank to discontinue the project once its NPV is negative. However, since the banks cannot commit to continue financing the project with positive NPV, the firm must pay premium to the bank to continue financing. This adversely affects the incentive to exert effort to increase a project's payoff, i.e. amplifies moral hazard. Bolton and Freixas (2000) add equity to the choice set and show, among other things, that if the supply of loans is large, equity will disappear and high–risk firms will borrow from banks while low–risk firms will issue bonds. This result is consistent with a special case of a Diamond's model. It is, however, based mostly on seniority considerations and thus is not directly applicable to international markets where relative seniority of bonds and loans is not always specified *de jure*.

This paper also relates to a number of empirical studies. Demirguc-Kunt and Maksimovic (1996), Schmukler and Vesperoni (2000), Domowitz, Glen, and Madhavan (2000), to name just a few, analyze other aspects of developing countries debt composition: debt versus equity, and the maturity structure. Folkerts-Landau (1985) and Aerni and Junge (1998) describe institutional features of

[2]Clearly, more direct measure of a country risk could be used, however this paper aims at determining the effects of macroeconomic fundamentals on debt composition.

international bond and loan markets. Both the bond market and the syndicated loan market have been treated in isolation,[3] however there has been little systematic attempt to analyze the two markets in an integrated fashion in order to account for the substitution between debt instruments.

The paper proceeds as follows. Part 2 briefly presents the basic model, several extensions and testable implications. All the derivations are presented in a Supplement to the paper. Part 3 discusses the data and the empirical methodology. Results are presented and summarized in Part 4. Part 5 concludes.

2 Model

2.1 Intuitive model description

Diamond (1991) presents a model in which monitoring and loan cancellations, but not renegotiations are allowed. In a dynamic version of the model, he endogenizes the cost of reputation and argues that reputation cost is the main reason that *most risky and least risky borrowers issue bonds while moderately risky borrowers borrow from the banks.* It can be shown that the result also holds in a static model with an exogenous and constant cost of default that may be interpreted as a reputation cost.

An alternative intuition for this result lies in the different characteristics of bonds and bank loans. Bank syndicates have a lead manager who monitors the borrower (reducing moral hazard) and takes the lead in (re–)negotiations with the borrower. Banks can refuse to roll–over the loans (as most syndicated loan contracts provide for bi–annual roll–over), which represents a credible threat to a borrower and therefore makes monitoring efficient. In contrast, after the launch of an international bond, bondholders have little control over the issuer's actions, since a bond issue cannot be reversed before it matures (bond maturity is on average 5 years for developing countries bonds). These facts suggest that banks can limit the risk of their loans and, hence, offer funds at a lower rate.

However, these advantages come at a cost. Banks bear costs not borne by bond holders, including reserve and capital requirements, as well as operating and monitoring costs, that they pass through

[3]On the pricing of international bonds, the literature goes as far back as Edwards (1986). On pricing and availability of international bank loans, see Eichengreen and Mody (2000).

to their borrowers. Hence, borrowers face a trade–off between the lower risk premium and additional costs of bank loans as compared to bonds.

This trade–off is resolved differently for different borrowers. At the low end of the risk spectrum, borrowers do not need to be monitored. For these borrowers, the costs of financial intermediation outweigh its benefits and they choose to use the bond market, which is able to provide funds at a lower cost than banks. For moderate–risk borrowers, monitoring can be efficient in reducing the risk of a loan. The costs of financial intermediation are then outweighed by the reduction in the risk premium, which makes bank loans cheaper than bonds. For high risk borrowers, adverse selection is important: If the bank cannot significantly reduce the risk of a loan, as will be the case with the most risky borrowers, it will charge higher rates than the bond market, due to its additional costs. In a situation of asymmetric information rates become too high for the low–risk borrowers, and the market disappears due to adverse selection *à la* Stiglitz and Weiss (1981). Critically, because of the additional costs of banking activity, the market for bank loans disappears at a lower risk level than does the bond market. In other words, safe projects get priced out of the loan market for a larger set of cases then they get priced out of the bond market. As a result, we expect *most and least risky borrowers to issue bonds, while those of the moderate riskiness rely primarily on bank loans.*

2.2 Summary of model setup

There are two types of projects: safe, with gross return G, and risky, with gross return $B > G$ with probability π and 0 with probability $1 - \pi$. There are three types of risk–neutral borrowers with limited liability: type G has only access to safe project, type B — only to risky project, and type S can choose between two projects. $G > \pi B$, therefore in the absence of limited liability risky projects will not be financed. The action that type S takes to choose the project is unobservable. The share of the "risky" type (B) then represents the degree of adverse selection, while the share of "switching" type (S) represents the degree of moral hazard (represented in this model by incentive to choose risky project). All borrowers borrow one unit of funds. Type distribution is given by simplex (f_G, f_B, f_S) and is known, while individual borrower's type is not observed.

Lenders can choose to monitor borrowers at some exogenous fixed cost $c > 0$ of monitoring. They

are risk–neutral and perfectly competitive, supplying an unlimited amount of funds at an expected rate of return equal to the exogenous risk–free gross rate R, $\pi B < R < G$, plus cost of monitoring if monitoring is chosen. Since borrowers types are not observed, bank will either monitor all the borrowers or not monitor at all, and all the borrowers will be offered funds at the same rate as shown in the table below for each of the possible strategy combinations.[4]

	Type S chooses safe project $s = g$	Type S chooses risky project $s = b$
Lender chooses not to monitor	Case 1. $r_1 = \frac{R}{1-(1-\pi)f_B}$	Case 3. $r_3 = \frac{R}{\pi+(1-\pi)f_G}$
Lender chooses to monitor	Case 2. $r_2 = \frac{R+C}{1-(1-\pi)f_B}$	Case 4. $r_4 = \frac{R-PR(1-f_G-f_B)+C}{\pi(1-P)+(1-\pi(1-P))f_G+\pi P f_B}$

Since $\pi B < R$, lending will only occur in each case i, $i = 1, ..., 4$, if $r_i < G$.

Monitoring unveils choice of risky project with probability P and the lender then cancels the project and can invest this unit of funds elsewhere. Cancellation of the project levies fixed cost L on borrower. If risky project is not cancelled and bad state of nature realized, borrower defaults and incurs a fixed cost of default $D > L$, while the lender's payoff is 0.

Borrowers of type S will choose a safe project over a risky one if the return on the safe project exceeds expected return on the risky one. The latter will be different depending on whether lender chooses to monitor or not. Borrower of type S will choose safe project without being monitored if

$$f_B \leq \frac{1}{1-\pi} - \frac{R}{(1-\pi)D + (G - \pi B)}, \tag{1}$$

and with monitoring if

$$f_B \leq \frac{1}{1-\pi} - \frac{(1-\pi(1-P))(R+C)}{(1-\pi)[Z + G - \pi(1-P)B]}, \tag{2}$$

[4]All the derivations are described in Supplement.

where $Z \equiv PL+(1-P)(1-\pi)D$ and can be interpreted as a cost of "failure" in case of monitoring.

If the share of type B borrowers is too high, the lowest rate the bank will accept with monitoring is too high to induce type S borrowers to prefer the safe project even though they are monitored. On the other hand, if the share of type B borrowers is sufficiently low, the interest rate r_1 is low enough for type S borrowers to prefer safe projects even without monitoring. Since monitoring is costly, it will not occur unless borrowers of type S would choose risky projects in the absence of monitoring. If condition (1) is satisfied and $f_S > 0$, the rate r_1 will be small, and monitoring will never be needed.

If monitoring is needed, it will occur if expected benefit from monitoring exceeds its cost. Expected benefit arises from two sources: first, when monitoring provides sufficient incentives for type S borrower that otherwise would choose risky project, to switch to a safe project; second, even if type S still chooses risky project under monitoring, monitoring increases expected payoff to the lender since a share of risky projects can be cancelled.[5] Thus lenders will monitor if monitoring induces type S borrowers to choose safe project and

$$f_G + \frac{R}{R+C} f_B \leq 1 - \frac{C}{(R+C)(1-\pi)}. \tag{3}$$

They will monitor also if type S borrowers still choose risky project and

$$f_B \leq 1 - f_G - \frac{C}{RP} - \frac{C}{RP} \frac{\pi}{(1-\pi) f_G}. \tag{4}$$

Intuitively, if the share of type S borrowers is too low, the benefit from monitoring will be small, since there is no benefit from monitoring types G and B. The higher the cost of monitoring, the larger is the share of borrowers of type S needed in order for monitoring to occur.

2.3 Model predictions

This model can be solved as shown in Supplement to lead to the following predictions.

- A larger differential between the return on the risky project in the good state and the return

[5] This second case (of 'junk loans') occurs only for a small set of parameter values.

on the safe project increases moral hazard for borrowers and thus increases the need for monitoring.

- If the risk–free interest rate rises, monitoring becomes more likely, since the interest rate at which banks lend to all the borrowers increases and therefore fewer borrowers are willing to choose safe projects without monitoring.
- A higher probability of success for risky projects increases moral hazard and thus makes monitoring more likely.
- An increase in the cost or a decline in the efficiency of monitoring (measured by P) reduces net benefit from monitoring and so monitoring is less likely to occur.
- A higher cost of default makes risky projects less attractive. This reduces the need for monitoring. A higher cost of loan cancellation increases the set of cases in which monitoring provides incentives to borrowers to choose safe projects. This raises the amount of monitoring.
- If only a few borrowers are subject to moral hazard (f_S is small), there is less benefit from monitoring, and thus monitoring is less likely to occur.
- If there are just a few borrowers of type B, interest rates will be low if type S borrowers choose safe projects. This too will reduce the need for monitoring.

2.4 Strategic default

If the reason for default is unobservable, then liquidity default (default due to inability to repay the debt in a bad state of nature) and strategic default (when borrower is able to repay the debt but chooses not to do so) have the same cost. In this case, an incentive constraint for the borrowers subject to strategic default has to be satisfied. The supplement shows that in the model considered, other things being equal, the set of cases in which lending occurs when strategic default is allowed is smaller than otherwise. This implies that sovereign borrowers (which are protected by sovereign immunity) will not be able to borrow as easily as private borrowers with the same characteristics.

Monitoring will also be more likely if we assume that monitoring allows lenders to determine the reason for default with some probability and therefore prevent some strategic defaults.

2.5 Discussion

The model focuses on the lender's decision of whether or not to monitor. If monitoring is not profitable, then lending will take the form of bonds: the bond market can offer a lower rate than banks because banks have additional costs — they are referred to as costs of monitoring, but can be interpreted more broadly as including operating costs, costs of raising equity to meet capital requirements, reserve requirements, and so on. In addition, a bank syndicate is modelled as a single actor. This is justified because the borrower deals with one bank (the lead manager) that monitors and renegotiates, while the other banks in the syndicate only contribute funds.

The model assumes that there is a fixed distribution of borrower types. This is not true in practice. In the real world, lenders form their beliefs about a borrower's type based on a borrower's reputation and other characteristics. The model can be applied if we assume that lenders face several sets of borrowers with different type distributions, and, based on signals (such as credit rating or default history) decide what distribution a particular borrower is from. This interpretation allows for empirical analysis of the model's implications.

Finally, the model assumes that lenders are perfectly competitive. Introducing a monopolistic lender will change the model's basic results, since a monopolist would be able to offer a menu of contracts to borrowers and thus potentially learn their types. This could be an interesting theoretical extension of the model, however two considerations suggest that a competitive framework is a more appropriate way of characterizing lending to emerging markets. First, the share of loans to emerging market borrowers in the total lending of international banks is not very large.[6] Second, international bank lending is syndicated, which means that the lead manager that is negotiating the loan does not disburse the full amount of the loan but involves other banks. Both factors indicate that the banks that lend to emerging markets can increase the amount they lend if there is a profitable opportunity. As long as the banks do not collude, the funds for international syndicated bank lending to emerging markets are elastic — if some banks try to charge rates that are too high, other banks will be able to switch their assets from other markets and undercut those rates.

[6] In December 2000, only 8.4% of all bank loans went to the emerging markets. This amount includes inter–bank loans and loans to businesses other than banks, and securities. For each of these categories, the share of emerging market liabilities is below 10%. For the data, see BIS Quarterly Review, June 2001, table 2.1, p.13.

2.6 Testable implications and explanatory variables

If a borrower is drawn from a distribution with lower risk (measured by a share of type B borrowers), lending is more likely to occur.[7] Borrowers from a very low risk distribution borrow mostly on the bond market. Borrowers from a distribution with moderate risk are more likely to take out loans, while borrowers drawn from a distribution with higher risk are likely to issue junk bonds. The relationship between the risk level and the debt instrument is illustrated in Figure 2.[8]

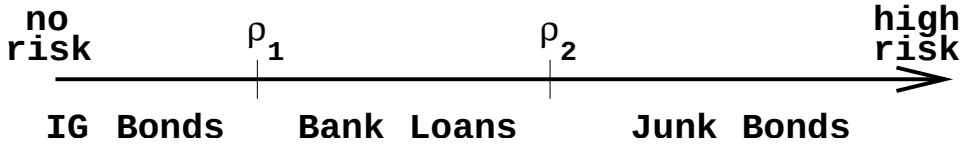

Figure 2: Risk and debt instrument

If we denote as y a choice that each borrower makes, the model predictions can formally be summarized as follows:

$$y = \begin{cases} \text{IG bond} & \text{if } \rho < \rho_1 \\ \text{Bank loan} & \text{if } \rho_1 \leq \rho < \rho_2 \\ \text{J bond} & \text{if } \rho_2 \leq \rho \end{cases}$$

where ρ is a risk level and ρ_1, ρ_2 are relevant threshold values that can be estimated.

Clearly, the risk level of the borrower cannot be perfectly observed. However, we can observe the variables that might affect the risk level of a borrower. If

$$\rho = X\beta + \varepsilon,$$

where X is the matrix of explanatory variables, β is a vector of coefficients, and ε is an i.i.d. error

[7] Risk can be more accurately defined as an inverse of probability that the loan will be repaid. This definition leads to the same qualitative predictions. Due to four different cases, however, the illustration would be extremely cumbersome as depending on the project choice of type S borrower, iso–risk lines will be either horizontal or vertical on a simplex figure shown in the Supplement. Algebraic derivation is also very messy. A definition of risk used in the text allows reader to map model prediction to testable implications more easily.

[8] This figure and the discussion that follows do not take into account the prediction that most risky borrowers will not be able to borrow at all. Since no information about those that applied for a loan and did not receive it or failed to issue a bond is available, it is not possible to test full set of model predictions. Even if it would be possible to include observations on those that did not borrow — which is easy to do for sovereigns, one would have to separate those who did not borrow from those who tried and failed, which does not seem to be possible given the data available at the time of writing. Additional tests were conducted to account for the possible selection bias using data aggregation and panel tobit estimation. The results are qualitatively the same, while estimation is extremely computationally demanding which prevents from conducting all necessary robustness tests. Binary probits presented below provide additional robustness tests.

term with distribution $F(0, \sigma)$, the above model is an ordered probability model with unknown threshold values and latent variable ρ. It can be estimated by maximum likelihood. The details of estimation procedure are described in the next section.

How risky a borrower is can be measured by, inter alia, its credit rating. But the credit rating is affected by macroeconomic variables that are interesting to consider as explanatory variables. Since the total effect of macroeconomic variables on borrowing decisions, and not just the direct effects for a given credit rating, is informative, a credit rating residual (purged of the effects of the obvious macroeconomic variables) is used as an explanatory variable, as described in Appendix 1. Individual borrowers' credit ratings are available only for a small subset of the borrowers and therefore cannot be used. Instead, each country's credit rating is used as a proxy. The credit rating residual can then be interpreted as a proxy for political risk.

Previous studies (Kaminsky, Lizondo, and Reinhart 1998, Eichengreen and Mody 2000, Eichengreen, Hale, and Mody 2001, Mody, Taylor, and Kim 2001) found that the following macroeconomic fundamentals are important as explanatory variables of the magnitude and cost of the capital flows to emerging markets, and the probability of the financial crisis:

- *Real economy:* rate of real GDP growth and the level of industrial production should both have a negative effect on the risk level;
- *Foreign position:* the ratio of foreign debt to GDP, the ratio of debt service to exports, the ratio of short–term to total debt, export volatility, real exchange rate appreciation, and the current account deficit, should each have a positive effect on the risk level, while the ratio of foreign reserves to short–term debt, to imports or to M2, and export growth should have a negative effect;
- *Monetary and financial sector:* the growth rate of domestic credit, the inflation rate, and the domestic short–term real interest rate should each have a positive effect on the risk level, while domestic stock market indices should have a negative effect.

All of these variables can potentially affect the choice of debt instrument through their effect on country risk. They are all interrelated and therefore cannot be included simultaneously as explanatory variables due to high collinearity (for example, the growth rate of real GDP can be

explained to a large extent by a combination of the other variables). Therefore a more parsimonious specification is adopted in what follows.[9]

In addition, the following global variables are found in previous studies (Mody, Taylor, and Kim (2001), among others) to affect capital flows to emerging markets: US GDP growth, the Emerging Market Bond Index (EMBI), the US swap rate and the US high–yield spread (as proxies for risk aversion). Again, they cannot all be utilized in the same specification due to high degree of collinearity.

There are several additional empirical implications:

- Borrowers with history of debt rescheduling will have larger share of bank debt. Since the data on the history of individual borrowers' defaults is not easily available, sovereign default data is used. A variable is constructed for each country that is equal to one if a country had debt rescheduling in the past year, and zero otherwise. Since Brady-Type debt rescheduling operations created a market for guaranteed bonds, as well as reduced the debt burden, they could have a different effect than other debt rescheduling operations. Thus separate variables for Brady–type and non–Brady–type debt rescheduling are used.
- Strategic default is more likely for sovereigns than private borrowers because of sovereign immunity. As a result, sovereigns will find it more difficult to borrow than private borrowers. The model is therefore estimated separately for different ownership sectors: private, sovereign and (non–sovereign) public.
- A higher opportunity cost of lending will reduce total lending but raise the share of bank loans. The 3-year US Treasury bond rate is used to proxy for the opportunity cost of lending.

The amount borrowed can sometimes determine the choice of instrument, whereas currency denomination can affect the riskiness of a given debt. Thus, the amount of each bond issue and loan contract (converted to US dollars at the exchange rate on a relevant date) and currency denomination are included as control variables. In addition, dummy variables for industrial sectors (if the borrower is not a sovereign) are included.

[9]The variables are chosen to minimize collinearity and maximize interpretative power as well as maximize the number of non–missing observations. For instance, using the ratio of current account to GDP would be informative, but this variable is unavailable for about half of the sample and thus is omitted.

Table 1: Shares of debt instruments by sector

	IG bond	Loan	Junk bond	Total
By number of issues and contracts				
Private sector (share)	5%	81%	13%	10608
Sovereign (share)	24%	40%	36%	1131
Public entities (share)	8%	86%	6%	5073
All sectors (share)	8%	80%	13%	16812
All sectors (total)	1261	13441	2110	16812
By the amount borrowed (bln. USD)				
Private sector (share)	11%	73%	16%	905
Sovereign (share)	27%	28%	45%	334
Public entities (share)	12%	81%	7%	701
All sectors (share)	14%	68%	18%	1940
All sectors (total)	271	1323	347	1940

3 Data and Empirical Methodology

3.1 Data

The data consist of the Capital Data Bondware and Loanware data sets, now available from Dealogic, combined with macroeconomic variables from IMF and World Bank publications, credit ratings from Institutional Investor, external debt data from the Bank for International Settlements, and daily US interest rate series provided by the Federal Reserve Board. These data span 1991 to 1999 and 75 non-OECD countries, although in most estimations only 58 countries are included as the rest drop out due to missing explanatory variables. The variables for Brady–type and non–Brady–type debt rescheduling are constructed from IMF publications. The macroeconomic data are quarterly while bond and loan data consist of all primary international bond issues and all international syndicated bank loans made during the 1990s. A complete data description and some summary statistics are presented in Appendix 2.

Since the model predicts three alternatives — investment grade bonds, bank loans and junk bonds — while the data provide only information on bonds and loans, it is useful to split the observed bonds into an investment grade subgroup and a junk bonds subgroup. This is done by using individual bond ratings when available, using sovereign ratings for sovereign bonds and also for

private bonds, according to the "sovereign ceiling" practice.[10] For the rest of the bonds, the predicted probability from fitting a probit equation for the bonds that are already classified is used. The validity of this classification technique is tested by applying the Independence of Irrelevant Alternative (IIA) test to the multinomial logit equation, where dependent variable is categorical (investment grade bonds, junk bonds or loans). The details of classification procedure, probit regression, IIA test explanation and results are presented in Appendix 3.

The shares of each of the debt instruments by the ownership type of a borrower for the entire data set are reported in Table 1. We can see that bank loans dominate the market not only by the number of the contracts (only large syndicated bank loans are in the data set), but also by the total amount borrowed, except for sovereign borrowers.[11]

The structure of the data is driven by the fact that it includes all bond issues and loan contracts of the developing countries throughout the 1990s. Each observation corresponds to a bond issue or a loan contract. Based on the date when the bond was floated or the loan contract was signed, this data was merged with quarterly country variables and global variables of various frequency. Therefore the data does not represent a panel. Rather, it is a cross–section in which the time dimension might play an important role.

Since some countries were much more active on the international debt market than others, the data set has different numbers of observations for different countries in different quarters. Thus, in estimation, the countries that borrowed heavily will disproportionately affect the results of estimation. This does not present any technical problems. However, one might wander how the results would change, if at all, if all countries and all quarters are given equal weights. To see this, importance weights are assigned to each observation in such a way that each country in each quarter has the same importance in the estimation, separately for each ownership sector (private, public or sovereign).[12]

Moulton (1990) showed that using aggregate data to explain micro–level variables can lead to standard errors biased downward. To control for this effect, robust standard errors clustered by

[10] According to this practice, private borrowers cannot obtain a rating that is better than rating of their sovereign.

[11] The amount reported as bank loans maybe larger than the actual amount lent, as it is measured by the total size of loan facilities agreed upon at the time of signing the contract, when actual amount drawn is not known.

[12] For example, in the first quarter of 1992, the Argentinean private sector appeared in the data set 10 times — 7 loan contracts and 3 junk bond issues. Thus, the weight attached to each of these observations is 0.1.

country and quarter were calculated along with unstructured robust standard errors. Clustered errors are not reported, but the discussion of the results points out cases in which they decrease significance level.

3.2 Estimation methodology

As described in the previous section, the model's predictions can be represented by an ordered probability model with unknown thresholds.

$$y = \begin{cases} \text{IG bond} & \text{if } \rho < \rho_1 \\ \text{Bank loan} & \text{if } \rho_1 \leq \rho < \rho_2 \\ \text{J bond} & \text{if } \rho > \rho_2 \end{cases},$$

where ρ can be interpreted as a latent variable that depends on a linear combination of explanatory and control variables described above. As discussed above, ρ can be thought of representing the investors' perception of the risk level of a borrower. Specifically, for country i in quarter t, observation n,

$$\rho_{itn} = Y_t'\gamma + X_{it}'\beta + Z_{itn}'\nu + \varepsilon_{itn},$$

where X is a matrix of country–specific variables, Y is a matrix of global variables, and Z is a matrix of bond/loan specific variables. ε is assumed to be i.i.d. across observations and are usually assumed to be drawn from either normal or logistic distribution.[13] Note that a constant is not included in the equation, as it cannot be identified separately from thresholds.[14]

The log likelihood function for each observation in this model is

$$\begin{aligned} \mathcal{L}_{itn} &= 1(y = \text{IG bond})[\log F(\rho_1 - (Y_t'\gamma + X_{it}'\beta + Z_{itn}'\nu))] \\ &+ 1(y = \text{Bank loan})[\log\left(F(\rho_2 - (Y_t'\gamma + X_{it}'\beta + Z_{itn}'\nu)) - F(\rho_1 - (Y_t'\gamma + X_{it}'\beta + Z_{itn}'\nu))\right)] \\ &+ (1 - 1(y = \text{IG bond}) - 1(y = \text{Bank loan}))[\log(1 - F(\rho_2 - (Y_t'\gamma + X_{it}'\beta + Z_{itn}'\nu)))]. \end{aligned}$$

Results that follow come from the estimation that assumes that $F(\cdot)$ is normal. Using logistic

[13] The i.i.d. assumption is relaxed when robust standard errors are calculated. A heteroscedastic probability model is also estimated. It produces results that are qualitatively the same as those from homoscedastic probability model.

[14] See, for example Ruud (2000), page 759.

density instead does not alter the results.

An ordered probability model, although consistent with theory predictions, imposes a restriction on the coefficients — they have to be the same in explaining choice between junk bonds and bank loans and between bank loans and investment grade bonds. As a robustness check and to obtain additional insights, binary probit models for investment grade bonds versus loans, junk bonds versus loans, and investment grade bonds versus 'all others' as well as junk bonds versus 'all others' are estimated.[15]

4 Empirical Results

Estimation is conducted for each of three ownership types: private, sovereign and other public borrowers, allowing, as an extension to the model suggests, for different threshold points and different coefficients on explanatory variables for different ownership sectors. Weighted as well as unweighed estimation results are reported in Tables 2 through 7 below. Note that the number of observations is smaller in the weighted regressions as each observation is assigned a weight that does not exceed one. This inevitably leads to less precise estimates in weighted regressions.[16] Marginal effects are also calculated for each outcome and are presented in Appendix 4.

To interpret the coefficients in Tables 2 through 7, note that positive coefficients in the first, third and fifth columns signify that an increase in an explanatory variable increases the perceived risk of the borrower (or has an analogous effect), while positive coefficients in the second and fourth columns have an opposite effect due to the fact that the default group (loans or 'all others') is more risky than the comparison group (investment grade bonds).

4.1 Private borrowers

The results for private borrowers in all industries are presented in Tables 2 and 3.

The effects of global variables are puzzling. A higher US Treasury rate is expected to reduce total lending and increase the share of bank loans. Since those who did not borrow are not in the

[15] An alternative model with logistically distributed errors was also estimated and leads to the same predictions.

[16] One need not be alarmed by less significant results as the size of the t–test depends on the scale of the weights.

Table 2: Private borrowers. No weights

	Ordered	IG vs. L	Junk vs. L	IG vs. not	Junk vs. not
US 3-year Treasury rate	-0.11***	0.23***	0.01	0.23***	-0.03
	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)
US swap rate	-0.007***	-0.0008	-0.013***	0.001	-0.013***
	(0.001)	(0.004)	(0.002)	(0.003)	(0.002)
Credit rating residual	-0.011***	0.015***	-0.018***	0.015***	-0.015***
	(0.001)	(0.006)	(0.002)	(0.005)	(0.002)
Foreign debt/GDP	0.57***	-2.20***	0.09	-2.13***	0.32**
	(0.08)	(0.24)	(0.14)	(0.21)	(0.13)
Debt service/exports	1.83***	-1.11***	1.59***	-1.32***	1.72***
	(0.10)	(0.36)	(0.12)	(0.30)	(0.12)
Export growth volatility	-0.15	-2.48***	-1.19***	-2.07***	-0.91***
	(0.20)	(0.78)	(0.35)	(0.78)	(0.33)
Reserves/short–term debt	0.009***	-0.006	-0.051***	-0.005	-0.041***
	(0.004)	(0.010)	(0.013)	(0.010)	(0.012)
Log real exchange rate	-0.04***	0.014	-0.063***	0.018	-0.056***
	(0.006)	(0.016)	(0.008)	(0.015)	(0.008)
Log real interest rate	0.19***	0.12	0.16***	0.05	0.18***
	(0.03)	(0.09)	(0.03)	(0.08)	(0.03)
Brady–type debt rescheduling	1.00***		0.95***		1.01***
	(0.11)		(0.11)		(0.11)
Non–Brady–type debt rescheduling	0.23***	-1.04**	0.19**	-1.01***	0.23***
	(0.06)	(0.41)	(0.07)	(0.38)	(0.07)
Log amount	-0.006	0.69***	0.43***	0.66***	0.36***
	(0.012)	(0.03)	(0.02)	(0.03)	(0.02)
US Dollar denominated	-0.32***	0.98***	-0.10	0.87***	-0.19***
	(0.04)	(0.12)	(0.06)	(0.11)	(0.06)
Deutsche Mark denominated	-0.41***	1.56***	0.02	1.47***	-0.10
	(0.10)	(0.22)	(0.13)	(0.21)	(0.13)
Yen denominated	-0.59***	1.87***	0.26	1.70***	0.09
	(0.16)	(0.22)	(0.17)	(0.20)	(0.16)
Finance industry	0.24***	1.06***	1.00***	0.89***	0.90***
	(0.04)	(0.12)	(0.06)	(0.11)	(0.06)
Service industry	0.13***	0.42***	0.34***	0.38***	0.33***
	(0.05)	(0.15)	(0.08)	(0.14)	(0.08)
Manufacturing industry	-0.10***	0.83***	0.16**	0.81***	0.11*
	(0.04)	(0.13)	(0.07)	(0.12)	(0.07)
Constant		-7.00***	-3.36***	-6.72***	-3.00***
		(0.39)	(0.21)	(0.38)	(0.21)
Observations	8682	7409	8164	8524	8682

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Robust standard errors are in parentheses.

Table 3: Private borrowers. Weights

	Ordered	IG vs. L	Junk vs. L	IG vs. not	Junk vs. not
US 3-year Treasury rate	0.02	-0.05	0.01	-0.06	0.01
	(0.03)	(0.14)	(0.09)	(0.14)	(0.09)
US swap rate	-0.006***	-0.001	-0.013**	-0.001	-0.013**
	(0.001)	(0.007)	(0.005)	(0.01)	(0.005)
Credit rating residual	-0.013***	0.005	-0.021***	0.007	-0.022***
	(0.002)	(0.011)	(0.007)	(0.011)	(0.007)
Foreign debt/GDP	0.07	-0.53	0.11	-0.59	0.12
	(0.11)	(0.77)	(0.45)	(0.73)	(0.44)
Debt service/exports	1.70***	-0.57	1.90***	-0.93	1.92***
	(0.16)	(0.98)	(0.45)	(0.87)	(0.44)
Export growth volatility	-1.05***	-0.27	-1.86	0.27	-1.97*
	(0.24)	(1.66)	(1.19)	(1.55)	(1.19)
Reserves/short–term debt	-0.03**	0.02	-0.06	0.02	-0.06
	(0.01)	(0.03)	(0.05)	(0.03)	(0.05)
Log real exchange rate	-0.03***	-0.02	-0.04	-0.01	-0.04
	(0.01)	(0.05)	(0.03)	(0.04)	(0.03)
Log real interest rate	0.03	0.03	0.06	0.03	0.05
	(0.05)	(0.20)	(0.10)	(0.18)	(0.10)
Brady–type debt rescheduling	0.69***		0.65*		0.68*
	(0.12)		(0.36)		(0.36)
Non–Brady–type debt rescheduling	0.41***	-1.21	0.33	-1.24	0.37*
	(0.08)	(1.34)	(0.22)	(1.25)	(0.22)
Log amount	0.11***	0.51***	0.46***	0.48***	0.43***
	(0.02)	(0.12)	(0.08)	(0.11)	(0.07)
US Dollar denominated	-0.36***	0.22	-0.54***	0.24	-0.54***
	(0.07)	(0.33)	(0.20)	(0.31)	(0.20)
Deutsche Mark denominated	-0.39**	0.70	-0.27	0.71*	-0.31
	(0.17)	(0.44)	(0.34)	(0.42)	(0.33)
Yen denominated	-0.71***	1.01	-0.35	0.96	-0.43
	(0.21)	(0.87)	(0.87)	(0.83)	(0.82)
Finance industry	0.30***	0.96***	0.93***	0.83***	0.87***
	(0.07)	(0.33)	(0.20)	(0.32)	(0.19)
Service industry	0.19***	0.37	0.45	0.31	0.42
	(0.07)	(0.49)	(0.31)	(0.48)	(0.31)
Manufacturing industry	0.04	0.40	0.22	0.36	0.21
	(0.05)	(0.38)	(0.22)	(0.37)	(0.22)
Constant		-4.08***	-3.07***	-3.89***	-2.94***
		(1.18)	(0.74)	(1.15)	(0.73)
Observations	747	646	722	729	747

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Robust standard errors are in parentheses.

data set, the first prediction cannot be addressed directly. However, it should be observationally equivalent to higher risk level of all the borrowers and thus we would expect the coefficient to be positive in column one. This is not the case: coefficients are either negative or insignificant. The second prediction is tested in columns two and three, where we expect the sign of the coefficient to be negative, as loans comprise a control group. This is not the case either. Possibly, the two effects offset each other, which would explain why the coefficients in all the regressions are not significant if the weights are considered.

A higher swap rate on the US markets is an approximation for risk aversion: the higher is the swap rate, the more risk–averse are investors. Therefore the effect of the swap rate increase should be analogous to the increase in the risk level of all the borrowers, and we would expect positive coefficient in the ordered regression. This is not the case. Alternative specifications, in which other global variables are used, lead to the results that are similarly puzzling. This result has been remarked upon in the literature before: Eichengreen and Mody (1998), for example, analyze a puzzling effect of the US interest rates on capital flows to developing countries. Further investigation of the effect of global variables on the perceived country risk should be conducted in order to fully understand these results.

The effects of country variables are mostly as predicted. A higher credit rating residual, which approximates for better political stability, decreases the risk level and the probability that the junk bond will be issued, while increasing the probability that the investment grade bond will be issued. These effects are strongly significant in the unweighed regressions and significant for ordered and junk bond regressions when weights are included. It appears, therefore, that investors assign a higher weight to political stability if borrowers come from an otherwise relatively risky country, which makes the borrowers unable to issue investment grade bonds.

The ratio of foreign debt to GDP has the predicted effect in all of the regressions, although the coefficients are not significantly different from zero when weights are introduced. By comparing the magnitude of the coefficients, we can see that the foreign debt to GDP ratio seems to have more weight for the borrowers that are relatively low risk and who therefore choose between loans and investment grade bonds. The opposite seams to be true of the ratio of debt service to exports, a

more short–run measure of indebtedness. The effect of this variable is as predicted and strongly significant in all five regressions without weights, but not significant for investment grade bond regressions when weights are included. A more short–term variable seems to have higher weight for more risky borrowers that choose between loans and junk bonds.

Export volatility seems to increase the probability that the borrower will take out a bank loan rather than issue a bond (whether junk or investment grade). This explains the lack of significant effect in the ordered regression. Possibly, when exports are more volatile, the level of moral hazard is higher, at least for the borrowers in exporting industries.[17] Then, as the model predicts, we should expect that borrowers will more likely borrow from the banks. Thus, at least within the framework of the model, export volatility does not seem to affect perceived country risk as some previous research suggested (see, for example, Eichengreen, Hale, and Mody (2001)), while considering bond market in isolation. Instead, higher export volatility might lower bond issuance or increase bond spreads due to added moral hazard and substitution towards bank loans.

A higher ratio of central bank foreign reserves to short–term debt reduces perceived risk (although the coefficient in the ordered probit regression is not significant if standard errors are clustered by country and quarter) and the probability that a junk bond will be issued, as expected, in both weighted and unweighed regressions. It does not have a significant effect on the probability that an investment grade bond is issued. This result makes intuitive sense — investors pay more attention to the ratio of reserves to short–term debt when it is low than when it is high. Thus, this variable is only important if country is in danger of debt and currency crises, in which case borrowers would be unable to issue investment grade bonds. As one can see from tables of marginal effects presented in Appendix 4, this result is supported by the weighted regression: if reserves are higher, the probability to issue junk bond is lower, and the probability to take out a bank loan is higher.

By construction, and increase in the real exchange rate index implies real depreciation. Thus, we should expect that the decline in this variable (real appreciation) increases perceived country risk due to a higher chance of a currency crisis. The results support this prediction. Again, as with the ratio of reserves to short–term debt, real exchange rate appreciation seems to only matter

[17] If the exporters do not undertake an effort to reduce the risk of their projects, aggregate exports will be more volatile. In addition, if the exports are volatile for some exogenous reason, exporters will be more inclined to blame this volatility for their failure and thus less likely to undertake a costly effort to reduce the riskiness of their project.

for the borrowers that come from an already risky country — the real exchange rate does not affect the probability that investment grade bonds will be issued. Similarly, a high short–term real interest rate might reflect the struggle of the country to curb its inflation and prevent (or delay) a currency collapse. Thus, a high real interest rate increases the perceived risk and the probability of junk bonds being issued, although none of the coefficients are significantly different from zero if the weights are introduced. Changes in real interest rate do not affect the probability that an investment grade bond will be issued.

Having a history of debt rescheduling is expected to increase perceived risk and also increase the share of bank loans. The results strongly suggest that the first effect dominates. Since some debt rescheduling arrangements included conversion of debt into guaranteed bonds (Brady–type deals), they might in addition have increased the probability that (any) bond will be issued by expanding the secondary market in bonds. Since private borrowers from the countries that had Brady–type arrangements in the previous four quarters never issued investment grade bonds, these two effects are not distinguishable. We can tell from the ordered regression that Brady–type debt rescheduling increases perceived country risk, as expected, but we cannot tell whether the probability of a junk bond being issued increases due to higher risk or due to a deepening of the secondary bond market. We might expect that both effects contribute, as the coefficients are larger in magnitude for Brady–type–rescheduling than they are for non–Brady–type rescheduling.

Issue–specific variables seem to have a significant and expected impact as well. A larger amount borrowed increases the probability of the bond being issued. Since bond issues are harder to arrange than bank loans, borrowers that do not need to borrow as much are more likely to borrow from the bank, other things being equal. If the debt is denominated in strong currency (Dollar, Mark or Yen — the control group being 'other' currency), it is perceived as less risky, as expected. Borrowers in all industries other than utilities and infrastructure (control group) are more likely to issue bonds. At this point of research, it is not obvious why this is the case: more micro–level analysis is needed to understand this result.

4.2 Sovereign borrowers

This category includes bonds issued and bank loans taken by central governments or central monetary authorities. In order to make tables more reader–friendly, the results for issue–specific variables are omitted in the tables for sovereign and public borrowers; they are available from the author upon request.

The results for sovereign borrowers are reported in Tables 4 and 5. In order not to be redundant, only the differences between them and the results for private borrowers will be discussed. Since in unweighed regression different quarters will have different influence in private and sovereign borrowers regression, only weighted regressions are appropriate for comparison of the magnitudes of the coefficients.

Table 4: Sovereign borrowers. No weights

	Ordered	IG vs. L	Junk vs. L	IG vs. not	Junk vs. not
US 3-year Treasury rate	-0.14***	0.03	-0.18**	0.08	-0.23***
	(0.05)	(0.10)	(0.08)	(0.08)	(0.07)
US swap rate	0.004	-0.012**	-0.003	-0.012***	0.001
	(0.003)	(0.005)	(0.005)	(0.004)	(0.004)
Credit rating residual	-0.080***	0.045***	-0.049***	0.089***	-0.10***
	(0.006)	(0.011)	(0.008)	(0.009)	(0.008)
Foreign debt/GDP	-0.60**	-0.76	-0.94**	0.17	-0.57
	(0.29)	(0.46)	(0.44)	(0.35)	(0.41)
Debt service/exports	1.65***	0.37	1.27**	-1.92***	2.19***
	(0.32)	(0.63)	(0.53)	(0.45)	(0.44)
Export growth volatility	3.33***	-2.24**	2.51***	-3.36***	4.17***
	(0.55)	(0.95)	(0.72)	(0.68)	(0.66)
Reserves/short–term debt	-0.012	0.029	0.032	0.025	0.033
	(0.022)	(0.029)	(0.041)	(0.029)	(0.032)
Log real exchange rate	0.16***	-0.24***	-0.016	-0.26***	0.13***
	(0.02)	(0.03)	(0.025)	(0.02)	(0.02)
Log real interest rate	-0.18**	0.48***	0.44***	0.47***	0.089
	(0.07)	(0.15)	(0.12)	(0.11)	(0.10)
Brady–type debt rescheduling	1.21***	-1.42**	0.56	-2.17***	1.17***
	(0.29)	(0.60)	(0.42)	(0.65)	(0.34)
Non–Brady–type debt rescheduling	0.76***	-1.24***	0.37*	-1.20***	0.72***
	(0.14)	(0.28)	(0.22)	(0.18)	(0.18)
Constant		-1.78**	-4.24***	-0.70	-4.50***
		(0.89)	(0.84)	(0.72)	(0.68)
Observations	828	533	592	828	828

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Robust standard errors are in parentheses. Log amount of the issue and its currency denomination are included but not reported.

The effect of US interest rate is as expected only in column three, but is not significant if weights

Table 5: Sovereign borrowers. Weights

	Ordered	IG vs. L	Junk vs. L	IG vs. not	Junk vs. not
US 3-year Treasury rate	-0.09	0.03	-0.08	0.07	-0.15
	(0.06)	(0.12)	(0.13)	(0.10)	(0.10)
US swap rate	0.0047	-0.0097	0.0002	-0.011*	0.004
	(0.0035)	(0.007)	(0.006)	(0.006)	(0.005)
Credit rating residual	-0.067***	0.028**	-0.062***	0.073***	-0.10***
	(0.007)	(0.013)	(0.015)	(0.010)	(0.013)
Foreign debt/GDP	-0.19	-1.02	-0.68	-0.30	-0.08
	(0.34)	(0.74)	(0.67)	(0.55)	(0.56)
Debt service/exports	1.45***	-0.33	0.90	-1.94***	2.09***
	(0.37)	(0.87)	(0.75)	(0.59)	(0.61)
Export growth volatility	2.34***	-0.76	2.86***	-1.61	3.76***
	(0.60)	(1.37)	(1.06)	(1.00)	(0.92)
Reserves/short–term debt	0.011	0.017	0.042	-0.001	0.066
	(0.023)	(0.051)	(0.067)	(0.044)	(0.048)
Log real exchange rate	0.17***	-0.21***	0.024	-0.25***	0.18***
	(0.02)	(0.05)	(0.043)	(0.04)	(0.04)
Log real interest rate	-0.12	0.65***	0.56***	0.47***	0.20
	(0.08)	(0.20)	(0.19)	(0.15)	(0.15)
Brady–type debt rescheduling	1.32***	-1.14	0.74	-1.83***	1.44**
	(0.31)	(0.81)	(0.66)	(0.67)	(0.56)
Non–Brady–type debt rescheduling	1.12***	-1.02	0.88**	-1.44***	1.24***
	(0.19)	(0.63)	(0.40)	(0.37)	(0.31)
Constant		-2.65**	-5.99***	-0.49	-6.27***
		(1.10)	(1.33)	(0.93)	(1.13)
Observations	359	240	241	359	359

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Robust standard errors are in parentheses. Log amount of the issue and its currency denomination are included but not reported.

are introduced. That is, global variable effects are puzzling for sovereign debt as well.

The coefficient on the credit rating residual has the same predicted sign for sovereigns as for the private borrowers, however its magnitude is significantly larger (by a factor of 5 to 8 for the coefficients, and even larger for marginal effects). Thus, political stability appears to be much more important when assessing the risk of sovereign debt as compared to private debt. This result is expected as political instability affects the government budget (and thus the sovereign's ability to service and repay the debt) more directly than it affects private balance sheets.

While the effect of a country's foreign debt to GDP ratio on the perceived risk of the private debt is relatively clean, as each borrower only contributes a little share to the total country debt, this effect is not as clean for sovereign borrowers. This might explain why the effects of this variable are not significant for the sovereign borrowers (and are contrary to expected in the unweighed regression although also insignificant if standard errors are clustered by country and quarter). The ratio of

debt service to exports, however, does have the expected effect — if it is high, investors would expect it to be more risky to lend more to the sovereigns as further debt expansion will increase incentives to default.

Export volatility would not have the same moral hazard effect for sovereign borrowers as it would have for private borrowers. This shows clearly in the results — the coefficients in both weighted and unweighed regressions strongly show that higher export volatility increases perceived country risk. Again, it might be a much more important variable for those investors that lend to sovereigns, as it is closely related to the volatility of foreign reserves of the central bank. The level of the reserves (or, rather, its ratio to short–term debt) does not seem to matter — all the coefficients on this variable are insignificant.

The effects of the real exchange rate and the real interest rate are not as clear. It appears that the coefficients are contrary to what is expected and have opposite signs to those in the regressions for private borrowers, although the effect of real interest rate is not significant if weights are introduced or standard errors are clustered by country and quarter. Additional analysis might shed light on these effects.

Since some of the sovereigns issued investment grade bonds after Brady–type debt rescheduling, we are able to tell that the effect of these deals on the perceived risk is larger than the effect on deepening bond markets: Brady–type deals reduce the probability of an investment grade bond being issued. Other coefficients strongly support the hypothesis that debt rescheduling increases perceived risk and suggest that Brady–type debt rescheduling has a stronger effect than non–Brady–type rescheduling. Note also that the coefficients on both types of debt rescheduling are much larger in the regression for the sovereigns that in the regression for private borrowers. Since debt rescheduling data only includes rescheduling by sovereigns, it is no surprise that investors punish sovereigns more for their default than they punish private borrowers.

4.3 Other public borrowers

This category includes government owned borrowers as well as local authorities. The results are reported in Tables 6 and 7. The results bring no surprises. The coefficients are mostly similar to those of the regressions for private borrowers and their magnitudes lie between those for private

and those for sovereign borrowers. It is most evident in the coefficients for the credit rating residual and the debt rescheduling dummy variables.

Table 6: Public borrowers. No weights

	Ordered	IG vs. L	Junk vs. L	IG vs. not	Junk vs. not
US 3-year Treasury rate	-0.10***	0.01	-0.19***	0.02	-0.17***
	(0.03)	(0.04)	(0.05)	(0.04)	(0.04)
US swap rate	-0.0013	-0.009***	-0.018***	-0.007***	-0.016***
	(0.0015)	(0.003)	(0.004)	(0.003)	(0.004)
Credit rating residual	-0.019***	0.033***	-0.016***	0.033***	-0.022***
	(0.003)	(0.005)	(0.005)	(0.005)	(0.004)
Foreign debt/GDP	0.011	-1.11***	-0.41**	-0.95***	-0.33**
	(0.086)	(0.26)	(0.16)	(0.24)	(0.14)
Debt service/exports	0.76***	0.03	1.05***	-0.13	1.09***
	(0.16)	(0.24)	(0.23)	(0.23)	(0.21)
Export growth volatility	1.73***	-2.74**	1.37***	-2.78***	1.71***
	(0.33)	(1.08)	(0.51)	(1.03)	(0.46)
Reserves/short–term debt	0.077***	-0.22***	-0.07**	-0.20***	-0.031
	(0.011)	(0.03)	(0.03)	(0.03)	(0.026)
Log real exchange rate	0.004	-0.034**	0.0009	-0.032*	0.007
	(0.01)	(0.017)	(0.014)	(0.016)	(0.014)
Log real interest rate	0.26***	0.018	0.40***	-0.064	0.40***
	(0.05)	(0.090)	(0.06)	(0.069)	(0.06)
Brady–type debt rescheduling	0.43**		0.66***		0.71***
	(0.20)		(0.25)		(0.24)
Non–Brady–type debt rescheduling	0.31***	-0.62***	0.00	-0.65***	0.10
	(0.11)	(0.24)	(0.14)	(0.22)	(0.13)
Constant		-2.05***	-3.09***	-1.94***	-3.20***
		(0.37)	(0.36)	(0.36)	(0.34)
Observations	3906	3603	3526	3862	3906

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Robust standard errors are in parentheses. Log amount of the issue, its currency denomination, and the industry of the borrower are included but not reported.

4.4 Summary of empirical results

As discussed above, the effects of macroeconomic fundamentals — the focus of this analysis — are largely consistent with model predictions. Most differences between coefficients for different ownership sectors also seem to be quite reasonable. As always with empirical analysis of this sort, there are some results that are not as expected and need further investigation.

Two questions should be addressed here: How important in magnitude are those effects? How much of the variation in the data does the model explain?

Using summary statistics in Appendix 2 and marginal effects presented in Appendix 4, we can

Table 7: Public borrowers. Weights

	Ordered	IG vs. L	Junk vs. L	IG vs. not	Junk vs. not
US 3-year Treasury rate	-0.08**	-0.061	-0.24**	-0.034	-0.21**
	(0.04)	(0.10)	(0.11)	(0.10)	(0.10)
US swap rate	0.0019	-0.010	-0.009	-0.008	-0.006
	(0.0023)	(0.005)	(0.006)	(0.006)	(0.006)
Credit rating residual	-0.019***	0.026***	-0.015	0.026***	-0.020**
	(0.003)	(0.010)	(0.010)	(0.009)	(0.009)
Foreign debt/GDP	0.31*	-1.50***	-0.008	-1.32**	0.094
	(0.16)	(0.55)	(0.46)	(0.53)	(0.43)
Debt service/exports	0.93***	-0.16	1.14**	-0.39	1.13**
	(0.21)	(0.63)	(0.50)	(0.59)	(0.48)
Export growth volatility	0.33	-1.18	-0.61	-1.20	-0.31
	(0.43)	(1.28)	(1.19)	(1.25)	(1.12)
Reserves/short–term debt	0.033**	-0.10*	-0.051	-0.090*	-0.040
	(0.014)	(0.050)	(0.057)	(0.053)	(0.055)
Log real exchange rate	-0.011	-0.030	-0.049	-0.019	-0.041
	(0.015)	(0.037)	(0.037)	(0.035)	(0.036)
Log real interest rate	0.077	0.14	0.18	0.088	0.17
	(0.059)	(0.17)	(0.12)	(0.15)	(0.11)
Brady–type debt rescheduling	0.74***		0.74*		0.81**
	(0.27)		(0.42)		(0.41)
Non–Brady–type debt rescheduling	0.62***	-0.65	0.36	-0.79*	0.46*
	(0.13)	(0.45)	(0.25)	(0.42)	(0.24)
Constant		-1.75**	-2.05**	-1.80**	-2.24***
		(0.79)	(0.88)	(0.77)	(0.85)
Observations	709	646	644	693	709

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Robust standard errors are in parentheses. Log amount of the issue, its currency denomination, and the industry of the borrower are included but not reported.

calculate the magnitudes of the effect. Numbers in the Appendix 4 tables represent the effects on the probability of each outcome and thus numbers in respective cells in all three tables some up to one (up to the rounding error). Some effects are remarkably large: Brady–type debt rescheduling increases the probability of issuing junk bond (rather than taking a loan or issuing investment grade bond) by 0.16-0.29 for private and by 0.45-0.49 for sovereign borrowers, other things being equal. Non–Brady rescheduling has smaller, but still substantial effect. If debt service to export ratio doubles (which would be an increase by about 0.3), probability of issuing a junk bond would increase by 0.09-0.11 for private and 0.14-0.16 for sovereign borrowers. If credit rating residual improves from -1.5 (average for sovereigns that took loans) to 1.8 (average for sovereigns that issued investment grade bonds), the probability that they will be able to issue investment grade bond will increase by 0.06. Same size improvement for private borrowers will only lead to the 0.003 increase in the probability of issuing an investment grade bond by private borrowers. Other effects

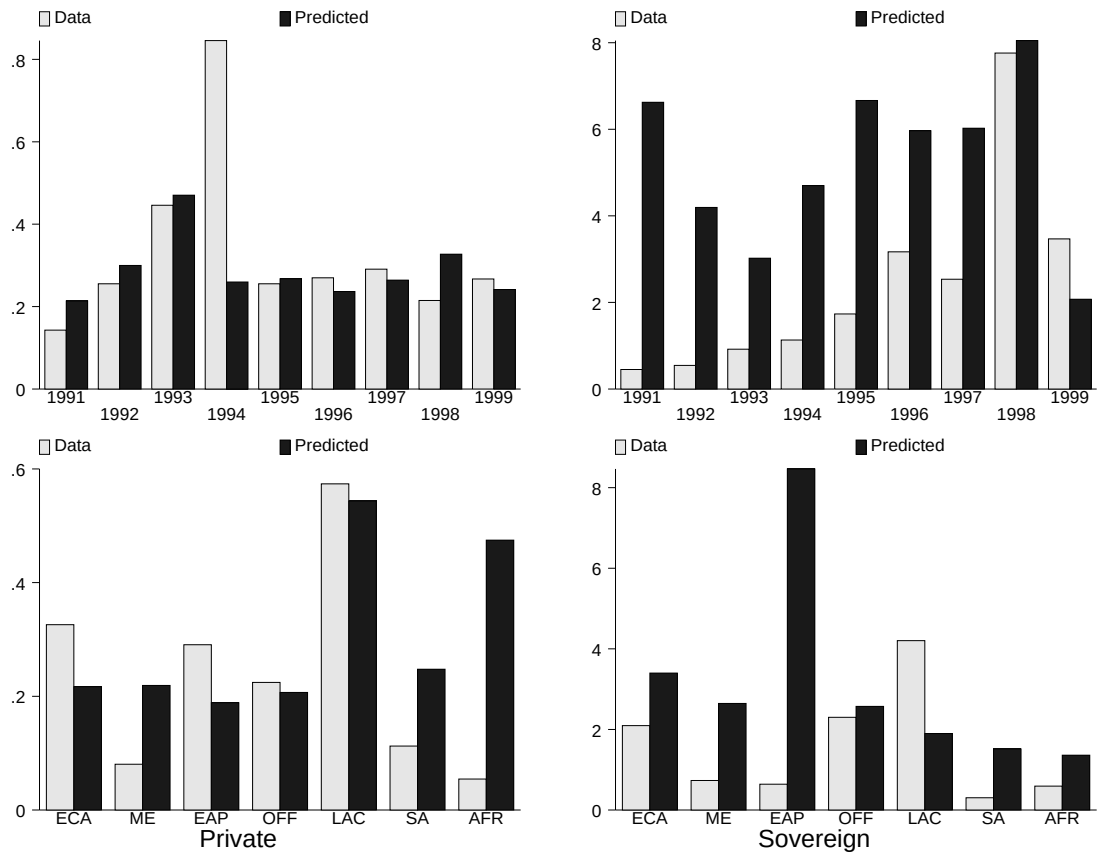

Figure 3: Actual and predicted ratios of bonds to loans.
Regions are: ECA = East Europe and Central Asia, ME = Middle East, EAP = East Asia and Pacific, OFF = Offshore zones, LAC = Latin America, SA = South Asia, AFR = Africa.

are relatively small: increasing the values from the mean by 100% will lead to less than 0.1 change in the probabilities.

One more observation arises from the analysis of marginal effects. It is frequently argued that borrowers that are trying to allocate larger debt are more likely to issue a bond rather than take a bank loan. Indeed, we can see that a 25% increase in the amount, would increase the probability that sovereigns issue junk bond by 0.07. However, most of this change is due to the reduction in the probability of issuing investment grade bond, not the probability of taking out a bank loan. Possibly, the reasoning for the argument does not really apply in this case, as we are considering only large syndicated bank loans.

To answer the second question, two variables are constructed: the ratio of the number of bond

issues (sum of investment grade and junk bonds) to the number of loan issues by year and by region in the data,[18] and the ratio of predicted probability of bond issue (either investment grade or junk) to predicted probability of loan issue from the estimation, by year and region. Both series are plotted (separately for sovereign and private borrowers) on Figure 3. One can clearly see that the model predictions explain fairly well the variance over time and across regions for private borrowers, but not for sovereigns.[19]There are two possible explanations for the failure of the model for the sovereigns: first, there are potentially endogeneity problems in the estimation and therefore regression coefficients are biased; second, it could be that considerations other than macroeconomic situation in the country play essential role in determining choice of the debt instrument by the sovereigns.

5 Conclusion

The two main contributions of this paper are empirical.

First, it tests for the determinants of the debt instrument — an important issue that had not been addressed in the literature previously. Theoretical analysis predicts a relationship between choice of debt instrument and perceived risk that is tested empirically. Empirical analysis allows us to identify fundamentals that do and do not affect country risk and therefore the choice of debt instrument, thus suggesting areas of focus for economic policies that are aimed at stabilizing international capital flows. The model fits private borrowers' debt composition much better than it fits the choice of debt instrument by the sovereigns. This is, in a sense, a good news for economic policy. If government is trying to affect the debt instrument that country relies mostly upon, it can alter its own borrowing. The paper shows, that in addition the government can predict the development of private debt structure as a result of conducted macroeconomic policies. It could be useful if policy consultants take the effect of macroeconomic variables on debt structure into account.

[18]The ration constructed with amounts borrowed rather than the number of issues are only slightly different and the results described below still hold qualitatively.

[19]Although t–tests reject at 5% confidence level the hypothesis that predicted ratio is equal to actual for both private and sovereign borrowers, the magnitude of the differences for private borrowers is much smaller (relative to the mean of the ratio) for the private borrowers. The test were conducted for data grouped by country and by quarter. Results are available from author upon request.

Second, by determining the variables that affect the choice of debt instrument, the findings of this paper facilitate empirical analysis of emerging market debt and open an avenue for further research on the relative importance of the bond market and bank financing to developing countries. While there is a large body of empirical literature on financial contagion, previous studies tend to be limited to either the bond or the loan markets. More rigorous study would require simultaneous analysis of both markets due to the possibility of substitution between the two instruments (as the effects of export volatility illustrate). This paper therefore takes the first step towards resolving the question of whether international bonds are safer than international bank loans in times of financial instability.

On the theoretical side, modification of the Diamond's model presented in this paper shows that qualitative results of Diamond's model hold without differentiated reputation cost. Essentially, this shows that Diamond's result are more general than his original paper suggests.

References

Aerni, P., and G. Junge (1998): "Cross–border Emerging Market Bank Lending," in *Emerging Market Capital Flows*, ed. by R. Levich. Kluwer.

Bolton, P., and X. Freixas (2000): "Equity, Bonds and Bank Debt: Capital Structure and Financial Market Equilibrium under Asymmetric Information," *Journal of Political Economy*, 108(2), 324–351.

Datta, S., M. Iskandar-Datta, and A. Patel (1999): "Bank Monitoring and the Pricing of Corporate Public Debt," *Journal of Financial Economics*, 51(3), 435–49.

Demirguc-Kunt, A., and V. Maksimovic (1996): "Stock Market Development and Financing Choices of Firms," *The World Bank Economic Review*, 10(2), 341–369.

Diamond, D. W. (1991): "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt," *The Journal of Political Economy*, 99(4), 689–721.

Domowitz, I., J. Glen, and A. Madhavan (2000): "International Evidence on Aggregate Corporate Financing Decisions," Presented at the World Bank Conference on Financial Structure and Economic Development, February 2000.

Dooley, M. (2000): "Can Output Losses Following International Financial Crises be Avoided?," NBER Working Paper 7531.

Edwards, S. (1986): "The Pricing of Bonds and Bank Loans in International Markets: An Empirical Analysis of Developing Countries' Foreign Borrowing," *European Economic Review*, 30(3), 565–589.

Eichengreen, B., G. Hale, and A. Mody (2001): "Flight to Quality: Investor Risk Tolerance and the Spread of Emerging Market Crises," in *International Financial Contagion*, ed. by S.Classens, and K.Forbes. Kluwer.

Eichengreen, B., and A. Mody (1998): "Interest Rates in the North and Capital Flows to the South: Is There a Missing Link?," *International Finance*, 1, 35–58.

——— (2000): "Lending Booms, Reserves and Sustainability of Short–Term Debt: Inferences from the Pricing of Syndicated Bank Loans," *Journal of Development Economics*, 63(1), 5–44.

Folkerts-Landau, D. (1985): "The Changing Role of International Bank Lending in Development Finance," *IMF Staff Papers*, 32(2), 317–363.

Kaminsky, G., S. Lizondo, and C. M. Reinhart (1998): "Leading Indicators of Currency Crises," *IMF Staff Papers*, 45, 1.

Krishnaswami, S., P. A. Spindt, and V. Subramaniam (1999): "Information Asymmetry, Monitoring, and the Placement Structure of Corporate Debt," *Journal of Financial economics*, 51(3), 407–34.

Mody, A., M. P. Taylor, and J. Y. Kim (2001): "Modelling Fundamentals for Forecasing Capital Flows to Emerging Markets," *International Journal of Finance and Economics*, 6, 201.

Moulton, B. R. (1990): "An Illustration of a Pitall in Estimation the Effects of Aggregate Variables on Micro Units," *The Review of Economics and Statistics*, 72(2), 334.

Rajan, R. G. (1992): "Insiders and Outsiders: The Choice between Informed and Arm's–lenght Debt," *Journal of Finance*, 47, 1367.

Ruud, P. A. (2000): *An Introduction to Classical Econometric Theory*. Oxford University Press.

Schmukler, S., and E. Vesperoni (2000): "Does Integration with Global Markets Affect Firms' Financing Choices? Evidence from Emerging Economies," Presented at the World Bank Conference on Financial Structure and Economic Development, February 2000.

Stiglitz, J. E., and A. Weiss (1981): "Credit Rationing in Markets with Imperfect Information," *The American Economics Review*, 71(3), 393–410.

Appendix 1. Credit rating residual

The credit ratings of sovereigns tend to be constructed by the rating agencies as a function of macroeconomic variables. Variables that are commonly used include the growth rate of real GDP (a higher growth rate should improve the credit rating), the ratio of total debt service to exports (a lower ratio should improve the credit rating), the ratio of total external debt to GNP (a lower ratio should improve the credit rating), the variance of export growth (a lower variance should improve the credit rating), and the inflation rate (a lower inflation rate should improve the credit rating). In addition, debt rescheduling typically worsens a country's credit rating.

	Weighted	Unweighed
Growth rate of real GDP	201.8***	266.8***
	(23.5)	(8.36)
Total debt service/Exports	-18.3***	-28.2***
	(1.54)	(0.46)
Total external debt/GNP	-12.8***	-13.9***
	(1.19)	(0.37)
Variance of monthly export growth	-33.0***	-36.6***
	(2.69)	(1.06)
Reserves/Short term debt	-1.06***	-1.26***
	(0.11)	(0.03)
Log of inflation rate	-2.76***	-3.06***
	(0.19)	(0.06)
Brady-type rescheduling	-10.4***	-13.6***
in past year	(1.59)	(0.60)
Non-Brady-type rescheduling	-9.91***	-9.17***
in past year	(0.87)	(0.30)
Constant	52.3***	57.8***
	(0.88)	(0.28)
Observations	2137	15232
Adjusted R^2	0.44	0.63

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Standard errors are in parenthesis.

The estimates in the table are from an OLS estimation. The weights are assigned to each observation in such a way that each country in each quarter has the same weight, provided that the country borrowed in the international market in a given quarter.[20] The dependent variable is the credit rating assigned to a country by Institutional Investor (0-100 scale) twice a year. Macroeconomic variables are quarterly. All the variables have predicted signs and are strongly significant. The credit rating residual is then a simple residual from this regression.

[20]The same regression without weights leads to a predicted credit rating residual that is highly correlated (correlation coefficient is equal 0.97) with the one predicted by the weighted regression.

Appendix 2. Data description

Table 8: Data sources

Variable	Source	Units	Frequency
US treasury rate	Federal Reserve	annual %	daily
Swap rate	Federal Reserve	b.p.	daily
Credit rating	Institutional Investor	0–100 scale	bi-annual
Debt service	IMF IFS	US$	quarterly
Exports and imports	IMF IFS	US$	quarterly, monthly
Real and nom. GDP	IMF IFS	index and n.c.	quarterly
C.B.Reserves	IMF IFS	US$	quarterly
Short–term I.R.	IMF IFS	annual %	quarterly
CPI	IMF IFS	index	quarterly
Exchange rate	IMF IFS	n.c./dollar	quarterly
External debt (total and sh.t.)	BIS	US$	bi-annual
Debt rescheduled	WB publications	index	quarterly
Bond data	Capital Data		by closing date
Loan data	Capital Data		by signing date

Table 8 describes all the series used in the paper. Tables 9 and 10 present means and standard deviations of explanatory variables by ownership sector and debt instrument subsamples. Standard deviations are in parenthesis and are omitted for dummy variables. Summary statistics are computed both without weights and with weights. All considered variables are included, not only the ones that appear in the final regression. For a given country and quarter country variables do not vary across observations: the difference are due to the fact that the number of each instrument issued by each sector varies from quarter to quarter, thus the means are different. They are informative: for example, investment grade bonds were mostly issued when and where credit rating residual was high, while junk bonds were issued when and where credit rating residual was low.

Table 11 lists the countries in the data set and the number of observations, as well as the number and amount of bonds and loans for each country. A share of investment grade bonds (relative to the total number of bonds) is derived from the artificial classification of bonds that is not in the original data set. See Appendix 3. Algeria, Barbados, Ethiopia, Ghana, Iran, Jamica, Lesotho, Liberia, Mauritius, Moldova, Oman, Panama, Qatar, Romania, Saudi Arabia, Seyshelles, Taiwan, United Arab Emirates and Vietname also borrowed internationally but are not included in the regression analysis due to missing explanatory variables.

Bond and loan data are summarized in Tables 12 and 13. Note that East Asian borrowers rely mostly on bank loans, while Latin American borrowers rely primarily on bonds. This is consistent with the model's predictions — East Asian borrowers were viewed by investors as relatively low–risk before the Asian crisis.

Table 9: Means and standard deviations without weights

	Sovereign			Public			Private		
	IG	L	J	IG	L	J	IG	L	J
US 3-year Treasury rate	5.8	5.8	5.7	5.8	5.8	5.5	6.3	5.9	5.8
	(0.8)	(0.9)	(0.7)	(0.8)	(0.8)	(0.8)	(0.8)	(0.8)	(0.8)
US 10-year -	1.2	1.5	0.9	1.3	1.4	1.4	1.3	1.1	1.2
US 1-year T. rate	(0.8)	(1.0)	(0.7)	(0.8)	(1.0)	(0.9)	(0.6)	(0.8)	(0.8)
US industrial prod.	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02
growth rate	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
EMBI spread value	775	790	783	755	788	723	778	776	717
	(277)	(263)	(279)	(271)	(279)	(245)	(244)	(289)	(257)
US swap rate	37	39	43	35	38	34	33	37	34
	(17)	(16)	(20)	(15)	(16)	(15)	(13)	(16)	(13)
High Yield spread	418	456	410	412	437	420	374	409	391
	(113)	(121)	(98)	(115)	(123)	(99)	(65)	(116)	(90)
Growth rate of real GDP	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Credit rating residual	3.2	-1.8	-4.4	7.4	1.4	1.1	7.9	5.1	0.77
	(9.4)	(8.4)	(9.8)	(7.5)	(9.2)	(8.3)	(6.1)	(9.6)	(9.3)
Foreign debt/GDP	0.44	0.46	0.38	0.27	0.37	0.39	0.14	0.35	0.35
	(0.17)	(0.23)	(0.14)	(0.16)	(0.31)	(0.19)	(0.18)	(0.24)	(0.17)
Debt service/exports	0.30	0.25	0.34	0.19	0.20	0.34	0.07	0.20	0.36
	(0.16)	(0.16)	(0.17)	(0.20)	(0.18)	(0.20)	(0.13)	(0.18)	(0.22)
Export growth volatility	0.12	0.13	0.13	0.08	0.11	0.11	0.07	0.09	0.09
	(0.09)	(0.12)	(0.11)	(0.05)	(0.07)	(0.06)	(0.04)	(0.07)	(0.06)
Reserves/Short–term debt	2.1	1.8	1.5	1.5	2.4	1.6	0.96	1.9	1.2
	(2.9)	(1.9)	(1.6)	(1.4)	(2.1)	(1.3)	(1.6)	(3.0)	(0.9)
Reserves/import	1.6	1.5	2.3	1.5	1.8	2.4	1.4	1.9	2.3
	(0.8)	(1.1)	(1.2)	(0.83)	(1.1)	(1.2)	(0.7)	(1.2)	(1.4)
Total debt/Short term debt	0.44	0.51	0.53	0.58	0.51	0.50	0.74	0.61	0.56
	(0.16)	(0.15)	(0.10)	(0.15)	(0.15)	(0.14)	(0.18)	(0.17)	(0.12)
Bank credit stock	1.5	1.0	0.79	2.5	1.8	1.3	4.1	2.3	1.6
	(1.1)	(0.9)	(0.5)	(1.4)	(1.4)	(1.0)	(2.1)	(1.7)	(1.3)
Log inflation rate	-2.0	-1.7	-2.4	-2.7	-2.1	-1.9	-2.6	-2.6	-2.1
	(1.1)	(1.3)	(1.9)	(0.8)	(1.3)	(1.9)	(0.6)	(1.2)	(1.9)
Log real exchange rate	2.9	4.8	3.6	3.8	3.2	3.1	3.3	3.8	2.4
	(1.8)	(3.6)	(4.1)	(2.4)	(2.6)	(2.8)	(2.1)	(2.9)	(2.7)
CA/GDP ratio	-8.7	-3.8	-6.1	-4.7	-6.9	-6.5	-6.3	-8.0	-6.4
	(14)	(13)	(11)	(12)	(14)	(9.3)	(11)	(11)	(9.9)
Reserve gain in	0.12	0.07	0.08	0.05	0.05	0.05	0.03	0.03	0.06
last quarter	(0.22)	(0.20)	(0.20)	(0.14)	(0.20)	(0.14)	(0.07)	(0.16)	(0.17)
Growth rate of domestic	0.04	0.07	0.06	0.05	0.06	0.10	0.05	0.07	0.11
credit	(0.05)	(0.09)	(0.07)	(0.03)	(0.08)	(0.19)	(0.03)	(0.11)	(0.21)
Log real interest rate	2.7	2.8	2.7	2.4	2.4	2.9	2.0	2.3	2.7
	(0.54)	(0.77)	(0.77)	(0.56)	(0.68)	(1.04)	(0.55)	(0.69)	(0.96)
Brady rescheduling	0.01	0.01	0.02	0.00	0.01	0.02	0.00	0.01	0.07
Non–Brady rescheduling	0.07	0.08	0.22	0.03	0.08	0.17	0.00	0.07	0.17
Maturity	8.2	6.6	7.0	7.3	5.6	5.2	8.3	4.7	5.6
	(7.6)	(5.0)	(7.1)	(8.0)	(4.1)	(3.3)	(6.9)	(3.5)	(4.9)
Log amount	5.4	4.3	5.6	4.9	4.0	4.8	4.9	3.7	4.4
	(0.9)	(1.4)	(0.8)	(0.9)	(1.2)	(0.8)	(0.7)	(1.2)	(0.8)
US Dollar denominated	0.43	0.75	0.44	0.52	0.82	0.75	0.80	0.76	0.79
Deutsche Mark denominated	0.12	0.02	0.18	0.07	0.03	0.05	0.02	0.02	0.03
Euro denominated	0.07	0.02	0.14	0.01	0.02	0.04	0.02	0.01	0.01
Yen denominated	0.27	0.07	0.12	0.26	0.04	0.09	0.05	0.01	0.01
Finance industry	0.07	0.04	0.00	0.60	0.25	0.48	0.71	0.33	0.64
Service industry	0.00	0.00	0.00	0.01	0.18	0.02	0.07	0.12	0.07
Manufacturing industry	0.00	0.01	0.00	0.02	0.11	0.01	0.16	0.31	0.16

Table 10: Means and standard deviations computed with weights

	Sovereign			Public			Private		
	IG	L	J	IG	L	J	IG	L	J
US 3-year Treasury rate	5.8	5.8	5.7	5.8	5.8	5.6	5.7	5.7	5.8
	(0.8)	(0.9)	(0.7)	(0.8)	(0.9)	(0.8)	(0.6)	(0.8)	(0.8)
US 10-year -	1.2	1.4	0.91	1.2	1.4	1.2	0.98	1.2	1.3
US 1-year T. rate	(0.9)	(1.0)	(0.7)	(0.8)	(1.0)	(0.9)	(0.8)	(0.9)	(0.9)
US industrial prod.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
growth rate	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
EMBI spread value	774	794	749	775	787	772	789	803	712
	(268)	(277)	(279)	(276)	(285)	(273)	(310)	(286)	(251)
US swap rate	38	38	42	37	39	38	42	41	35
	(17)	(16)	(20)	(16)	(17)	(18)	(19)	(18)	(14)
High Yield spread	425	446	404	411	442	420	407	436	397
	(118)	(125)	(105)	(109)	(129)	(99)	(91)	(128)	(98)
Growth rate of real GDP	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Credit rating residual	1.8	-1.5	-4.5	6.1	-0.3	-1.3	2.5	0.4	-3.4
	(9.4)	(9.6)	(9.8)	(9.2)	(10)	(8.1)	(11)	(12)	(11)
Foreign debt/GDP	0.41	0.46	0.39	0.29	0.43	0.39	0.30	0.40	0.40
	(0.17)	(0.24)	(0.15)	(0.18)	(0.32)	(0.18)	(0.15)	(0.27)	(0.19)
Debt service/exports	0.27	0.24	0.32	0.18	0.22	0.34	0.16	0.21	0.32
	(0.16)	(0.17)	(0.19)	(0.18)	(0.19)	(0.20)	(0.15)	(0.17)	(0.20)
Export growth volatility	0.12	0.12	0.13	0.09	0.11	0.10	0.10	0.11	0.10
	(0.09)	(0.11)	(0.11)	(0.06)	(0.09)	(0.07)	(0.05)	(0.09)	(0.07)
Reserves/Short–term debt	2.1	1.9	1.8	1.5	2.1	1.6	2.3	2.1	1.4
	(3.0)	(2.0)	(1.7)	(1.5)	(2.1)	(1.5)	(3.1)	(2.4)	(1.3)
Reserves/import	1.6	1.5	2.1	1.4	1.6	2.3	1.7	1.8	2.2
	(0.85)	(1.2)	(1.4)	(0.76)	(1.2)	(1.3)	(0.98)	(1.4)	(1.3)
Total debt/Short term debt	0.45	0.53	0.52	0.60	0.53	0.54	0.55	0.55	0.52
	(0.16)	(0.16)	(0.11)	(0.17)	(0.17)	(0.12)	(0.18)	(0.18)	(0.13)
Bank credit stock	1.6	1.1	0.86	2.6	1.5	1.2	1.7	1.6	1.4
	(1.2)	(0.94)	(0.60)	(1.8)	(1.3)	(0.96)	(1.6)	(1.5)	(1.1)
Log inflation rate	-2.2	-1.9	-2.1	-2.7	-2.1	-2.0	-2.6	-2.3	-1.9
	(1.1)	(1.4)	(1.5)	(0.9)	(1.4)	(2.0)	(1.1)	(1.4)	(1.9)
Log real exchange rate	2.8	4.2	3.8	3.5	3.2	2.5	3.1	3.4	2.3
	(1.8)	(3.3)	(3.7)	(2.4)	(2.9)	(2.8)	(2.2)	(2.8)	(2.6)
CA/GDP ratio	-7.1	-4.1	-6.1	-4.5	-7.5	-6.4	-7.6	-6.9	-4.1
	(15)	(15)	(13)	(14)	(15)	(11)	(15)	(16)	(14)
Reserve gain in	0.10	0.08	0.07	0.05	0.05	0.05	0.05	0.03	0.06
last quarter	(0.22)	(0.23)	(0.22)	(0.16)	(0.23)	(0.16)	(0.12)	(0.21)	(0.18)
Growth rate of	0.04	0.06	0.07	0.05	0.06	0.12	0.06	0.06	0.11
domestic credit	(0.05)	(0.10)	(0.07)	(0.04)	(0.09)	(0.22)	(0.05)	(0.08)	(0.20)
Log real interest rate	2.6	2.7	2.8	2.4	2.5	2.7	2.3	2.5	2.7
	(0.56)	(0.76)	(0.71)	(0.69)	(0.72)	(1.1)	(0.76)	(0.74)	(1.0)
Brady rescheduling	0.01	0.02	0.03	0.00	0.01	0.06	0.00	0.02	0.07
Non–Brady rescheduling	0.05	0.06	0.17	0.02	0.08	0.26	0.00	0.08	0.18
Maturity	8.1	6.6	6.8	7.2	5.3	5.1	6.6	4.8	5.9
	(7.5)	(5.2)	(6.6)	(7.8)	(3.9)	(3.9)	(6.8)	(3.5)	(5.1)
Log amount	5.4	4.4	5.6	4.9	4.1	4.6	4.5	3.5	4.3
	(0.8)	(1.4)	(0.8)	(0.9)	(1.2)	(0.8)	(0.9)	(1.2)	(0.8)
US Dollar denominated	0.43	0.71	0.53	0.53	0.78	0.73	0.62	0.75	0.74
Deutsche Mark denominated	0.12	0.02	0.18	0.09	0.05	0.06	0.11	0.06	0.06
Euro denominated	0.08	0.02	0.10	0.05	0.01	0.08	0.09	0.01	0.01
Yen denominated	0.25	0.09	0.10	0.17	0.04	0.06	0.03	0.00	0.01
Finance industry	0.07	0.03	0.00	0.54	0.20	0.51	0.68	0.30	0.64
Service industry	0.00	0.01	0.00	0.01	0.16	0.02	0.05	0.10	0.06
Manufacturing industry	0.00	0.01	0.00	0.03	0.13	0.01	0.14	0.32	0.17

Table 11: Amount (bln. USD) and number of bonds and loans by country

Country	N. bonds	N. loans	Am. bonds	Am. loans	Share IG in N.	Share IG in Am.
Angola	0	33	0	6.5	0	0
Argentina	379	401	78.4	49.8	0	0
Bahrain	13	77	0	9.1	8%	0
Bangladesh	0	12	0	0.9	0	0
Bolivia	3	21	0.03	0.81	0	0
Brazil	431	336	56.6	44.5	0	0
Bulgaria	4	15	0.2	0.7	0	0
Chile	44	337	5.2	51.6	68%	81%
China	122	1324	21.2	78.5	66%	76%
Colombia	41	159	9.1	17.4	27%	18%
Costa Rica	9	13	1.6	0.2	0	0
Croatia	11	68	1.4	3.5	82%	93%
Czech Republic	173	141	8.9	13.2	20%	61%
Dominican Republic	6	6	0.7	0.2	50%	14%
Ecuador	11	22	1.2	0.6	0	0
Egypt	1	59	0.1	6.7	0	0
El Salvador	3	41	0.4	1.2	100%	100%
Estonia	24	148	1.0	3.5	54%	80%
Guatemala	6	15	0.6	0.7	0	0
Hong Kong	563	881	96.2	100.1	56%	63%
Hungary	77	184	19.0	12.4	97%	99%
India	53	420	5.9	29.7	0	0
Indonesia	130	1069	18.1	65.9	4%	2%
Kazakhstan	9	47	1.4	3.0	0	0
Kenya	0	9	0	0.2	0	0
Korea	584	1015	69.5	55.7	46%	72%
Kuwait	0	89	0	22.6	0	0
Latvia	7	29	0.4	0.7	100%	100%
Lebanon	42	30	9.1	1.3	0	0
Lithuania	10	54	1.0	1.7	0	0
Malaysia	62	583	14.1	51.5	65%	82%
Mexico	345	538	83.7	81.1	42%	64%
Morocco	7	62	1.3	4.7	0	0
Nigeria	0	25	0	0.9	0	0
Pakistan	6	212	0.9	13.2	0	0
Papua New Guinea	0	33	0	3.4	0	0
Paraguay	0	9	0	0.3	0	0
Peru	9	101	0.5	7.9	0	0
Philippines	112	242	17.9	19.8	0	0
Poland	28	170	5.9	11.0	39%	44%
Russia	45	319	21.8	43.4	0	0
Singapore	56	324	8.2	27.6	25%	23%
Slovak Republic	24	110	3.1	5.5	0	0
Slovenia	6	132	2.4	6.3	100%	100%
South Africa	47	163	14.5	18.1	68%	83%
Sri Lanka	9	30	0.4	1.9	0	0
Thailand	150	916	16.0	53.8	21%	25%
Trinidad and Tobago	17	25	2.4	3.6	71%	67%
Tunisia	15	58	2.8	3.1	100%	100%
Turkey	99	552	27.1	41.1	0	0
Ukraine	10	18	34.4	0.4	0	0
Uruguay	37	22	4.2	0.7	89%	93%
Venezuela	134	183	30.3	18.7	28%	27%
Zambia	0	76	0	4.5	0	0
Zimbabwe	0	59	0	1.9	0	0

Table 12: Amount of bonds and loans issued by region and year

Region	1991	1992	1993	1994	1995	1996	1997	1998	1999	1991-9
E. Europe	15%	7%	10%	6%	9%	6%	10%	26%	14%	12%
and C.Asia	10%	5%	7%	9%	8%	8%	12%	9%	7%	9%
Middle East	4%	15%	7%	5%	7%	5%	5%	8%	10%	7%
	29%	26%	15%	18%	16%	9%	13%	16%	20%	17%
E. Asia and	34%	29%	35%	52%	42%	41%	34%	16%	29%	34%
Pacific	32%	40%	52%	55%	47%	52%	43%	30%	32%	43%
Carribean	0%	1.4%	0.7%	1.3%	0%	0.5%	0.6%	1.4%	0.5%	0.7%
	0.3%	0.3%	0.1%	0.5%	0.1%	0.2%	1.2%	0%	0.5%	0.4%
Latin America	43%	44%	46%	31%	36%	46%	44%	47%	44%	43%
	18%	17%	17%	11%	15%	21%	24%	37%	32%	22%
South Asia	1.7%	0%	1.0%	2.0%	1.4%	1.3%	2.1%	0.2%	0.1%	1.2%
	2.6%	3.3%	4.3%	4.7%	4.4%	4.8%	3.9%	3.8%	3.4%	4.0%
Africa	2.4%	3.8%	0.9%	3.5%	3.1%	1.2%	4.4%	1.7%	2.2%	2.6%
	8.1%	7.8%	4.0%	2.3%	9.9%	4.1%	2.8%	3.6%	5.7%	5.1%
Total	13.1	21.1	57.5	55.3	58.1	106.5	136.2	80.0	87.6	615.4
(bln U.S.$)	87.5	74.8	83.2	104.4	150.7	161.8	234.7	130.4	120.2	1147.7

Note: First line - bonds, second line - loans. Percent of total.

Table 13: Number of bond issues and loan contracts by region and year

Region	1991	1992	1993	1994	1995	1996	1997	1998	1999	1991-9
E. Europe	11%	7%	6%	6%	11%	7%	12%	20%	15%	10%
and C.Asia	5%	6%	8%	9%	9%	9%	13%	17%	14%	10%
Middle East	2.4%	7%	3%	1.9%	4%	4%	5%	9%	8%	5%
	12%	14%	12%	8%	6%	6%	8%	12%	14%	9%
E. Asia and	45%	29%	35%	52%	53%	50%	42%	16%	39%	42%
Pacific	55%	52%	53%	60%	60%	63%	52%	36%	37%	53%
Carribean	0%	1.5%	0.7%	2.1%	0%	0.9%	1.0%	2.1%	0.5%	1.0%
	1.3%	0.6%	0.5%	0.8%	0.2%	0.3%	0.6%	0%	0.4%	0.5%
Latin America	39%	53%	53%	34%	27%	35%	36%	50%	36%	38%
	15%	18%	16%	11%	13%	12%	17%	26%	26%	17%
South Asia	0.8%	0%	1.4%	2.2%	2.0%	2.3%	3.1%	1.0%	0.2%	1.8%
	3.4%	3.2%	4.3%	7.1%	5.8%	6.7%	6.3%	4.9%	2.9%	5.3%
Africa	2.4%	3.0%	0.7%	1.5%	2.2%	0.9%	1.2%	1.7%	1.4%	1.4%
	8%	6%	6%	3%	4%	4%	3%	4%	5%	5%
Total	127	203	434	481	454	690	669	289	427	3774
	924	1045	1160	1371	1790	1979	2182	1172	1070	12693

Note: First line - bonds, second line - loans.

Appendix 3. Bond classification into investment grade and "junk"

Unfortunately, individual bond ratings are available for only a small subset of the bonds. Moody's individual bond ratings are available for only 1951 out of 3774 bond issues.[21] In most cases, the S&P and Moody's rating, when both available, either both assign investment grade, or both assign speculative grade to the borrower.[22] There are 139 issues for which issuers are rated by S&P, which provides information for additional 21 bond issues (as 118 issues overlap with those for which ratings are available). Thus, based on available ratings, we can classify 1972 bonds, out of which 819 are investment grade and 1153 are "junk".

Next, sovereign bonds can be classified using sovereign credit ratings. Since Institutional Investor's credit rating does not provide a clear split between investment and speculative grade, and Moody's refused to provide historical data, S&P ratings that are available on the Internet are utilized. Unfortunately, this data is overlapping with existing classification and thus does not allow us to classify any of the additional bonds.[23]

There are two ways to classify the rest of the bonds. First would be to use the so-called "sovereign ceiling" practice, when rating agencies do not assign private ratings that exceed the rating of their sovereign. Assuming that no borrowers in a country could issue an investment grade bond if their sovereign is assigned a non-investment rating, additional 518 bonds that were not classified before can be classified as "junk".[24] The sovereign ceiling does not allow us to classify any bonds as investment grade. Now 2490 bonds are classified: 819 are investment grade and 1671 are "junk".

This information can be extrapolated in order to determine for the majority of still unclassified bonds if they are investment grade or junk bonds. First, a binary variable that takes up a value of 1 if the assigned rating is investment grade and 0 otherwise is constructed.[25] We then fit a probit model using available data on issuers. The results reported in Table 14 are used to predict the probability that the bond is investment grade. A bond is classified as investment grade bond if the predicted probability for this bond is more than

[21]The individual bond ratings from Moody's are available for 1945 bonds; additional 6 bonds are classified based on Moody's issuer rating that is available for 256 bond issues with 250 bonds for which individual ratings are also available. Except for 11 issues, whenever a bond is assigned an investment grade, the issuer is also assigned an investment grade and vice versa. For 11 issues, the issue is rated "Baa3" while the issuer has a one-notch-lower rating — "Ba1". The boundary between investment grade and speculative bonds lies just between those two grades. I classify those 11 issues as non-investment grade, due to the fact that, when the S&P rating for the same issuers is available, it is a non-investment rating.

[22]There are 13 bonds for which S&P assigned non-investment grade while Moody's assigned investment grade and 5 bonds for which Moody's assigned non-investment grade and S&P assigned investment grade. I rank those bonds according to Moody's as individual bond ratings are more precise than issuer's ratings.

[23]There are 195 sovereign bonds for which S&P sovereign ratings do not agree with the classification described above. Since sovereign ratings are somewhat imprecise (by construction of my data set they are only changed quarterly), I stick to the previous classification. For 363 sovereign bonds, both measures lead to the same results.

[24]I choose not to impose the sovereign ceiling when individual ratings are available. As S&P claim, they are "less likely than other agencies to use sovereign ceiling".

[25]To make this as clean as possible, I only use the individual Moody's bond ratings that are available for 1951 bonds.

Table 14: Probit regression used to classify bonds

	All	Private	Public	Sovereign
Credit rating	0.019***	0.010*	0.033***	0.065***
	(0.004)	(0.006)	(0.007)	(0.011)
Spread	-0.003***	-0.004***	-0.002***	-0.003***
	(0.000)	(0.001)	(0.001)	(0.001)
Guarantee	0.268**	0.151	0.539**	-0.434
	(0.128)	(0.183)	(0.241)	(0.444)
UK governing law	-0.485***	-0.816***	-0.735***	-0.352
	(0.091)	(0.310)	(0.193)	(0.218)
US governing law	-0.096	-0.346	-0.467	-0.132
	(0.142)	(0.275)	(0.321)	(0.232)
Issue in DM	0.119	0.561	1.162***	-0.602**
	(0.160)	(0.378)	(0.350)	(0.257)
Issue in Euro	0.209	1.097***	0.343	-0.446*
	(0.174)	(0.411)	(0.566)	(0.241)
Issue in Yen	0.371***	0.131	0.498**	0.012
	(0.139)	(0.354)	(0.231)	(0.231)
Finance industry	-0.349	-0.652***	0.522	
	(0.259)	(0.189)	(0.361)	
Manufacturing	0.251			
	(0.292)			
Government services	-1.102***			
	(0.351)			
Utility/Infrastructure	-0.041	-0.791***	1.334***	
	(0.273)	(0.252)	(0.386)	
Service	-0.272			
	(0.299)			
Public (non–sovereign) borrower	-0.728***			
	(0.240)			
Private borrower	-1.703***			
	(0.251)			
Constant	1.106***	0.629	-1.496***	-1.617***
	(0.412)	(0.554)	(0.577)	(0.533)
Observations	1612	650	395	546
Log likelihood	-752.13	-254.28	-183.10	-262.15
Pseudo R^2	0.2975	0.2576	0.3079	0.2803

Note: * = significant at 10% level, ** = significant at 5% level, *** = significant at 1% level. Standard errors are in parentheses.

0.5, otherwise a bond is classified as speculative (or "junk").[26] For 1644 bonds that are already classified this procedure provides correct classification, while 364 bonds are misclassified. Given that in 82% of the cases this procedure gives the right answer, it seems to be useful for classifying the remaining bonds. This procedure allows to classify additional 213 bonds as investment grade and additional 374 bonds as "junk" — for a total of 3077 bond issues classified.

The other 697 bond issues are missing explanatory variables, predominantly spread. For now, they are left unclassified and are not considered in the empirical analysis.

A categorical variable is then created. It is equal to 0 if an investment grade bond is observed, to 1 if a loan is observed, to 2 if a junk bond is observed, and is missing for the bonds that are not classified. Further, we

[26]For sensitivity tests we also estimate separate probit regressions for each ownership sector and construct separate predictions for each ownership sector. The results are presented in Table 14.

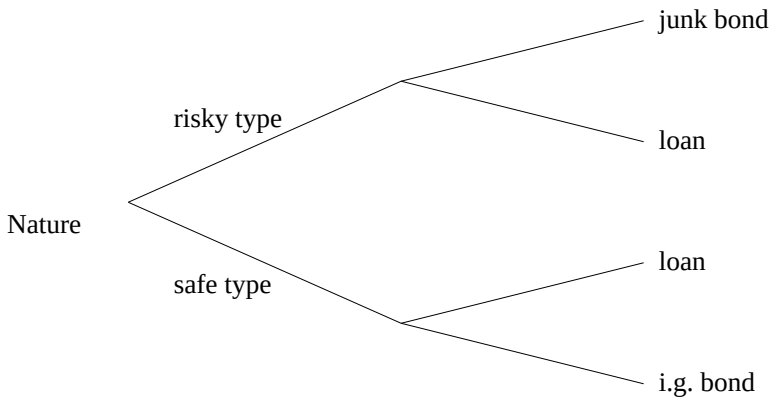

Figure 4: Decision-making

test whether the above classification of bonds is appropriate. According to the model, there are basically two group of borrowers: some can choose between investment grade bonds and bank loans, while others can choose between junk bonds and bank loans. Adding a third choice to each of the groups should not affect the decision, as shown in Figure 4. Thus, if classification is appropriate, we should expect that in multinomial logit estimation IIA holds when a second type of bonds is excluded. If loan alternative is removed, however, IIA should fail strongly, as investors do not choose between junk and investment grade bonds. If the bonds are misclassified, there is no reason why IIA should hold.

Table 15: IIA test to verify bond classification

Omitted	χ^2	D.of F.	Prob$(. > \chi^2)$	Evidence
Small–Hsiao (LR) tests of IIA assumption				
I.G. bond	13.3	14	0.51	for Ho
Junk bond	14.8	14	0.39	for Ho
loan	56.5	14	0.00	against Ho

H_0: Odds (Outcome-J vs Outcome-K) are independent of other alternatives Results are based on multinomial logit estimation. Explanatory variables are U.S. 3-year Treasury rate, swap rate, credit rating residual, foreign debt/GDP, debt service/exports, variance of export growth, reserves to short-term debt ratio, log real exchange rate, log real interest rate, Brady–type debt rescheduling in a past year, non–Brady–type debt rescheduling in a past year, borrower is private, borrower is public. Dependent variable is categorical: loan, investment grade bond, junk bond. Robust standard errors are used.

The results of Small–Hsiao LLR test to test for IIA are reported in Table 15. They strongly suggest that the classification is appropriate: excluding either investment grade or junk bonds does not change the results, while excluding loans does change them. These results also hold for alternative definitions as mentioned above.

Appendix 4. Marginal effects

Marginal effects are computed for each outcome of the ordered probit regression. They represent the derivative of the probability of a given outcome with respect to explanatory variable. They are evaluated at the mean of independent variables using the coefficients from unweighed and weighted regressions. For dummy variables the marginal effects are the effects of the change of the variable from 0 to 1 on the probability of a given outcome. Marginal effects for the binary probit models are available from author upon request. Standard errors are in parenthesis.

Table 16: Effects on the probability to issue an investment grade bond

	Private		Sovereign		Public	
	No Weights	Weights	No Weights	Weights	No Weights	Weights
US 3-year Treasury rate	0.01***	-0.001	0.04***	0.03	0.01***	0.01**
	(0.001)	(0.002)	(0.01)	(0.02)	(0.00)	(0.01)
US swap rate	0.001***	0.0004***	-0.001	-0.002	0.0002	-0.0003
	(0.0001)	(0.0001)	(0.001)	(0.001)	(0.0002)	(0.0004)
Credit rating residual	0.001***	0.001***	0.02***	0.02***	0.003***	0.003***
	(0.0001)	(0.0002)	(0.00)	(0.00)	(0.000)	(0.001)
Foreign debt/GDP	-0.05***	-0.004	0.18**	0.06	-0.002	-0.05*
	(0.01)	(0.007)	(0.09)	(0.11)	(0.012)	(0.03)
Debt service/exports	-0.15***	-0.11***	-0.50***	-0.46***	-0.11***	-0.14***
	(0.01)	(0.01)	(0.10)	(0.12)	(0.02)	(0.03)
Export growth volatility	0.01	0.07***	-1.00***	-0.75***	-0.25***	-0.05
	(0.02)	(0.02)	(0.16)	(0.19)	(0.05)	(0.06)
Reserves/short–term debt	-0.001***	0.002**	0.004	-0.003	-0.01***	-0.005**
	(0.0003)	(0.001)	(0.01)	(0.01)	(0.00)	(0.002)
Log real exchange rate	0.003***	0.002***	-0.05***	-0.05***	-0.001	0.002
	(0.000)	(0.001)	(0.01)	(0.01)	(0.0015)	(0.002)
Log real interest rate	-0.02***	-0.002	0.05**	0.04	-0.04***	-0.01
	(0.00)	(0.003)	(0.02)	(0.03)	(0.01)	(0.01)
Brady–type debt rescheduling	-0.04***	-0.02***	-0.21***	-0.23***	-0.05***	-0.07***
	(0.00)	(0.00)	(0.02)	(0.03)	(0.01)	(0.01)
Non–Brady–type debt rescheduling	-0.02***	-0.02***	-0.18***	-0.25***	-0.04***	-0.06***
	(0.00)	(0.00)	(0.03)	(0.03)	(0.01)	(0.01)
Log amount	0.001	-0.01***	-0.06***	-0.06***	0.01***	0.01*
	(0.0010)	(0.001)	(0.01)	(0.01)	(0.003)	(0.004)

Table 17: Effects on the probability to take out a loan

	Private		Sovereign		Public	
	No Weights	Weights	No Weights	Weights	No Weights	Weights
US 3-year Treasury rate	0.01***	-0.002	0.01**	0.004	-0.003***	-0.004**
	(0.00)	(0.003)	(0.004)	(0.003)	(0.001)	(0.002)
US swap rate	0.001***	0.001***	-0.0002	-0.0002	-0.00004	0.0001
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Credit rating residual	0.001***	0.001***	0.004***	0.003**	-0.001***	-0.001***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.0002)	(0.0003)
Foreign debt/GDP	-0.06***	-0.01	0.03*	0.01	0.0004	0.02
	(0.01)	(0.01)	(0.02)	(0.01)	(0.003)	(0.01)
Debt service/exports	-0.18***	-0.16***	-0.09***	-0.06*	0.03***	0.05***
	(0.01)	(0.02)	(0.03)	(0.03)	(0.01)	(0.02)
Export growth volatility	0.01	0.10***	-0.18***	-0.09*	0.06***	0.02
	(0.02)	(0.02)	(0.07)	(0.05)	(0.02)	(0.02)
Reserves/short–term debt	-0.001***	0.003**	0.001	-0.0004	0.003***	0.002*
	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log real exchange rate	0.004***	0.003***	-0.01***	-0.01**	0.0001	-0.001
	(0.001)	(0.001)	(0.003)	(0.003)	(0.0003)	(0.001)
Log real interest rate	-0.02***	-0.003	0.01**	0.004	0.01***	0.004
	(0.00)	(0.004)	(0.005)	(0.004)	(0.002)	(0.003)
Brady–type debt rescheduling	-0.25***	-0.14***	-0.25***	-0.25***	-0.02	-0.06
	(0.04)	(0.04)	(0.07)	(0.07)	(0.03)	(0.06)
Non–Brady–type debt rescheduling	-0.03***	-0.06***	-0.12***	-0.18***	-0.01	-0.03
	(0.01)	(0.02)	(0.03)	(0.05)	(0.008)	(0.02)
Log amount	0.001	-0.01***	-0.01**	-0.01*	-0.002**	-0.002
	(0.0012)	(0.00)	(0.00)	(0.004)	(0.001)	(0.002)

Table 18: Effects on the probability to issue a junk bond

	Private		Sovereign		Public	
	No Weights	Weights	No Weights	Weights	No Weights	Weights
US 3-year Treasury rate	-0.02***	0.003	-0.05***	-0.03	-0.01***	-0.01**
	(0.00)	(0.004)	(0.02)	(0.02)	(0.00)	(0.004)
US swap rate	-0.001***	-0.001***	0.001	0.002	-0.0001	0.0002
	(0.000)	(0.0003)	(0.001)	(0.001)	(0.0002)	(0.0002)
Credit rating residual	-0.002***	-0.002***	-0.03***	-0.02***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.00)	(0.00)	(0.000)	(0.000)
Foreign debt/GDP	0.10***	0.01	-0.21**	-0.07	0.001	0.03*
	(0.02)	(0.02)	(0.10)	(0.12)	(0.01)	(0.02)
Debt service/exports	0.33***	0.27***	0.58***	0.52***	0.08***	0.09***
	(0.02)	(0.02)	(0.11)	(0.13)	(0.02)	(0.02)
Export growth volatility	-0.03	-0.17***	1.17***	0.84***	0.19***	0.03
	(0.04)	(0.04)	(0.20)	(0.22)	(0.04)	(0.04)
Reserves/short–term debt	0.002***	-0.01**	-0.004	0.004	0.01***	0.003**
	(0.001)	(0.002)	(0.01)	(0.01)	(0.001)	(0.001)
Log real exchange rate	-0.01***	-0.004***	0.06***	0.06***	0.001	-0.001
	(0.001)	(0.002)	(0.01)	(0.01)	(0.0011)	(0.001)
Log real interest rate	0.03***	0.01	-0.06**	-0.04	0.03***	0.01
	(0.00)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)
Brady–type debt rescheduling	0.29***	0.16***	0.45***	0.49***	0.07*	0.13*
	(0.04)	(0.04)	(0.09)	(0.09)	(0.04)	(0.07)
Non–Brady–type debt rescheduling	0.05***	0.08***	0.29***	0.43***	0.04**	0.09***
	(0.01)	(0.02)	(0.05)	(0.07)	(0.02)	(0.03)
Log amount	-0.001	0.02***	0.07***	0.07***	-0.01***	-0.01*
	(0.002)	(0.00)	(0.01)	(0.02)	(0.002)	(0.003)

Supplement. Technical presentation of the model.

Borrowers. The population of risk-neutral borrowers includes three types: G, B and S with the following characteristics:

Type G invests in a safe project that yields gross return G with probability 1.

Type B invests in a risky project that yields gross return B with probability π, and 0 with probability $1-\pi$.

Type S takes an unobservable action, s. $s=g$ if it invests in a safe project identical to that of type G; $s=b$ if it invests in a risky project identical to that of type B.[27]

Borrower type is not observable. Thus, banks have the same beliefs about all borrowers. The type distribution is publicly known and is given as follows: share f_G of all borrowers are type G, share f_B are type B, and share f_S are type S. f_G, f_B and f_S belong to a simplex. All borrowers are risk-neutral and maximize their expected profit. All borrowers borrow one unit of capital.[28] Borrowers have limited liability and no initial endowment, and are therefore effectively risk–loving.

Lenders. A storage technology that brings a return R with probability 1 is available to lenders. Assume that $B > G > R$ and that risky projects have a negative net present value: $\pi B < R$. For simplicity assume that lenders have abundant funds and are risk–neutral. Therefore, lenders will always accept an expected rate of return equal to R without monitoring and equal to $R+c$ with monitoring, where $c>0$ is the cost of monitoring. This implies that the supply of funds will be perfectly elastic at the (expected) reservation interest rate, which differs depending on whether there is monitoring.

Monitoring, loan cancellation and default. Since the lender cannot distinguish between different types, it will either monitor all the borrowers or not monitor at all.[29] Monitoring is imperfect. With exogenous probability P,[30] borrowers of type S that choose $s=b$ will be caught and their loans cancelled. No action is taken by the other types and therefore monitoring borrowers of types B and G will be uninformative.[31] With probability $1-P$, monitoring borrowers of type S will be uninformative, as if no action were taken. This is equivalent to the results of monitoring types B and G. In the case of loan cancellation, the

[27] For simplicity, I do not consider mixed strategies for borrowers of type S.

[28] Allowing the amount of borrowing to be different across borrowers does not change the results of the model, if this amount is exogenous. Allowing it to be a choice variable is potentially an interesting modification of the model, because it can lead to a separating equilibrium.

[29] To keep the model simple, I do not allow for mixed strategies for lenders.

[30] This probability can be interpreted as a measure of monitoring effectiveness.

[31] This implies that a loan to a type B borrower cannot be cancelled. This assumption is made to capture the fact that borrowers of type B are not subject to moral hazard.

borrowers' monetary payoff is 0 and the lenders can still use the storage technology or lend to someone else. However, even in the case of loan cancellation, the lenders bear the cost of monitoring. Borrowers bear an exogenous fixed cost L of loan cancellation due to reputation deterioration and other losses.

Monitoring occurs for two reasons. First, it can provide an incentive for borrowers of type S to choose $s = g$, which will increase the bank's expected payoff for a given rate. Second, even if it does not provide sufficient incentive, monitoring can still be profitable since the lender can cancel the share P of the risky projects undertaken by borrowers of type S, and thus increase the expected payoff.

If borrowers invest in risky projects and the return is 0, they default on their loans. In this case the monetary payoff to both parties is 0. In addition, borrowers bear an exogenous fixed cost D of default, $D > L$.[32] All variables except for the borrower's type, action, and payoff are common knowledge.

Rates. The sequence of actions is as follows. Borrowers offer a take-it-or-leave-it contract that specifies r, the gross return they are willing to pay. Lenders accept or reject the contract and choose whether or not to monitor. Borrowers of type S then choose their action.

Given these assumptions, there is no signaling or other motive for borrowers to offer a rate above the minimum that lenders will accept. Borrowers with safe projects are not able to offer a rate above the maximum profitable rate that the borrowers with risky projects can offer. Thus, borrowers with safe projects are not able to signal their type, because they are not able to separate themselves from the borrowers that have or choose risky projects. Since borrowers with risky projects are not willing to signal their type, all borrowers offer the same rate. If we assume that lenders are rational (i.e., given their information they can infer which action would be chosen by type S), we can derive the minimum gross rates of return that will be accepted by the lenders.

If there is no monitoring, the lender will accept the rate that will give him an expected return equal to R. If type S chooses project g, then the share f_B of borrowers will pay back with probability π, the rest will pay

[32] An interpretation of this condition is that in case of loan cancellation, a borrower's reputation worsens within the bank syndicate but not beyond, whereas in case of default a borrower's reputation worsens everywhere. A no-reputation cost interpretation is also possible: in the case of loan cancellation, the cost to a lender is c, which is significantly less then the amount of the loan, and thus the lender's incentive to take "revenge" steps is much smaller then in the case of default, where the cost to a lender is equal to r. An additional constraint on parameters needs to be imposed for risky projects to occur. Namely, the cost of default, D, should not be too high given B and π: $D < \frac{\pi(B-r)}{1-\pi}$.

back with probability 1. Therefore

$$\begin{aligned} r_1((1-f_B)+\pi f_B) &= R \\ r_1(1-f_B+\pi f_B) &= R \\ r_1 &= \frac{R}{1-(1-\pi)f_B}. \end{aligned}$$

If type S chooses project b, then the share $1-f_G$ of borrowers will pay back with probability π and the rest will pay back with probability 1. Therefore,

$$\begin{aligned} r_3(f_G+\pi(1-f_G)) &= R \\ r_3(f_G+\pi-\pi f_G) &= R \\ r_3 &= \frac{R}{\pi+(1-\pi)f_G}. \end{aligned}$$

With monitoring, no matter what the outcome is, the bank bears the cost C of monitoring. Therefore it will not accept an expected rate of return below $R+C$. If monitoring provides incentives, borrowers of type S will choose $a=g$ and therefore

$$\begin{aligned} r_2((1-f_B)+\pi f_B) &= R+C \\ r_2 &= \frac{R+C}{1-(1-\pi)f_B}. \end{aligned}$$

Matters are more complicated if monitoring does not provide incentives. Since type B borrowers do not take any action, their "choice" of risky project cannot be "caught". Therefore, as before, they pay with probability π. Type S borrowers can be "caught" and, if caught, the bank cancels the loan, which means that the total number of loans is smaller by Pf_S, although the cost of monitoring has already been borne. Type S borrowers actually pay the bank with the probability $(1-P)$ that they are not caught multiplied by the probability π that their return is positive. Therefore,

$$\begin{aligned} r_4(f_G+(1-P)\pi(1-f_G-f_B)+\pi f_B) &= R(1-P(1-f_G-f_B))+C \\ r_4(f_G(1-(1-P)\pi)+f_B(\pi-(1-P)\pi)+(1-P)\pi) &= R(1-P(1-f_G-f_B))+C \\ r_4((1-P)\pi+(1-(1-P)\pi)f_G+\pi P f_B) &= R(1-P(1-f_G-f_B))+C \\ r_4 &= \frac{R(1-P(1-f_G-f_B))+C}{(1-P)\pi+(1-(1-P)\pi)f_G+\pi P f_B}. \end{aligned}$$

If the rate offered by a borrower is higher than G, then lenders can infer that there will be no investment

in safe projects. Since we have assumed that $\pi B < R$, no lending will occur. Therefore for lending to take place all rates should not exceed G, which leads to the following set of constraints:

$$f_B \leq \frac{1}{1-\pi}\left(1 - \frac{R}{G}\right) \tag{5}$$

$$f_B \leq \frac{1}{1-\pi}\left(1 - \frac{R+C}{G}\right) \tag{6}$$

$$f_G \geq 1 - \frac{G-R}{(1-\pi)G} \tag{7}$$

$$f_G \geq 1 - \frac{G-R-C}{(1-\pi)G - P(R-\pi G)} + \frac{P(R-\pi G)f_B}{(1-\pi)G - P(R-\pi G)}. \tag{8}$$

These feasibility constraints are derived from the following conditions:

$$\begin{aligned} r_1 = \frac{R}{1-(1-\pi)f_B} &\leq G \\ r_2 = \frac{R+C}{1-(1-\pi)f_B} &\leq G \\ r_3 = \frac{R}{\pi+(1-\pi)f_G} &\leq G \\ r_4 = \frac{R - RP(1-f_G-f_B) + C}{\pi(1-P) + (1-\pi(1-P))f_G + \pi P f_B} &\leq G. \end{aligned}$$

They are then straightforwardly derived except for 8, which is derived below.

$$\begin{aligned} f_G &\geq -\frac{(PR - G\pi\, P)\, f_B}{PR - G + G\pi - G\pi\, P} - \frac{R - PR + C - G\pi + G\pi\, P}{PR - G + G\pi - G\pi\, P} \\ f_G &\geq 1 - \frac{G-R-C}{(1-\pi)G - P(R-\pi G)} + \frac{P(R-\pi G)f_B}{(1-\pi)G - P(R-\pi G)}. \end{aligned}$$

Choice of project by the borrowers of type S. Borrowers of type S will prefer $s = g$ to $s = b$ without being monitored if and only if their return from the safe project is at least as high as the expected return from the risky project minus the expected cost of default:

$$(G - r_1) \geq \pi(B - r_1) - (1-\pi)D.$$

We can substitute for r_1 to find that this is equivalent to

$$f_B \leq \frac{1}{1-\pi} - \frac{R}{(1-\pi)D + (G - \pi B)}, \tag{9}$$

which can be derived as follows.

$$\begin{aligned}
(G - r_1) &\geq \pi(B - r_1) - (1 - \pi)D \\
r_1 &\leq \frac{G - \pi B + (1 - \pi)D}{1 - \pi} \\
r_1 &\leq \frac{G - \pi B}{1 - \pi} + D \\
\frac{R}{1 - (1 - \pi)f_B} &\leq \frac{(G - \pi B) + D(1 - \pi)}{(1 - \pi)} \\
R(1 - \pi) &\leq (G - \pi B) + D(1 - \pi) - (1 - \pi)(G - \pi B)f_B - D(1 - \pi)^2 f_B \\
f_B &\leq \frac{(G - \pi B) + D(1 - \pi) - R(1 - \pi)}{(1 - \pi)(G - \pi B) + D(1 - \pi)^2} \\
f_B &\leq \frac{1}{1 - \pi} - \frac{R}{(1 - \pi)D + (G - \pi B)}
\end{aligned}$$

This implies that if the share of borrowers of type B is sufficiently low, the interest rate r_1 is low enough for borrowers of type S to prefer safe projects even without monitoring. Since monitoring is costly, it will not occur unless borrowers of type S would choose risky projects in the absence of monitoring. If condition (9) is satisfied and $f_S > 0$, the rate r_1 will be small, and monitoring will never be needed.

Borrowers of type S will choose $s = g$ when monitored if the expected return from the safe project is at least as high as the expected return from the risky project minus the expected cost of default or loan cancellation.

$$(G - r_2) \geq -PL + (1 - P)[\pi(B - r_2) - (1 - \pi)D],$$

which is equivalent to

$$f_B \leq \frac{1}{1 - \pi} - \frac{(1 - \pi(1 - P))(R + C)}{(1 - \pi)[Z + G - \pi(1 - P)B]}, \tag{10}$$

where $Z \equiv PL + (1 - P)(1 - \pi)D$ and can be interpreted as a cost of "failure" in case of monitoring. If the share of borrowers of type B is too high, the lowest rate the bank will accept with monitoring is too high to induce borrowers of type S to prefer the safe project even though they are monitored.

The above is derived as follows.

$$\begin{aligned}
(G - r_2) &\geq P(-L) + (1 - P)[\pi(B - r_2) + (1 - \pi)(-D)] \\
r_2 &\leq \frac{G + PL - (1 - P)\pi B + (1 - P)(1 - \pi)D}{1 - (1 - P)\pi} \\
r_2 &\leq \frac{[PL + (1 - P)(1 - \pi)D] + G - (1 - P)\pi B}{1 - (1 - P)\pi}.
\end{aligned}$$

Denote now $PL + (1-P)(1-\pi)D \equiv Z$. Note that $0 < Z < D$.

$$\begin{aligned}
\frac{R+C}{1-(1-\pi)f_B} &\leq \frac{Z+G-(1-P)\pi B}{1-(1-P)\pi} \\
(R+C)(1-(1-P)\pi) &\leq (Z+G-(1-P)\pi B)\,(1-(1-\pi)f_B) \\
f_B &\leq \frac{(Z+G-(1-P)\pi B)-(R+C)(1-(1-P)\pi)}{(1-\pi)\,(Z+G-(1-P)\pi B)} \\
f_B &\leq \frac{1}{1-\pi} - \frac{(R+C)(1-(1-P)\pi)}{(1-\pi)\,(Z+G-(1-P)\pi B)}.
\end{aligned}$$

Choice by the lenders of whether or not to monitor. For lenders to be willing to monitor, it is necessary that monitoring is needed (condition (9) is violated).[33] Monitoring will then occur in two situations:

A. Monitoring provides incentives for borrowers to choose the safe project that they would not have chosen were they not monitored. In other words, borrowers when monitored choose $s = g$, as determined by condition (10). Monitoring will then occur if the expected benefit from monitoring is greater then its cost,[34] which holds if

$$f_G + \frac{R}{R+C} f_B \leq 1 - \frac{C}{(R+C)(1-\pi)}, \tag{11}$$

which is derived as follows.

Lenders will choose to monitor given the choice of a safe project by borrowers of type S if:

$$\begin{aligned}
r_2[(1-(1-\pi)f_B) - (\pi + (1-\pi)f_G)] &\geq C \\
\frac{R+C}{1-(1-\pi)f_B}[(1-(1-\pi)f_B) - (\pi + (1-\pi)f_G)] &\geq C \\
R + C - (R+C)\frac{\pi + (1-\pi)f_G}{1-(1-\pi)f_B} &\geq C \\
(R+C)\frac{\pi + (1-\pi)f_G}{1-(1-\pi)f_B} &\leq R \\
\pi + (1-\pi)f_G &\leq \frac{R}{R+C}(1-(1-\pi)f_B) \\
f_G &\leq \left(1 - \frac{C}{(R+C)(1-\pi)}\right) - \frac{R}{R+C} f_B.
\end{aligned}$$

Intuitively, if the share of type S borrowers is too low, then the benefit from monitoring will be small, since there is no benefit from monitoring types G and B. The higher the cost of monitoring, the larger is the share of borrowers of type S needed in order for monitoring to occur.

[33] In other words, without monitoring, borrowers of type S would choose risky project.

[34] The expected benefit from monitoring is the increase in the probability of being repaid multiplied by the amount to be repaid and is equal to $[(1-(1-\pi)f_B) - (\pi + (1-\pi)f_G)]r$ in this case.

B. Monitoring does not provide incentives for borrowers to choose safe projects, but lenders can still cancel the loan. Lenders will choose to monitor because this allows them to cancel the share P of risky projects, thus increasing the probability of being repaid. For monitoring to occur it is necessary that the benefit from this increase be higher than the cost of monitoring,

$$f_B \leq 1 - f_G - \frac{C}{RP} - \frac{C}{RP}\frac{\pi}{(1-\pi)f_G}, \tag{12}$$

which can be derived as follows.

Lenders will choose to monitor given the choice of a risky project by borrowers of type S if:

$$\begin{aligned} r_4[\pi(1-P) + (1-\pi(1-P))f_G + \pi P f_B] - R + PR(1 - f_G - f_B) - C &\geq r_4[\pi + (1-\pi)f_G] - R \\ \frac{[R - PR(1-f_G-f_B) + C][\pi + (1-\pi)f_G]}{\pi(1-P) + (1-\pi(1-P))f_G + \pi P f_B} &\leq R \\ 1 - f_G - \frac{C}{RP} - \frac{C}{RP}\frac{\pi}{(1-\pi)f_G} &\geq f_B. \end{aligned}$$

Again, the share of borrowers of type S must be high enough in order for monitoring to be profitable.

Case 3, when borrowers choose risky projects and lenders choose to not monitor, will occur in two situations: if monitoring is needed and provides incentives for borrowers to choose $s = g$ but is too costly; or if monitoring is needed, does not provide incentives for borrowers, and is too costly (relative to its efficiency P) to be used to increase the repayment probability.

To summarize,

Case 1 will occur if and only if conditions (9) and (5) are satisfied.

Case 2 will occur if condition (9) is violated and conditions (11) and (6) are satisfied.

Case 3 will occur if (9) and (11) are violated and (10) holds or if (9), (10) and (12) are violated.

Case 4 will occur if (9) and (10) are violated and condition (12) holds.

No lending will occur if feasibility constraints are violated.[35]

The implications of the model are summarized in the propositions below, for which proofs are presented at the end of this Supplement.

Proposition 1 *Given the distribution of borrower types, monitoring is more likely if:*

— *the difference between the returns, $B - G$, is higher;*

[35] Only constraints (7) and (8) can be binding.

— *the risk–free rate, R, is higher;*
— *the probability of success of the risky project, π, is higher;*
— *the efficiency of monitoring, P, is higher and the cost of monitoring, C, is lower;*
— *the cost of default, D, is lower and the cost of loan cancellation, L, is higher.*

Proposition 2 *Given the distribution of borrower types, the set of cases in which lending occurs will be larger if:*

— *the difference between the returns, $B - G$, is lower;*
— *the risk–free rate, R, is lower;*
— *the probability of success of the risky project, π, is higher;*
— *the efficiency of monitoring, P, is higher and the cost of monitoring, C, is lower;*
— *the cost of default, D, and the cost of loan cancellation, L, are higher.*

Proposition 3 *The distribution of borrower types affects lending and monitoring in the following way:*

— *if the share of borrowers of type B is high, overall lending is less;*
— *monitoring does not occur if the share of borrowers of type B is very high or very low;*
— *monitoring is more likely if the share of type S borrowers is high.*

Strategic default. If the reason for default is unobservable, then liquidity default in a bad state of nature and strategic default have the same cost D.[36] Borrowers will then choose to repay their debt if and only if

$$D \geq r_i \ , \text{ where } \quad i = 1,\ 2,\ 3,\ 4,$$

which is equivalent to the following set of constraints:

$$f_B < \frac{1}{1-\pi}\left(1 - \frac{R}{D}\right), \tag{13}$$

$$f_G > 1 - \frac{D-R}{(1-\pi)D}, \tag{14}$$

$$f_B < \frac{1}{1-\pi}\left(1 - \frac{(R+C)}{D}\right), \tag{15}$$

$$f_G < 1 - \frac{D-(R+C)}{(1-\pi)D - P(R-\pi D)} + \frac{PR - D\pi P}{(1-\pi)D - P(R-\pi D)} f_B. \tag{16}$$

These incentive constraints are derived in the same fashion as the feasibility constraints above.

[36]Liquidity default is due to inability to repay the debt, strategic default occurs when a borrower can repay its debt but chooses not to.

These constraints bind if $D < \frac{1}{\pi}R$ and $D < G$. These conditions are stronger than conditions (7), (8) and (10), which implies that the set of cases in which lending occurs is smaller if strategic default is allowed. Although the set of constraints that leads to different cases is changed, Propositions 1-3 still hold for the sovereigns as shown at the end of this Supplement.

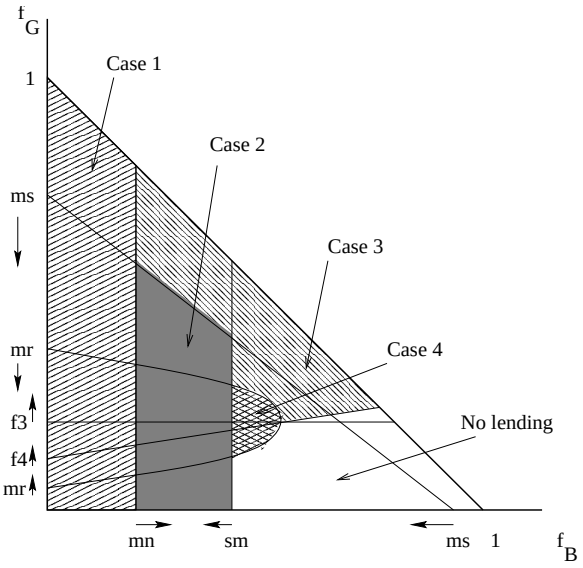

Figure 5: Model predictions

Proofs of the Propositions The options open for each pair of f_G and f_B are shown on Figure 5. The notation is as follows:

- mn — Monitoring is needed versus Case 1 (equation (9))
- sm — Borrowers choose safe project with monitoring (equation (10))
- ms — Lenders choose to monitor given that borrowers of type S choose the safe project (equation (11))
- mr — Lenders choose to monitor given that borrowers of type S choose the risky project (equation (12))
- $f4$ — Feasibility constraint for r_4 (equation (8))
- $f3$ — Feasibility constraint for r_3 (equation (7)).

The two remaining feasibility constraints are not binding.

The following can be shown by taking the derivatives of the right hand sides of the conditions depicted:

Increase in G will shift mn right, sm right, $f3$ down
Increase in B will shift mn left, sm left, $f3$ up
Increase in R will shift mn left, sm left, $f3$ up
Increase in π will shift mn left, ms down, $f3$ down
Increase in P will shift sm right

Increase in C will shift sm left
Increase in D will shift mn right, sm right
Increase in L will shift sm right

Propositions 1 and 2 follow directly. Proposition 3 follows immediately from the graph.

Equations (13)—(16) make constraints (7), (8), (11) non-binding. A possible case given the restriction on the parameters is presented on Figure 6. The lines IC_2, IC_3 and IC_4 correspond to constraints (14), (15), (16) respectively.

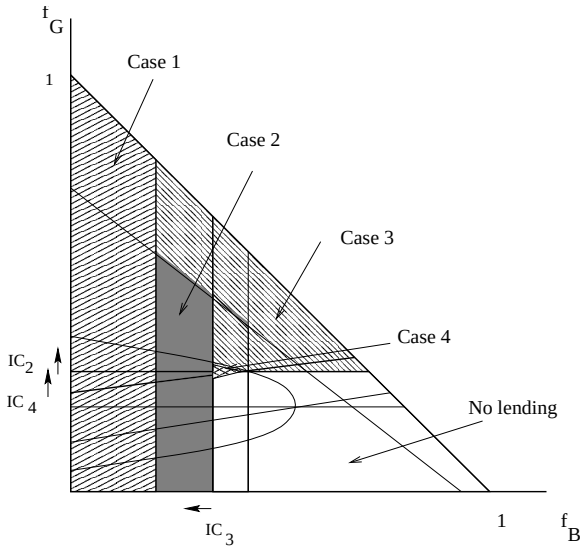

Figure 6: Model predictions for sovereigns

The following can be shown by taking the derivatives of the right hand sides of conditions (14) and (15):

Increase in R will shift IC_2 up, IC_3 left
Increase in π will shift IC_2 down, IC_3 right
Increase in C will shift IC_3 left
Increase in D will shift IC_2 down, IC_3 right.

When IC_2 shifts up, the set of cases with bond lending decreases. When IC_3 shifts to the left, the set of cases with bank lending decreases. Other variables will have the same effects as before. This immediately leads to propositions 1-3.