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Abstract

The role that domestic and international financial conditions have in shaping developing countries' governments' debt structure is structurally estimated using data on individual bond issuance. The structural model, which employs financial and demographic conditions to achieve identification, is used to estimate three key characteristics of sovereign bonds: issue size, maturity and spread. To minimize sample selection concerns, in a first step, the issuance decision is studied by means of a probit model. Results show that better developed domestic financial markets and looser international financial conditions raise developing countries ability to tap international markets and, mainly through their effect on the spreads, are important determinants of the observed debt structure. We find evidence of complementarities between domestic financial deepening and financing conditions in global markets.

Keywords: Sovereign debt, financial markets, global liquidity, structural analysis.

JEL codes: F34, G12, C30.

1 Introduction

How could the International Financial Architecture be reformed, to reduce the frequency and extent of financial crises? Commentators have pointed out that many of the last crises episodes in developing countries (EMEs and LDCs); have occurred after periods of accumulation of large quantities of debt on short maturities. Is it that these economies have a preference for short term debt, or market conditions do not allow them to borrow otherwise? Already in 1995, the World Bank recommended Asian countries to develop their domestic bond markets. The subsequent crises taught that developing economies actually needed deeper and more liquid bond markets. These would help to reduce both maturity and currency mismatches.[1]

Along these lines, an empirical literature assessing the importance of domestic financial conditions has emerged. Eichengreen and Luengnaruemitchai (2004) or Jeanne and Guscina (2006) are excellent examples of this growing literature, that aims to link overall financial development with the sovereign debt structure, and financial crises. The present analysis follows that road. It sheds light on the link between financial markets, both domestic and international, sovereign debt structure and financial crises. Converse to previous studies, it does so by modelling the structural relation between the variables of interest using individual sovereign bond issuance data. We estimate a fully fledged supply and demand model for spreads and maturities. Identification of the model is achieved through the use of exclusion restrictions, based on demographics, domestic policies and international financial conditions. This allows addressing the effect of different financial factors in the specific characteristics of bond contracts. From the domestic side, special attention is paid to both the size and the level of activity of bond and stock markets. Regarding the international dimension, in addition to U.S. interest rates, an index reflecting international liquidity (investors' wealth) is used.

As a first step the issuance decision is analyzed by means of a probit model. This tells us what factors are behind the ability of developing economies to tap the markets. Additionally, the estimation is used to derive a control function that permits correcting biases when estimating the structural model which could arise due to sample selection problems.

Eichengreen et al. (2001), and Min et al. (2004) show that non fundamental factors, "market sentiment" in their terminology, are very important determinants of when and how developing governments borrow. The current analysis, by accounting for financial conditions both at home and abroad, unmasks some factors behind that residual. The international financial situation is represented by including U.S. T-bill rates, an index that proxies global liquidity and a variable reflecting the growth rate of the previous index. These last two variables, whose construction is explained in detail in section 3, can be seen as directly related with investors' risk attitude.[2] An increase in the level of international liquidity, by increasing the money available in the hands of investors, reduces their (relative) risk aversion. To understand the role of domestic financial conditions different variables, obtained mostly from the Financial Structure Database, were used. Main focus was domestic bonds and stocks markets. The first was represented by the size of the public debt bond market relative to GDP. This same variable was used in Eichengreen and Luengnaruemitchai

1. See Broner et al. (2004) or Bussiere et al. (2006) for models featuring these mismatches.
2. For a sovereign debt maturity model with risk-averse investors, see Broner et al. (2004).

(2004).[3] It reflects the level of development of the domestic bond market for public debt. To represent stock markets two variables were included: the stock market capitalization over GDP, and the stock market turnover. The first measure gives an idea of the relative size of the stock market. The last variable represents the level of liquidity/activity on that market. To assess the robustness of the results, the analysis was also performed using two different data sets. One with data on financial conditions collected by La Porta et al. [LLSV (1999)], and other with data obtained from the World Development Indicators (WDI).

Results show that when spreads rise, governments prefer to issue shorter maturities. They also show that ampler global liquidity increases developing economies ability to tap the market and drives down the spreads. On the other hand, development of domestic financial markets appears to facilitate issuance in longer maturities and/or with lower spreads. This is evidence of a beneficial interaction between domestic financial deepening and access conditions on international financial markets. Some preliminary evidence is provided about the role of issuance clustering. It is shown that issuance clustering has an undoubtedly beneficial effect on the average maturity of domestic debt.

The next section gives an overview of past findings, and summarizes the main contributions of the paper. Section 3 presents the econometric strategy, with a detailed explanation of the identification strategy. In section 4 the data used is briefly described. The main results and robustness checks are commented in section 5. Section 6 concludes. Tables and data sources are presented in the Appendix.

3. Another choice would be to include a variable measuring the bid-ask spread. Unluckily this kind of data is not available for many of the countries in our sample. Using bid-ask spreads also raises the issue of what bond to use [see Jeanneau and Perez Verdia (2006)].

2 What do we know about the Sovereign Debt Structure?

It has been long argued that developing economies borrowing strategy is at the basis of most of the last financial crises. The predominant view states that they over borrowed on a short term basis and/or in strong (foreign denominated) currencies. This inability to borrow on a long term basis using the domestic currency ["original sin" in the terminology of Eichengreen and Hausmann (1999)], leads to the so-called currency and maturity mismatches. These, when not adequately managed, have been a stepping stone into financial crises, and defaults. The empirical literature has tried to understand what factors are behind the "original sin", and if it is *de facto* to be blamed on developing economies. Approaches have differed both in the econometric strategy and in the type of data used. Regarding the first aspect, econometric strategies range from standard OLS regressions in panels or cross-sections [see Min (2004) or Lane (2005)], to structural [EHM (2001)] or disequilibrium models [Eaton and Gersovitz (1981)]. On the other hand, while some papers have used macroeconomic aggregates, others have focused on individual issues. Macro data is useful to get an intuition about the big numbers of an economy. But, if the focus is on specific debt characteristics, it is necessary to use individual issues. However, this kind of data is scarce and incomplete. These may be the reasons why available analyses with micro data have pooled together public and private debt, in the form of both, bond or loans.

The broad picture that arises from these contributions is that sound economic aggregates, monetary stability, and the political and legal environment are the fundamental factors explaining the observed debt structure.

The Macro Oriented Empirical Literature

Interest rates in the U.S. are often seen as an important factor conditioning capital flows to developing economies. Antzulatos (2000) shows that the ongoing process of portfolio diversification has reduced their effect. The "original sin" is analyzed in great detail in Hausmann and Panizza (2003). They find little evidence that factors like the level of development, institutional quality or monetary credibility are at the basis of it. The role of institutional factors, in determining the currency composition of the debt, is examined in Claessens et al. (2003). They find evidence of scale effects, countries with a larger base of domestic investors issue longer debt denominated in domestic currency. Evidence relating fixed exchange rates with larger foreign denominated debt markets is presented. Lane (2005) finds a significant relation between openness and debt levels. In Mody and Taylor (2004) a model of market disequilibrium is estimated. This allows recovering a supply and a demand function for capital.[4] The results show that informational asymmetries are an important determinant of credit crunches. Eichengreen and Luengnaruemitchai (2004) shows that the slow development of bond markets in Asia is due to the combination of weak institutions, exchange rate volatility, and lack of competition in the banking industry. In line with this result, Boot and Thakov (1997) show that for a financial system to become mature the development of sources of credit different than bank lending is a must. The role of exchange rate volatility in generating large shares of short term debt is explored in Bussiere et al. (2006). Jeanne and Guscina (2006) present a new database on government debt in emerging countries. They report significant cross country differences, and attribute it especially to the different record of monetary stability.

4. Their model is based in the early work by Maddala and Nelson (1974). See Eaton and Gersovitz (1981) for another application of this methodology to debt markets.

The evidence, summarized above, shows how economic, financial and political factors are important determinants of the debt structure and of the development of financial markets. However, this kind of analysis, due to its macroeconomic nature, is not helpful if the interest is in understanding the importance of the cost (spread) of the debt for the observed maturity. In Broner et al. (2004) investors holding bonds with long maturities are exposed to price risk, arising from the absence of liquid secondary markets. Therefore countries willing to issue long maturities must compensate investors for this risk, making long debt so expensive that sovereigns prefer shorter maturities, even at the cost of possibly facing sudden capital outflows.[5] As Eichengreen and Luengnaruemitchai (2004), our paper supports this view.

The Micro Oriented Empirical Literature

When analyzing lending, there are three characteristics which are of capital importance: spread, maturity and size of the issue. There are a number of theoretical contributions which have managed to jointly analyze all three. However, empirical analyses are much harder to find, especially for developing economies. There are two main reasons for this. The first is a lack of data; markets for developing economies' public debt were basically inexistent prior to the nineties. Second, such an analysis, among many other empirical complications, implies the estimation of a simultaneous equation model and requires dealing with sample selection problems. Eichengreen and Mody (1999) were the first to address concerns about sample selection. They estimated the determinants of bond and loan spreads, together with a probit to assess the factors determining bond issuance. Eichengreen, Hale and Mody [EHM hereafter (2001)], presented an econometric model where maturities and spreads were jointly analyzed, along with a probit to control for sample selection. In order to overcome the identification problem they assumed that, while the maturity affects the spread, the spread has no contemporaneous effect on the maturity. However, such strategy disregards cost considerations by the government when choosing the maturity. Their study made clear the importance of sound fundamentals, as they make the maturity of the debt longer, and relatively cheaper. However, it also showed that non fundamental factors, "market sentiment", are a very important determinant of the observed borrowing patterns. Hale (2001) shows that borrowers with high political and economic risk will issue only "junk" bonds, while those countries with low levels of both risks will issue investment grade bonds. The rest are more likely demand loans from the banking sector. Gelos et al. (2004) presents an analysis on the determinants of market access. Default does not seem to provoke a strong punishment in terms of lost of market access. The quality of policies and institutions is an important determinant of the ability of sovereigns to tap the markets. Min et al. (2004) provides panel data analysis of debt spread determinants, however it disregards both endogeneity and sample selection problems. Jeanneau and Perez Verdia (2006) investigate the link between the development of the domestic government bond market in Mexico and the government's debt composition. It shows how the development of a domestic bond market, has helped raising the maturity of the debt.

This Paper

The main contribution regards the econometric strategy. The simultaneous equations system we handle is expressed as a supply and demand model, for which we can find exclusion restrictions based on previous theoretical and empirical contributions. Comfortingly, results indicate that the identification mechanism works.

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5. Erce (2005) presents a similar mechanism, and shows how the interaction of both, illiquid markets and higher levels of short term debt, can give rise to unnecessary (panic based) crises.

Another relevant contribution of this paper is that, while the papers above jointly analyze loans and bonds, both private and public, we focus solely on public bonds. Bonds and loans are very different types of contracts. Private debt depends not only on macroeconomic characteristics, but also on specific firms' characteristics. If we want to understand the markets for public bonds, it is therefore important to look at the factors determining their characteristics without pooling them with other types of debt or issuers, as this could give a distorted picture. Among the variables included in the study, our careful representation of financial conditions is the most innovative contribution. In this way we can test how domestic and international financial conditions affect the borrowing strategy of developing governments. In this way, the results shed light on how the specific contract characteristics are affected by financial factors. EHM (2001) argued that spreads and maturities reflect to a large extent market sentiment (risk aversion). The paper shows that financial conditions can explain part of this residual.[6]

Finally, the paper addresses concerns about the possible biases that could arise if borrowers would strategically time their issuances. While clustering does not seem to bias the results obtained, it appears to have a positive effect on the maturity of the debt.

6. In EHM (2001) international conditions were represented by interest rates in the U.S.A., and financial domestic factors by a measure of the domestic credit market.

3 Econometric Strategy

The econometric analysis presented here, in addition to the sample selection concern, addresses two issues that were disregarded in previous studies. First, when estimating the maturity-spread relation, the issued amount variable is treated as an endogenous variable. Previous work has assumed that the issued amount was unrelated with other bond characteristics. Such an assumption, if false, could give rise to endogeneity problems. Second, a strategy to estimate the maturity-spread relation without relying on diagonalization is provided. The goal is to understand how spreads and maturity are jointly determined. The problem can be stated in terms of supply and demand equations,

$$M_{it}^{\text{demand}} = \alpha S_{it} + \Theta_M X_{it} + \omega_{it}^D, \quad (1)$$

$$M_{it}^{\text{supply}} = \beta S_{it} + \Theta_S X_{it} + \omega_{it}^S, \quad (2)$$

$$M_{it}^{\text{supply}} = M_{it}^{\text{demand}} = M_{it}, \quad (3)$$

where S_{it} and M_{it} are the spread and maturity of a bond issued by country i at time t. These are the potentially endogenous variables of the system. X_{it} is a vector containing the exogenous variables.[7] The errors are assumed to be well behaved, $E(\omega_{it}^D) = E(\omega_{it}^S) = E(\omega_{it}^D \omega_{it}^S) = 0.$

The supply equation explains the preferred maturity of the investors. The demand equation determines the preferred maturity for the government. This makes it easier to find a set of exclusion restrictions in Θ_S and Θ_D, needed to identify the structural parameters, and permits to relax the unpleasant assumption that spreads have no effect on observed maturities [see EHM (2001)].

Simple manipulation of the system above leads to

$$Y_{it} = BY_{it} + \Gamma X_{it} + \varepsilon_{it} \quad (4)$$

$i \in \{1,...N\}, t \in \{1,...T\},$ where $Y_{it}^{'} = \begin{pmatrix} M_{it} & S_{it} \end{pmatrix}$ contains the endogenous variables, X_{it} is a $kx1$ vector containing the k exogenous variables, B is a $2x2$ non-singular matrix, Γ is a $2xk$ matrix, $\varepsilon_{it} \sim N(0, \Sigma)$ are $i.i.d.$ This is the model to be estimated.[8]

As mentioned before, along with the analysis of the characteristics of the bond, we study the issuance decision by means of a probit model. The dependent variable is access to financial markets in a given quarter. This quarterly indicator, I_{it}, takes value one when country i tapped the market on period t. The model, once that the issuance analysis is included is

$$Y_{it} = BY_{it} + \Gamma X_{it} + \varepsilon_{it} \quad if \quad I_{it} = 1$$
$$I_{it}^{*} = \Psi X_{it}^{I} + \upsilon_{it} \quad (5)$$

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7. Enumeration of the explanatory variables included at each stage of the analysis is relegated to the next section.

8. The relation between the coefficients in equations (1) to (3), and those in equation (4) is,

$$B = \begin{pmatrix} 0 & \alpha \\ \frac{1}{\beta} & 0 \end{pmatrix}, \Gamma = \begin{pmatrix} \Theta_M \\ -\frac{\Theta_S}{\beta} \end{pmatrix}, \varepsilon_{it} = \begin{pmatrix} \omega_{it}^D \\ -\frac{\omega_{it}^S}{\beta} \end{pmatrix}.$$

This is useful not only because it allows us to make an assessment of the factors determining the ability of developing economies to tap the financial markets, but also because it is a way to create the control function (the mills ratio) required to fix sample selection biases. As pointed out above, participation in the bond market has risen over time. This could imply that, OLS estimates of the relationship between specific country characteristics and spreads could be biased if these country characteristics not only affected the price of the debt, but also market access.[9]

3.1 Political Risk

Previous analyses have shown that political risk is an important determinant of both market access and borrowing strategies. Following Eichengreen and Mody (1999) and EHM (2001) an OLS estimation of the credit rating against a set of macroeconomic factors is performed,

$$rating_{it} = \theta X_{it}^{rating} + \varepsilon_{it}^{rating}$$

The OLS-residual of this regression, $\varepsilon_{it}^{rating} = rating_{it} - \hat{\theta} X_{it}^{rating}$, can be understood as a measure of political risk.[10] By construction, a higher rating residual is associated with higher political risk. This residual will be used as an additional regressor in subsequent steps.

3.2 Issuance

Once that $\varepsilon_{it}^{rating}$ has been obtained, the analysis moves to the estimation of the issuance decision [see equation (5)], using $\varepsilon_{it}^{rating} \in X_{it}^{I}$. From this analysis the inverse mills ratio, $\lambda_{it} = \frac{\phi(\hat{\Psi} X_{it}^{I})}{\Phi(\hat{\Psi} X_{it}^{I})}$, is obtained. This ratio will be used as a regressor in subsequent estimations. It will help us controlling for the sample selection concerns expressed before. It should be noted that the mills ratio collects, not only the factors that affect the issue decision of credit rationed governments, but also voluntary decisions not to access the market.[11] As in EHM, to guarantee identification the probit model contains a variable only present at this stage of the estimation, the ratio of reserves to imports.

3.3 Size

As mentioned above, the issue size, Q_{it}, can be simultaneously determined with the other terms of the contract. Endogeneity problems could arise from the direct introduction of the variable in the system.[12] To avoid this problem the extended system is made triangular, and the size of the issue is replaced by the estimated value obtained from an OLS regression using a set of variables that previous studies found significant,

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9. This would be the case whenever $cov(\varepsilon_{it}, \upsilon_{it}) \neq 0$.

10. We used this indicator for consistency with EHM work.

11. A natural extension would be to use disequilibrium models (see Maddala and Nelson, 1974) to understand if the selection arises due to credit rationing or to a voluntary decision.

12. If the amount is endogenous, the system can be redefined as $Z_{it} = AZ_{it} + DX_{it} + E_{it}$, where $Z_{it} = (Q_{it}, M_{it}, S_{it})$ The estimation strategy amounts to triangularise the system. In terms of the matrix A,

$$A = \begin{pmatrix} 0 & 0 & 0 \\ a & 0 & b \\ c & d & 0 \end{pmatrix}$$

This implies that, once a country can issue, the decision of how much debt to issue is not guided by the spreads or by the maturity. This is a quite restrictive statement, which may fit best countries who do not suffer from credit rationing.

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

where: $\varepsilon_{it}^{rating}$ and $\lambda_{it} \in X_{it}^Q$, and $\hat{Q}_{it} = \hat{\theta}_{it} X_{it}^Q$ is the predicted size.

The ratio of short term debt to total debt and GDP were selected as exclusion restrictions in this step. The first gives an idea of the possible need of funds in the short run. The fact that larger countries tend to have larger financial needs motivates the introduction of the second.

3.4 Structural Model

Finally, the analysis moves to jointly determining spread and maturity. On each period of time there are countries for which no debt was issued, while others tapped the market more than once. The estimation is done by considering each issue as an individual observation, and then taking care of time and spatial effects by including periods and region dummies.

In order to estimate the simultaneous equations system, a two steps procedure was chosen.[13] The way in which the procedure works is briefly summarized below. The first step amounts to estimate the reduced form parameters. We know that for the model (4) a reduced form always exists:

$$Y_{it} = \Pi X_{it} + u_{it}$$

where $\varepsilon_{it}^{rating}, \hat{Q}_{it}$ and $\lambda_{it} \in X_{it}$, $\Pi = \Gamma(I - B)^{-1}$ and $u_{it} = \varepsilon_{it}(I - B)^{-1}$.

This allows retrieving $\hat{Y}_{it} = \hat{\Pi} X_{it}$ where $\hat{\Pi}$ is the OLS estimates of Π. The next step is to replace the endogenous variables by their first step estimate,

$$Y_{it} = B\hat{Y}_{it} + \Gamma X_{it} + \eta_{it} \qquad (6)$$

where $\eta_{it} = \varepsilon_{it} + (\Pi - \hat{\Pi}) B X_{it}$.

MODEL IDENTIFICATION

Identification of the system requires defining two sets of instruments. The one used to identify the effect of the maturity on the spread equation requires variables which directly affect the preferred maturity of the government, but only affect the preferred maturity of the investors through the spread. Two candidates are presented, pension reforms and the demographic structure. During the last decade, some developing economies financed reforms in their pension systems by issuing sovereign bonds.[14] The maturity of these bonds could be affected by the interest of the governments to match durations. An indicator which takes value one on debt issued up to three years after the reform was constructed. Given the high cost of these reforms, it makes sense to assume that they were financed over a number of years after the

13. Also a three steps procedure was applied, yielding similar results.

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

implementation. The next group of instruments is related with the demographic distribution in the population. Two variables reflecting the proportion of the population between 35 and 55, and above 55 were included. Governments, with a higher proportion of older people, can have political incentives to issue longer debt. This is a political economy argumentation, in order to guarantee the voting of the elder a government may have an incentive to issue longer debt to be repaid by future generations.[15]

Next, we need to define the identification restrictions on the supply equation, required to identify the effect of the spread on the maturity. Three different types of variables were included. They can be summarized as variables affecting investors' wealth, political risk, and variables affecting investors outside option. Regarding the last, the 10 years U.S. T-bill rate was used. This is a standard variable in spread analyses [see Eichengreen and Mody (1999) or Min et al. (2004)]. As for the first, the index of international liquidity mentioned above, which is defined in more detail in the next section, was chosen. It reflects the level of wealth available for international investors. Theoretically, increases in this variable should make investors less concerned about liquidity issues, and hence require a lower premium. Finally the residual of the rating regression was used as a measure of political risk. As the number of exclusion restrictions is larger than that of endogenous variables, the system can be overidentified. Sargan tests for overidentifying restrictions were performed for a variety of specifications. The specific results are presented in the next section. The null hypothesis was never rejected, suggesting that the model was correctly identified.

15. See Perotti and Alesina (1997), Persson et al. (2005) or Bassetto and Sargent (2005) for models of political economy yielding the argument presented here.

4 Data

We obtained data on bond characteristics from Bondware (Dealogic). It included data on maturity, spread, credit rating, issued amount and currency denomination. We had around 2000 observations of public bonds issued by developing economies from 1990 to 2005. A list of countries, for which the analysis was performed, is contained in the Appendix. To show that the effects obtained were not driven by an ad-hoc choice of the explanatory variables the variables included in each part of the analysis are, as long as available, as in EHM (2001).

The macroeconomic variables reflecting both domestic and international conditions were obtained mostly from the International Financial Statistics and the World Development Indicators. T-bill rates were obtained from Datastream. Data on stock markets and bond markets was obtained from the Financial Structure Database. Exchange rates were obtained from Global Finance Data. Data on pension systems' reform was obtained from the U.S. Social Security Administration, which collects data from pensions' reforms worldwide.[16] Data coming from both the World Bank and the Paris Club was used to construct an indicator of debt rescheduling process, which takes value one when on the specific year in which a country went through a debt rearrangement. The data about the demographic structure was obtained form the World Development Indicators. Two variables were used. One, which we labelled as "old", reflects the proportion of the population that is above 55. The other, under the name "adults" collects the proportion of the population with aged between 35 and 55. A full source description can be found in the Appendix.

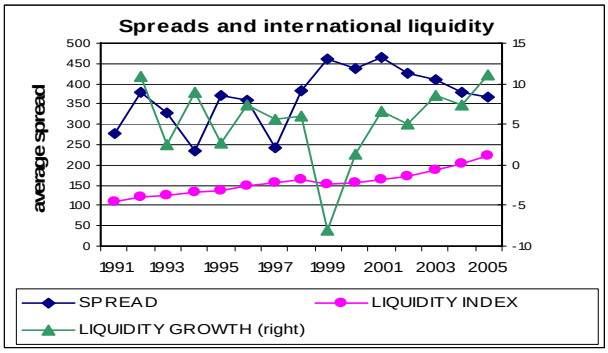
Global Liquidity

"International" liquidity is hard to measure. More developed countries have higher liquidity ratios as measured by monetary aggregates (M1, M2, etc.) to GDP than less developed countries. Part of the change in liquidity measures for emerging economies could thus simply indicate that they are becoming financially more sophisticated. It is hence difficult to aggregate measures over all countries in the world. Furthermore, strictly speaking, one would like to have only "narrow" money, but narrow money is often not available. However, in developing countries the monetary base is backed by international reserves. Hence, developments in foreign reserves can be used as a proxy for developments in narrow money. Therefore, the international availability of funds is proxied by an index with base in 1990, that adds together country by country data about the ratio of M2 (or reserves when M2 was not available) to GDP. Data for this index was obtained from IFS.[17]

16. The data used is available at: http://www.ssa.gov/policy/docs/progdesc/ssptw/

17. Measuring world liquidity using this kind of indices is common practice in Investment Banking. See European Investment Bank (September, 2005) or IXIS (July, 2005).

Chart 1: Global Liquidity



Source: Dealogic and author's calculations.

As shown in Chart 1, the process of yield compression that started with the new century has come hand in hand with large increases in global liquidity. In the chart, the variable liquidity growth reflects the percent change in the index in a period by period basis. The critical role that international reserves play in the expansion —and potential contraction— of global liquidity has received much attention recently. Arista and Griffith-Jones (2006) nicely explains the way in which increased U.S. dollar holdings at developing economies' Central Banks, can give rise to increased liquidity back in the United States, as they are repatriated in exchange for U.S. Treasuries.

In order to minimize endogeneity issues, lagged values of all variables were used in the estimation procedure. Dummy variables to control for regional and time effects were constructed. Period dummies were constructed reflecting four different time periods. One accounts for issues until the Mexican crisis (1994), the next covers the period between the Mexican and the Asian crises (1995-1996), the next accounts for period between the Asian and the Russian crises (1997-1999), and the last runs from 2000 until 2005. To control for regional effects dummies were constructed reflecting the membership to the following regions: Latin America, East Europe, Asian Tigers, New Giants (China and India), Middle East and Africa.

5 Results

In this section, the main results of the different parts of the analysis are reported step by step. The main focus is on the effect of financial conditions, the identification strategy, and on results that contrast with previous findings. Tables containing the estimation results and the specification tests can be found in the Appendix.

5.1 Determinants of Credit Rating

In for this part of the analysis we used the Standard and Poors definition of credit rating. The Appendix contains a table explaining the way in which the ratings were represented. By construction, higher values on the variable are associated with a worse rating. Results are similar to those in EHM, and are summarized in Table 1 below.[18]

Table 1: Regression for the Credit Rating

Variables	
Debt reschduled las period (dummy)	1.075**
Reserves over gdp	-9.649**
Total external detb over gdp	3.825**
Exports over gdp	-0.027**
Inflation	0.0007**
GDP growth	-1.387**
Latin american dummy	1.06**
East European Dummy	-0.617**
Tigers	1.024**
Orient	1.83**
Africa	0.109
constant	10.918**
No. of observations	1894
Adjusted R- squared	0.422

Our estimates show that previous debt rescheduling, higher total external debt over GDP and higher inflation have a negative impact on the rating. On the other hand higher reserves over GDP, exports over GDP or GDP growth are associated with improving ratings.

5.2 The Issuance Decision

The analysis of the probability of issuance is performed by adding to the benchmark EHM probit specification, first the variables reflecting international availability of funds, then the ones representing the domestic financial conditions, and finally all together. Additionally, most of the regressions include dummies to collect the possible effects that crises would have. They take a value one on the specific quarter in which commentators claim the crises to have started and on the following three quarters. The results are reported in tables A1 and A2 in the Appendix.

18. This is a comforting result because, while we used the S&P rating, EHM used data from Institutional Investors.

The first two columns in table A1 collect the results for the model that replicates the analysis in EHM; in the last column the results when the measures of international liquidity were included are presented. Results are similar to those in previous studies. Larger size, as proxied by a larger GDP, lower political risk, and higher ratios of reserves to imports increase the probability of issuance. However, the sign of the last one changed when domestic financial variables were added to the regression. Previous debt rescheduling, higher external debt, and a lower debt service to exports ratio seem to reduce the probability of a country issuing debt. Increases in the growth of international liquidity, as expected, raise the probability of issuance. Regarding the crises dummies, although the significance was not always especially high, there are some indications, consistent with the contagion stories found elsewhere, that the Mexican and the Russian crises affected the probability of observing developing economies tapping the financial markets at a global level. It is interesting to note that the international liquidity appears to be a more important determinant of issuance than the 10 year U.S. T-bill. As long as those two variables can be seen as reflecting quantity and price of the international funds, this result points to the fact that the quantity of funds available is more important for issuance than their cost (credit rationing).

The next set of results, when domestic financial conditions are taken into account is collected in table A2. First column adds to the EHM benchmark the selected variables. In the second column the international liquidity variables are added.[19] The last column collects the results of the estimation that was used for computing the correction for the sample selection problem.[20] There are several consistent findings. First, a larger stock market capitalization is associated with a lower probability of issuance. A possible interpretation is that public and private agents are in competition for international funds. The larger stock market is the harder for the government to place its bonds.[21] Second, if financial markets are liquid, as reflected by the turnover variable, it is easier for investors to hedge against risks and this makes it easier for the governments to place their debt in the market. However, this is a non linear relation, and for large levels of turnover the effect becomes negative. The non linear effect of stock market turnover on the issuance probability is represented in Chart 2. Finally, the larger the market capitalization of the public bond market, the easier that a government will issue debt. One should be cautious in giving an interpretation to this result. This may imply that larger bond markets make it easier to issue additional debt, but it can also reflect the fact that countries which issued large quantities of sovereign debt in the past are more likely to do it in the present. As can be seen in Chart 3, changes in the international liquidity index have a positive effect on the issuance probability. It should be noted, however, that the significance of the variables reflecting international liquidity was greatly reduced when the estimation included the measure about the size of the public bond market.

5.3 Issue Size Determinants

All the variables included in the analysis are based in previous analyses.[22] Most of those studies disregarded the role of financial conditions. An exception is Mody and Taylor (2004).The results are summarized in table A3. There is strong evidence of a size effect, larger economies borrow larger amounts. The interest rate for the 10 years T-bill is negatively associated with the size of the issue. As before, when measures of international liquidity are

19. Note that the amount of observations falls greatly when data about public bond market is used. To maximize the number of observations available for the next step we decided not to include this variable when obtaining the Mills ratio.
20. The analysis was also performed by adding one variable at a time with identical results.
21. This is of course on of the many explanations that one can think of. Other would be that as the stock markets develop the Government faces less often the need of raising funds directly as firms can do it through the stock exchange.
22. See Antzulatos (2000), Mody and Taylor (2004), Lane (2004), Hale (2001), or Eaton and Gersovitz (1981).

introduced the significance of this variable drops (see column 2). As one would expect, when the level of wealth in the hands of international investors rises, their appetite for developing sovereign bonds follows suit, and with it the size of the observed issues. This can be seen also in the significance of the dummy reflecting issues since 2000 period on which the interest of investors for developing countries' debt has grown together with the level of international liquidity (see chart 1). Dummies reflecting the currency denomination of the bond were introduced. Issues in U.S. dollars tend to be significantly larger, while issues denominated in domestic currency are smaller. This can be one of the factors explaining the recurrent use of hard currency issuance by developing countries. There is a group of explanatory variables whose effect changes when variables reflecting domestic financial conditions are introduced. This can be seen when comparing the coefficients in columns 1 and 2 with those in columns 3 and 4. The ratio of short term debt to total debt, the ratio of debt service to exports, the sample selection control, and the political risk indicator, which in the absence of domestic financial variables had a negative and significant sign, turn positive or insignificant when the financial variables are added. The first two can be understood of variables determining financial needs, but can also represent liquidity problems. Once we control for financial conditions in a rigorous way, they are collecting the fact that more resources may be needed and hence the positive effect on the amount issued. The ratio of exports to GDP and the dummy reflecting previous debt rescheduling have a negative coefficient.

Domestic financial conditions have a significant effect on the amount of debt. As the turnover in the stock market increases, i.e., as the liquidity in domestic financial markets rises, the size of the issues becomes smaller. This result can be related to the positive effect of turnover on issuance. When financial markets are more liquid, governments can tap the market more often and do so in smaller amounts. Additionally, we found a non-linear effect from the relative size of the public bond market on the size of the issues. Increasing public bond markets seem to be associated with larger issues, however as the size keeps growing this effect becomes negative. When public bond markets become more developed issuance becomes easier, and as before this may give an incentive to governments to launch smaller issues at a time.

5.4 Determinants of the Maturity and Spread

As with the issuance decision, we performed the joint analysis of spreads and maturities in steps, adding to the benchmark specification [EHM (2001)] the variables reflecting financial conditions. Given that EHM (2001) analysis is closest to this, it seems the best way to proceed to stick to their specification as much as possible. Again, following EHM, a first step was to test for the existence of a non linear relation of maturities and spreads with the credit rating.[23] Given the results, as in previous studies, we performed the analysis by separating the observations in two categories, investment grade and non-investment grade bonds.[24]

The results for the maturity are presented in table A4, and those for the spread in Table 6. The first column from both tables reproduces the analysis in EHM, but introducing the variables aimed at identifying the system. The next columns, [4.2] and [4.2], report the results when controlling for the endogeneity of the amount issued. The main difference is

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23. A simple OLS regression shows that,

$$M_{it} = 0.456 * rating_{it} - 0.026 * (rating_{it})^2. \quad R^2 = 0.11$$

Standard errors are 0.163 and 0.008 respectively. Hale (2001) makes a related point.

24. Unluckily the number of observations with an investment grade rating was too small to perform the structural analysis. Here we present only the analysis for the non-investment grade bonds.

the significance of the parameter associated with the effect of the spread once that endogeneity is accounted for. The rest of the results are (as expected) similar to those in previous studies. Next two columns, [4.3], [4.4], [5.3], and [5.4], explore the effect that domestic factors have in the determination on the spread and maturity of the bonds.

ROBUSTNESS

To asses the robustness of these results we decided to construct two alternative measures representing the domestic financial conditions. The first one was constructed by obtaining the first principal component of data on the total value of the stocks traded and the turnover ratio, coming from the World Development Indicators. The second measure was constructed using two measures of financial market efficiency constructed by La Porta et al. [LLSV (1998)]. The variables were the ratio of turnover to net interest margin and the ratio of turnover to overhead costs. For both data sets, one factor was enough to collect most of the information available.[25] The results of the analysis are reported in Columns 5 and 6 from tables A4 and A5. The eigen values and factor loadings for both factors are presented in Tables A7 and A8 in the appendix.

IDENTIFICATION

Comfortingly the variables proposed to identify the system were significant. This is always true for the variable representing the proportion of the population above 55. For many of the different specifications Sargan tests for overidentifying restrictions were performed. The results for the test were almost always positive, in the sense that the system was correctly identified. Therefore, the structural parameters obtained are to be trusted. Table A9 in the Appendix summarizes the results of the tests, and explains how they were performed.

Maturity

There is evidence of a negative relation between the spread and the maturity. This result is on line with the theoretical insights presented in Broner et al. (2004) and Erce (2005). When the cost of the debt, as represented by the spread, rises, governments have an incentive to issue shorter maturities.

Our results do not show any direct relation between the observed maturity of the debt and the indicators of domestic financial development. Other factors affecting the maturity are previous debt rescheduling and (surprisingly) the growth rate of GDP. Both have a negative influence on the maturity of the issued bond. On the other hand, as the ratio of reserves to short term debt increases, the maturity also raises. In the absence of liquidity needs in the short run, governments prefer to issue debt in longer maturities. Also the size of the issue affects positively the maturity of the bond. In general, issues in U.S. dollar have a larger maturity than the rest. Finally, we summarize the results for the identification variables. While the pension system reform variables do not seem to affect the maturity, the results show a positive and highly significant relation between the proportion of population above 55 and the maturity of the issued bonds. The first result may be due to the fact that most of the bonds available for this part of the analysis were denominated in foreign currencies and issued in international markets, while pensions' reform tended to be financed with domestic debt.

25. The rule to select the number of factors was the standard one. Add those factors with an eigen value well above one.

Spread

Overall results point to a significant effect of domestic financial factors. More developed, in the sense of larger and/or more liquid domestic financial markets, drive down the observed spread, and this leads governments to issue larger maturities. This can be seen in columns 3 to 6 from Table A5. The coefficients for the value and squared value of the size of the public bond market, the size of the stock market, and those for the factors obtained from both WDI and LLSV data have a highly significant and negative coefficient.

Also the international liquidity index has a consistent negative effect on the spreads. Wealthier investors have an increased appetite for developing countries debt, and this is reflected in the premium they ask for, which is reduced. On the other hand, higher external debt, higher political risk, lower GDP growth, and a higher ratio of reserves to GDP, lead investors to ask for a higher yield, and thereby increase the observed spread. As in EHM a negative relation of both the 10 years U.S. T-bill and the mills ratio with the spreads was found. U.S. dollar denominated issues are not only associated with larger maturities, but also with larger spreads.

The results have an important message, they point to a synergy between domestic financial factors and the conditions under which developing economies can borrow in international markets. Better developed domestic markets help improving financing conditions abroad. In addition, through the effect that the spread has on the preferred maturity of the government, they lead to larger maturities.

5.5 Simultaneous Issuance: the case for being strategic

Throughout the paper we have tried to overcome a variety of sources of endogeneity by using both lags and exclusion restrictions. In this section we explore another possible miss-specification of the model, issuance clustering.

Table 2 below presents the quarterly average maximum maturity observed for two groups. One containing those observations for which no other issue was observed that quarter (unique). The other contains the maximum maturity in periods when more than one bond was issued (clustered). It shows that "simultaneous" issuance is more common in domestic markets, while it is accompanied by a longer range of maturities in international markets. When developing economies cluster issuance in determined periods of time the same fundamentals need to explain a variety of maturities and spreads.

Table 2: Issuance Clustering in Domestic and Foreign Markets

Maximum maturity		Average	Standard Deviation	% of cases
domestic issue	unique	8.94	6.63	31
	clustered	9.21	6.22	69
foreign issue	unique	9.18	6.65	62
	clustered	11.73	7.70	38

It sounds reasonable that, by offering a more diverse spectrum of assets, investors are better able to diversify their portfolio, which could make their willingness to hold larger maturities increase and/or reduce the premium to be paid. Not accounting for this could lead to biased estimates. The importance of issuance clustering for the observed debt structure, and the concerns about estimation biases are analyzed below.

How far into the future? The case for strategic issuance

As just argued the scope of this section is twofold. On the one hand, it will allow us to check if the results obtained in the previous section are robust. On the other hand, by assessing the effects of issuing a variety of bonds in specific periods on the terms of the same, we are investigating if there is a case for developing economies to strategically concentrate debt issuance in specific periods. We pursued the following strategy. For every period for every country we chose the bond with the largest maturity. In this way for each country at each point in time there is at most one bond. Additionally to control for the effect that offering a variety of bonds can have, an indicator (a variety dummy) was constructed which takes a value one when in that specific period a country issued more than one bond. As argued above, significance of this coefficient may be associated with effects arising from allowing investors to diversify their portfolio. The results for a variety of specifications are presented in table A6. Remarkably the results are basically identical to those obtained before. This indicates that previous estimates did not suffer from biases arising form simultaneous issuance. As before, more developed domestic financial markets reduce the spread to be paid, and this raises the observed maximum maturity. Additionally, we find a significant effect of the variety dummy on the maximum maturity observed. When countries offer the market a variety of bonds they are able to place bonds with larger maturities.

These are important results. First, they show that countries can benefit from timing the issuances and offering a variety of alternatives. Second, this reinforces the argument on the benefits of developing the domestic financial markets. Results show how they help to enlarge the maximum maturity for which bonds can be issued.

6 Conclusion

This paper adds to a large list of studies trying to understand what factors drive the borrowing strategy followed by developing economies. The paper presents an estimation strategy which allows identification of the structural parameters in a model of the simultaneous determination of maturities and spreads. The model was estimated using data on individual bond issuance by sovereign governments and was used to asses the impact of financial development on the terms of sovereign debt contracts. Results regarding the effect of the usual macroeconomic aggregate variables are in line with previous studies.

As one would expect, estimates point to a significant effect of both domestic and international conditions. This effect affects both the timing and the form of sovereign borrowing. When the level of liquidity international markets is high, Governments find it easier to tap the market, and can do so with better conditions. On the other hand, better functioning domestic financial markets, both for stocks and for bonds, seem to affect the conditions that investors impose on international bonded debt. Results suggest that well developed domestic bond markets and more liquid financial markets help reducing spreads, and this creates incentives for issuing bonds with longer maturities.

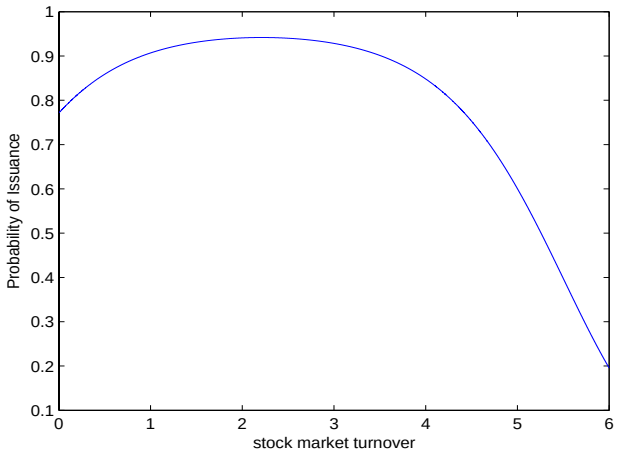
To address concerns about miss-specification, we analyzed the effect of issuance clustering. Reassuringly, this effect, though significant, does not seem to be driving the rest of the results. The results give a significant role to issuance clustering. When a variety of bonds is offered to investors, governments seem to be able to issue debt on larger maturities. Developing economies should try to take advantage from this by strategically clustering their debt issuance. These results reinforce the argument in favor of developing domestic financial markets as a way to reduce the depth of financial crises.

APPENDIX

Table A1: Result for the Issuance Probit Analysis. EHM and International Liquidity

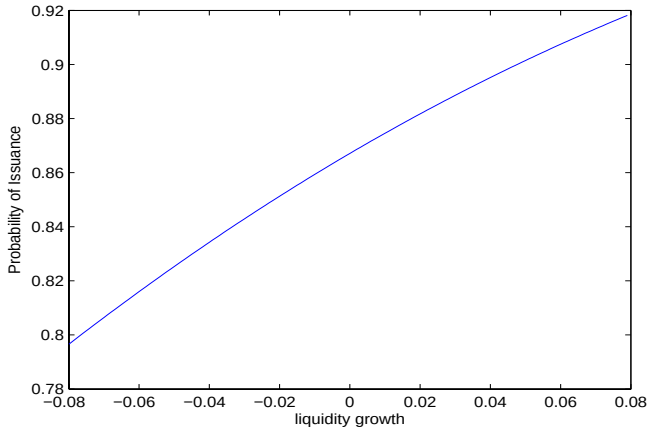
Variable	(1)	(2)	(3)
Rating residual	-0.041**	-0.043**	-0.043**
10 years U.S. T-Bill rate	-0.296	-0.432	-0.337
U.S. Treasury Yield Curve (10y-1y)	0.09	0.043	0.09
External debt to GDP	-0.278	-0.301	-0.298
Debt service to exports ratio	0.011**	0.012**	0.012**
Debt rescheduled last year (dummy)	-0.49**	-0.483**	-0.482**
Exports over GDP	-0.003	-0.003	-0.003
Reserves to imports ratio	0.311**	0.288*	0.307*
Reserves to short term debt ratio	-0.0001	0.0001	0.00002
GDP (/e-11)	0.207**	0.206**	0.207**
Domestic credit (/e-8)	-0.143**	-0.145**	-0.145**
Level of international liquidity	-	-	-0.002
Growth on international liquidity	-	-	**3.164****
Latin America	0.705**	0.705**	0.707**
East Europe	1.3**	1.295**	1.301**
Four Asian Tigers	0.723**	0.731**	0.733**
Orient	0.714**	0.712**	0.714**
Africa	0.207	0.178	0.189
Before Mexican crises	-0.455**	-0.543**	-0.681**
Mexican to Asian crises	-0.199*	-0.217	-0.24
New century	0.091	-0.016	0.047
Mexican crisis	-	-0.33*	-0.347*
Asian crisis	-	-0.158	-0.116
Russian crisis	-	-0.385**	-0.146
Argentinian crisis	-	-0.121	-0.135
Constant	-0.985*	-0.592	-0.401
No. observations	1766	1766	1766
Pseudo R-squared	0.155	0.16	0.162
Predicted probability of issuance	0.3192	0.3913	0.3195
Observed probability	0.321	0.321	0.321

Chart 2: Issuance Probability and Stock Market Turnover



Source: Author's own calculations.

Chart 3: Issuance Probability and International Liquidity



Source: Author's own calculations.

Table A2: Result for the Issuance Probit Analysis. Domestic Financial Conditions

Variable	(1)	(2)	(3)	Mills
Rating residual	-0.027	-0.036	-0.041	-0.074**
10 years U.S. T-bill rate	-0.811**	-1.138**	-0.771	-0.273
U.S. Treasury yield curve (10y-1y)	0.125	0.041	0.03	0.133*
External debt to GDP	-1.719**	-1.942**	-1.912**	-0.172
Debt service to exports ratio	-0.008	-0.007	-0.006	0.009**
Debt rescheduled last year (dummy)	-0.296*	-0.276	-0.25	-0.47**
Reserves to imports ratio	-0.393	-0.466*	-0.509*	0.296*
Reserves to short term debt ratio	-0.003	-0.007	-0.005	-0.004**
Exports over GDP	-0.002	-0.002	-0.002	0.003
GDP (/e-11)	0.944**	0.086**	0.008**	0.199**
Domestic credit (/e-8)	0.0104	0.003	-0.004	-0.166**
Level of international liquidity	-	-	0.006	-0.0001
Growth on international liquidity	-	-	2.856	**3.541****
Capitalization public bond market over GDP	**1.946****	**1.967****	**1.971****	-
Stock Market capitalization over GDP	**-0.015****	**-0.016****	**-0.016****	**-0.01****
Stock market turnover	**0.775****	**0.802****	**0.781****	**0.747****
Squared stock market turnover	**-0.178***	**-0.183***	**-0.177***	**-0.169****
Latin America	1.875**	1.893**	1.874**	1.413**
East Europe	1.522**	1.508**	1.451**	1.523**
Four Asian Tigers	1.781**	1.808**	1.77**	1.32**
Orient	2.256**	2.282**	2.277**	1.171**
Africa	1.787**	1.723**	1.737**	2.5**
Before Mexican crises	-0.716**	-0.951**	-0.747**	-0.562**
Mexican to Asian crises	-0.099	-0.179	-0.104	-0.013
New century	0.037	-0.144	-0.163	0.165
Mexican crisis	-	-0.535**	-0.441*	-0.305
Asian crisis	-	-0.301	-0.258	0.003
Russian crisis	-	-0.779**	-0.58*	-0.065
Argentinian crisis	-	-0.375**	-0.28	-0.232*
Constant	0.857	1.858*	0.175	-1.659
No. observations	767	767	767	1445
Pseudo R-squared	0.25	0.265	0.269	0.185
Predicted probability of issuance	0.464	0.465	0.465	0.37
Observed probability	0.467	0.467	0.467	0.372

Table A3: Analysis of the Issued Amount

Variables	[1]	[2]	[3]	[4]
GDP(e-10)	0.028	0.027	0.017	0.022
	(8.97)**	(8.58)**	(4.35)**	(4.64)**
Short term debt over total debt	-0.018	-0.020	0.009	0.010
	(5.89)**	(6.40)**	(1.91)*	(2.24)**
Debt service over exports	-0.017	-0.016	-0.003	0.001
	(7.39)**	(7.05)**	(0.91)	(0.25)
Exports over GDP	0.002	0.003	-0.010	-0.008
	(0.72)	(1.21)	(4.21)**	(3.11)**
10 years U.S. T-bill rate	-0.526	-0.118	-0.895	-0.832
	(2.40)**	(0.46)	(4.18)**	(3.42)**
Debt rescheduled last period	-0.046	-0.068	-0.286	-0.420
	(0.36)	(0.53)	(2.23)*	(2.93)**
Reserves to short term debt ratio	-0.001	-0.001	-0.069	-0.060
	(0.58)	(0.61)	(2.73)**	(2.36)**
Inv. Mills Ratio	-0.379	-0.310	0.391	0.929
	(2.07)**	(1.53)	(1.47)	(2.47)**
Rating residual	-0.076	-0.087	0.023	0.000
	(4.19)**	(4.67)**	(1.09)	(0.02)
Level of international liquidity		**0.009**		**0.005**
		(3.10)**		**(1.72)***
Growth in international liquidity		-0.184		1,913
		(0.13)		(1.43)
SMTO			**-0.445**	**-0.303**
			(4.27)**	**(2.44)****
SMC			0.002	-0.002
			(0.87)	(0.46)
PBMC			**2,588**	**2,486**
			(2.48)**	**(2.38)****
Squared PBMC			**-2,988**	**-3,260**
			(1.58)*	**(1.72)***
Four Asian Tigers	0.188	0.138	-1,552	-1,105
	(0.67)	(0.49)	(4.09)**	(2.49)*
East Europe	0.179	0.196	-0.909	-0.370
	(0.61)	(0.66)	(2.34)*	(0.79)
Latin America	0.773	0.808	-0.940	-0.432
	(2.69)**	(2.76)**	(2.51)*	(0.96)
Orient	1,132	1,170	-0.438	-0.009
	(3.70)**	(3.76)**	(1.23)	(0.02)
Africa	1,149	1,208	-1,847	-0.860
	(2.98)**	(3.13)**	(2.74)**	(1.05)
Before Mexico	-0.438	-0.195	-0.368	-0.336
	(2.53)**	(1.01)	(2.21)**	(1.78)*
New century	0.490	0.406	0.531	0.534
	(5.46)**	(4.30)**	(5.67)**	(5.58)**
Mexico-Asia	-0.123	-0.019	-0.146	-0.103
	(0.89)	(0.13)	(1.24)	(0.82)
Domestic currency	-1,770	-1,760	-0.983	-0.965
	(12.12)**	(11.96)**	(7.13)**	(6.94)**
USD	0.239	0.232	0.282	0.287
	(2.06)**	(2.01)**	(2.85)**	(2.92)**
Non-investment grade	-0.470	-0.452	0.001	-0.007
	(5.36)**	(5.13)**	(0.01)	(0.07)
Constant	6,770	4,562	7,673	5,529
	(12.41)**	(5.10)**	(11.45)**	(4.54)**
No. of observations	1717	1717	1215	1215
Adj. R-squared	0.503	0.51	0.53	0.54

*Note: Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%.*

1

Table A4: Structural Model Results – Maturity.

Variables	[4.1]	[4.2]	[4.3]	[4.4]	[4.5]	[4.6]
Spread	-0.007	-0.013**	-0.011*	-0.013**	-0.01	-0.013**
DC to GDP	1.59	2.09	0.908	1.79	1.62	1.86
Debt rescheduled	-3.57**	-3.16**	-3.65**	-3.43**	-3.73**	-2.78**
Inflation	-0.001	-0.001	-0.0001	0.0001	-0.792	-1.05*
U.S. T-bill YC	-0.67	-0.97	-0,99*	-0.627	-0.0007	-0.0004
ED to GDP	-2.15	5.14	0.95	2.93	-0.948	6.75
GDP growth	-6.78**	-8.37**	-8.3**	-9,91**	-9.57**	-8.52**
DS to X	-0.002	-0.022	-0.039	-0.012	-0.03	-0.03
RES to ST debt	1.09**	1.03*	0.822	1.045*	0.678	0,97*
Log amount	2,77**	-	-	-	-	-
Est. amount	-	5.07**	3,9**	5.28**	3,94*	5.62**
Inv. Mills Ratio	0.95	-1.4	-0.98	-0.368	-0.765	-2.26
PBMC	-	-	10.85	-	-	-
SMTO	-	-	-	1.63	-	-
SMC	-	-	-	0.021	-	-
Financial Factor WDI	-	-	-	-	1.392	-
Financial Factor LLSV	-	-	-	-	-	-3.31
Pensions reform	-1.25	-0.6	-	-	-	-
Proportion of old	***0.504****	***0.67****	***0.65****	***0.701****	***0,63****	***0.58****
Proportion of adult	*-0.64*	***-1.03***	*-1.08*	*-1.09*	*-1.12*	***-1.14****
Latin America	2.75	2.21	7.39	5.75	4.04	2.46
East Europe	-1.77	0.62	6.29	4.62	4.34	1.48
Orient	0.69	-0.25	5.05	2.12	0.58	0.54
Four Asian Tigers	-1.59	-3.4	1.87	0.59	0.48	-3.16
Before Mexico	-1.55	-0.46	-1.38	-1.11	-1.53	-0.18
Mexico-Asia	-1.32	-0.3	-0.88	-0.65	-0.92	-0.2
New century	0.84	-1.35	-0.83	-1.44	-0.59	-1.43
USD	3,1**	3.49**	3,68**	3,47**	2,83**	3,29**
EUR	-1.54	-1.22	-0.99	-1.23	-1.57	-1.35
constant	27.92	39.45	46.02	37.71	53.28	43.04
No. of observations	292	292	292	292	254	292
R- squared	0.31	0.26	0.27	0.254	0.245	0.253

DC: Domestic credit (billions)
ED to GDP: External debt to GDP
DS to X: Debt service to exports
PBMC: Public Bond Market Capitalization over GDP
SMC: Stock market capitalization over GDP
SMTO: Stock market turnover
US T-bill YC:US Treasury yield curve (10y-1y)
RES to ST debt: Reserves to short term debt
Estimated amount (1) was used.

Table A5: Structural Model Results – Spreads

Variables	[5.1]	[5.2]	[5.3]	[5.4]	[5.5]	[5.6]
Maturity	-9.25	-9.66	-6.06	-7.03	-15.69	-8.73
DC to GDP	43,84**	44,52**	42,44**	47,21**	73,92**	20.34
Debt rescheduled	-1.76	1.81	3.67	1.21	-9.44	29.91
Inflation	0.05	0.058	0.05	0.049	0.046	0.048
U.S. T-bill YC	-13.58	-17.88	-11.8	-15.49	-33,28*	-20.34
ED to GDP	250,95**	251,07**	276,33**	316,52**	339,79**	419,99**
GDP growth	-306,5**	-326,07**	-290,61**	-292,31**	-326,21**	-296,6**
DS to X	1,63**	1,21*	1.64**	1,47**	0.21	-0.1
RES to ST debt	-14.23	-18.37	-26.68**	-16.67	-15.37	-14.36
Log amount	30.52	-	-	-	-	-
Est. amount	-	11.05	-13.76	55.62	37.3	74.65
Inv. Mills Ratio	104,48**	71,3*	99,34**	114,62**	9.66	-16.04
PBMC	-	-	**624,38***	-	-	-
Squared of PBMC	-	-	**-1119,8****	-	-	-
SMTO	-	-	-	27.41	-	-
SMC	-	-	-	**-1.41***	-	-
Financial factor WDI	-	-	-	-	**-100,3****	-
Financial factor LLSV	-	-	-	-	-	**-238,1****
Rating residual	***23,51****	***22,51****	***21,65****	***18,74****	***23,04****	***18,43****
10-y US T-bill rate	***-527,3****	***-513,02****	***-541,15****	***-483,05****	***-463,18****	***-450,78****
International liquidity	***-2,92****	***-2,76****	***-2,67****	***-3.06****	***-2.45***	***-3.51****
Liquidity growth	*-160.5*	*-179.04*	*-105.04*	*-46.73*	*-404.34*	*-362.2*
Latin America	140,02**	147,76**	193,04*	-38.38	84.16	140,1**
East Europe	140,5*	170,96**	114.48	-80.05	59.13	117.9
Orient	62.76	63.83	63.17	-148.73	56.95	78.1
Four Asian Tigers	-63.6	-55.42	-116.1	-219.15	-206.52	-24.08
Before Mexico	-126,9**	-125,9*	-128,74**	-133,64**	-79.29	-96,04*
Mexico-Asia	-26.8	-23.44	-19.88	-20.71	-12.39	-15.11
New century	20.88	29.79	36.18	13.77	19.27	13.92
USD	93,28**	104,05**	98,98**	79,98**	104,26**	81,42**
EUR	44,46*	47,49***	53,35**	40.68	22.44	30.48
constant	1253,3**	1357,34**	1431,9**	1208,8**	1122,4**	948**
No. of observations	292	292	292	292	254	292
R- squared	0.53	0.52	0.59	0.576	0.35	0.55

Table A6: Structural Analysis of the Maximum Maturity

Table A6.1: Maturity

Variables	[1]	[2]	[3]	[4]
Spread	-0,022**	-0,025**	-0,021**	-0,025**
DC toGDP	1.28	1.35	0.58	0.645
Debt rescheduled	-3,85**	-3,94**	-4,18**	-2.96
Inflation	0.0005	0.001	0.001	0.001
Variety dummy	-	**3,48****	**3,4****	**3,48****
U.S. T-bill YC	-1.37	-1.42	-1.42	-1,67*
ED to GDP	15.02	15,96*	12.23	20,19*
GDP growth	-12,57**	-13,16**	-12,28**	-13,18**
DS to X	0.014	-0.009	-0.02	-0.03
RES to ST debt	1,46**	1,39**	1,29*	1,3*
Estimated amount	8,47**	8,07**	7,04**	9,66**
Inv. Mills Ratio	-0.91	-0.9	-0.96	-3.12
PBMC	-	-	6.16	-
FFLLSV	-	-	-	-7.86
Proportion of old	***1,4****	***1,25****	***1,17****	***1,06****
Proportion of adults	*-1.07*	*-0.77*	*-0.78*	*-1.07*
Latin America	1.95	2.65	5.26	2.86
East Europe	-2.73	-2.63	0.265	-1.04
Orient	-0.59	-1.07	1.52	0.6
Four AsianTigers	-2.73	-2.17	0.86	-1.58
Before Mexico	-0.72	-0.16	-0.484	0.94
Mexico-Asia	-0.03	0.39	0.073	0.802
New century	-3.45	-2.79	-2.46	-3.23
USD	3,52**	3,4**	3,37**	2,97*
EUR	-1.15	-1.41	-1.41	-1.6
Constant	18.16	2.11	6.8	10.41
No. of observations	157	157	157	157
R- squared	0.32	0.35	0.37	0.35

PBMC: Public Bond Market Capitalization over GDP
FFLLSV: Financial Factor LLSV.

Table A6.2: Spread

Variables	[1]	[2]	[3]	[4]
Maturity	5.55	3.76	4.73	0.54
DC toGDP	49,14*	47,41*	37.17	3.58
Debt rescheduled	30.16	23.43	12.14	40.4
Inflation	0,084*	0,08**	0,08*	0.06
Variety dummy	-	**23.21**	**22.71**	**27.54**
U.S. T-bill YC	0.44	-1.9	2.36	-15.99
ED to GDP	197.34	214.12	212.64	545,12**
GDP growth	304,8**	-316,29**	-295,21**	-277,81**
DS to X	1,99**	1,81*	1,99*	-0.26
RES to ST debt	-30,74*	-27.3	-37,6**	-15.15
Estimated amount	-63.84	-52.98	-83.19	88.14
Inv. Mills Ratio	75.85	70.24	101,9*	-61.1
PBMC	-	-	**785,04***	-
Squared of PBMC	-	-	**-1306,88***	-
FFLLSV	-	-	-	**-360,73****
Rating residual	***25,59****	***26,28****	***26,34****	***17,9****
10-y U.S. T-bill rate	***-602,72****	***-571,17****	***-594,86****	***-439,53****
International liquidity	***-4,06****	***-3,98****	***-3,53****	***-4,43****
Liquidity growth	*-181.17*	*-141.02*	*-63.96*	*-428.61*
Latin America	147,12**	146,72**	192.7	131,65**
East Europe	191,22*	182,79*	241,33*	91.33
Orient	107.87	97.93	131.85	104.45
Four AsianTigers	-75.39	-71.91	-100.8	-7.24
Before Mexico	-193,76**	-180,8**	-184,32**	-100.1
Mexico-Asia	-56.12	-51.41	-47.53	-21.7
New century	50.51	47.55	57.9	-1.97
USD	50.48	53,5*	62,34*	31.47
EUR	55.59	51.42	58.22	23.41
Constant	2056,9**	1913,3**	1955,1**	902.76
No. of observations	157	157	157	157
R- squared	0.585	0.62	0.61	0.68

Table A7: Domestic Financial Conditions (WDI) – Factor Analysis

Method: Unrotated principal components	
Factor	**Eigenvalue**
Factor 1	***1.066***
Factor 2	-0.228

Factor loadings	
Variable	**Factor 1**
Stocks traded, total value (% of GDP)	0.73
Stocks traded, turnover ratio (%)	0.73

Table A8: Domestic Financial Conditions (LLSV) – Factor Analysis

Method: Unrotated principal components	
Factor	**Eigenvalue**
Factor 1	***1.563***
Factor 2	0.437

Factor loadings	
Variable	**Factor 1**
Overall efficiency 3: turnover / net interest margin	0.565
Overall efficiency 4: turnover / overhead costs	0.565

Table A9: Sargan Test for Over-identifying Restrictions

Compare model (a) with model (b)				
Under Ho: Model (b) is consistent and Model (a) is consistent **Under Ha: Model (b) is inconsistent but Model (a) is consistent**				
(b)	**(a)**	**j**	**Prob>chi2**	**Result**
unreported*	(2) Table 5	20	1	**Accept Ho**
unreported**	(2) Table 6	21	1	**Accept Ho**
unreported**	(2) Table 7	21	1	**Accept Ho**
unreported**	(3) Table 7	21	-	-
Accept Ho, under specification (a) the model is overidentified				

*Note: * Did not include pensions, adults nor the two measures of international liquidity.*
*** Did not include the adults variable nor the two measures of international liquidity.*

Table A10: Countries and Regional Dummies

Country	Region
Czech Republic	1 (East Europe)
Mexico	2 (Latin America)
China	3 (New Giants)
Thailand	4 (Tigers)
Saudi Arabia	5 (Orient)
Morocco	6 (Africa)
Bulgaria	1
Croatia	1
Hungary	1
Latvia	1
Lithuania	1
Poland	1
Singapore	4
Slovenia	1
Russia	1
Slovak republic	1
Bahrain	5
Malaysia	4
Romania	1
Ukraine	1
Egypt	5
Sri Lanka	5
Dominican Republic	2
Brasil	2
Pakistan	5
Lebanon	5
Uruguay	2
Argentina	2
Bostwana	6
Chile	2
Colombia	2
Costa Rica	2
Cyprus	1
Ecuador	2
El Salvador	2
Estonia	1
Guatemala	2
India	3
Indonesia	4
Kazakhstan	5
Korea	4
Republic of Mauritius	6
Moldova	1
Panama	2
Peru	2
Serbia	1
South Africa	6
Congo	6
Philippines	4
Trinidad y Tobago	2
Turkey	5
Venezuela	2

Table A11: Credit Ratings

AAA	1
AA+	2
AA	3
AA-	4
A+	5
A	6
A-	7
BBB+	8
BBB	9
BBB-	10
BB+	11
BB	12
BB-	13
B+	14
B	15
B-	16
CCC+	17
CCC	18

Table A12: Data Sources

Variables	Source	Frequency
Bonds characteristics	Bondware	
US T-bill 1 year. Const. maturities-middle rate (1)	Datastream	Quarterly
US T-bill 10 year. Const. maturities-middle rate (2)	Datastream	Quarterly
Yield curve = (2) - (1)	Datastream	Quarterly
Stock market capitalization to GDP	FSD (WB)	Yearly
Public bond market capitalization (% of GDP)	FSD (WB)	Yearly
Stocks traded, turnover ratio (%)	FSD (WB)	Yearly
External debt, total (DOD, current USD)	WDI (WB)	Yearly
GDP (current USD)	WDI (WB)	Yearly
Exports as a % of GDP	WDI (WB)	Yearly
Imports as a % of GDP	WDI (WB)	Yearly
Short-term debt (% of total external debt)	WDI (WB)	Yearly
Total debt service (% exports of goods and services)	WDI (WB)	Yearly
Total reserves (current USD)	WDI (WB)	Yearly
Inflation	WDI (WB)	Yearly
Proportion of population above 55	WDI (WB)	Yearly
Proportion of the population between 35–55	WDI (WB)	Yearly
Stocks traded, total value (% of GDP)	WDI (WB)	Yearly
Stocks traded, turnover ratio (%)	WDI (WB)	Yearly
Total amount of debt rescheduled (USD)	GDF (WB)	Yearly
Domestic Credit (national currency, millions)	IFS (IMF)	Yearly
GDP (National Currency, Millions)	IFS (IMF)	Yearly
Various Exchange rates	GFD	Quarterly
Turnover / net interest margin	LLSV	
Turnover / overhead costs	LLSV	
Data on pensions reform	USSSA	
Data about debt agreements	Paris Club	

WDI: World Development Indicators
FSD: Financial Structure Database
GDF: Global Development Finance
IFS: International Financial Statistics
GFD: Global Financial Data
USSSA: US Social Security Administration
LLSV: La Porta et al. (1996)

$$M = \alpha S + \beta Z + \Phi_M X_M$$
$$S = \gamma M + \delta Z + \Phi_S X_S$$

where Z is the variable whose effect we want to study.

Simple manipulation of the equations above leads to the two following equations:

$$M(1-\alpha\gamma) = (\beta + \alpha\delta)Z + REST$$
$$S(1-\alpha\gamma) = (\gamma\beta + \delta)Z + REST$$

From here it is straight forward to obtain the marginal effect of an increase in Z on both variables,

$$\frac{\partial M}{\partial Z} = \frac{(\beta + \alpha\delta)}{(1-\alpha\gamma)}$$
$$\frac{\partial S}{\partial Z} = \frac{(\gamma\beta + \delta)}{(1-\alpha\gamma)}$$

Marginal effects

	Spread	Maturity
Liquidity	<0	>0
Bond market development		
Low	>0	<0
High	<0	>0
Stock market development	<0	>0
LLSV – Financial Mkt. Liquidity	<0	>0

Increases in the availability of funds on international markets are followed by rising maturities along with decreasing spreads. Increases on the liquidity of domestic financial markets raise the maturity of the debt, and this raises the spread.

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