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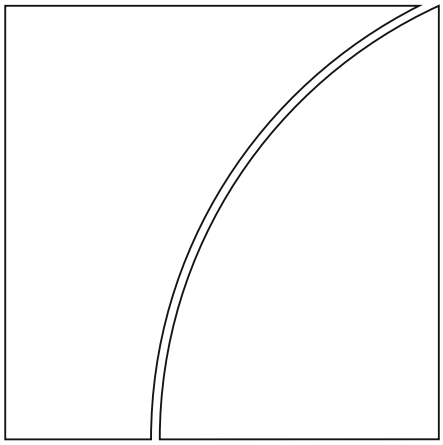

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by Ramon Moreno and Jose Maria Serena-Garralda

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Keywords: International bonds, Credit Risk, Global risk appetite, Firm-level data

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Firms' credit risk and the onshore transmission of the global financial cycle

Ramon Moreno and Jose Maria Serena-Garralda *†

Abstract

We investigate the role of firms' credit risk in the onshore transmission of international bond market conditions. We show that reductions in the global price of risk, measured by the excess bond premium, encourage more international bond borrowing by smaller and younger firms. Due to informational asymmetries, these firms pay a higher credit spread. Thus their funding costs, and consequently their international borrowing, are more tightly linked to the global price of risk. The funds borrowed in response to favourable market conditions cause their balance sheets to deteriorate; over a three-year horizon, leverage increases, in support of capital expenditure, and cash holdings increase. Our results reveal a micro-level link between rising global risk appetite and the gradual build-up of domestic vulnerabilities.

Keywords: International bonds, Credit Risk, Global risk appetite, Firm-level data

JEL Codes: F24, F36, G15, G30.

*Bank for Intenational Settlements, Centralbahnplatz 2, Basel (Switzerland). Corresponding author: Jose.Serena@bis.org

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1 Introduction

Cross-border capital flows are highly responsive to global financial conditions. Recent research has established that lending by international investors strongly depends on global risk appetite. This general pattern holds in international bond markets: firms raise large amounts of financing from international investors when global financial conditions ease; their borrowing sharply declines when conditions tighten.[1]

The capital structure literature suggests, however, that certain firm-specific features could strongly influence how global conditions are transmitted across borders. Previous research has already identified some robust patterns. A first finding is that larger and better capitalised banks, with higher non-core liabilities, more actively transmit global shocks into domestic lending (Baskaya et al. [2017a], Baskaya et al. [2017b]). On the borrower side, it is well established that exchange rate appreciations, a factor transmitting global conditions across borders, ease the financial constraints of firms with currency mismatches (Shin [2015], Kalemli-Ozcan et al. [2018], Avdjiev et al. [2018a]). This happens since collateral constraints are disproportionately relaxed for these firms, due to improvements in net worth.

Poor information constitutes an additional source of credit risk, and it is often independent on firms' capital structure. It can represent an important constraint to borrowing in international bond markets, since institutional investors have less monitoring ability than global banks (Diamond [1984]). Informational asymmetries are severe, for instance, for small and young firms, as they are often unknown to lenders. Since credit risk assessment is difficult, these firms need to pay a premium to issue debt. Consequently, for small and young firms the cost of raising external debt fluctuates with the price of risk. This cost is particularly low when global investors' ability or willigness to

[1]There is a large literature on the drivers of international lending. See, for instance, Forbes and Warnock [2012],Miranda-Agrippino and Rey [2013], Bruno and Shin [2015],Feyen et al. [2015],Lo-Duca et al. [2016],McCauley et al. [2015]).

absorb risk is high. In the case of large and old firms, the cost of raising debt does not fluctuate much, since they do not pay a high premium in international markets.

This suggests the following testable hypothesis: declines in global risk appetite encourage international bond borrowing by firms perceived as riskier, due to their size and age, since they generally pay higher credit spreads to access international markets.[2] This mechanism is complementary to the impact that improvements in firms' net worth might have on their funding costs; fluctuations in the global price of risk have a direct and stronger impact, we presume, on the funding costs of firms with low credit quality. As we discuss our measures of credit risk reflect uncertainty as to the value of firms, and are unrelated to firms' capital structure.

The purpose of this paper is to examine this hypothesis using of a firm-level cross-country dataset covering companies headquartered in 40 small open economies, over the period 2000-2015. Our dataset matches companies' financial statements with their bond-level issuance in international markets.[3] These bond-level data are, on an aggregate basis, similar to the corresponding series in the BIS international debt securities (BIS IDS) statistics. Thus we are investigating firms' cross-border financing using a micro-level dataset.

To test the hypothesis we adapt an empirical model of determinants of change in leverage, in line with the literature on capital structure (Rajan and Zingales [1995], Baker and Wurgler [2002], Farre-Mensa and Ljungqvist [2016]). We verify whether changes in global financial conditions have a larger effect on international borrowing by firms perceived as riskier by international investors.

The dependent variable is the total amount of international bond issuance by a firm relative to its total assets in the previous year. Global risk appetite is measured with the excess bond premium

[2]Shifts in risk appetite might reflect fluctuations in intermediaries' risk-bearing capacity, or time-varying perceptions toward risk. Both have similar effects, and in this paper we do not try to discriminate between them.

[3]We gather the bond data on a consolidated level, and this way we overcome the problems of using data at the residence level (see Appendix A).

proposed by Gilchrist and Zakrajsek [2012]. It is the price of bearing exposure to risk in the US corporate bond markets, obtained by substracting from credit spreads the portion due to expected default risk. Low levels of the excess bond premium reflect strong risk appetite, *net* of reductions in firms' credit risks which might occur simultaneously.

We use the Hadlock-Pierce index (Hadlock and Pierce [2010]) as an indicator of informational asymmetries between firms and global investors. This index is constructed using simultanously firms' size and age. The higher values correspond to young and small firms, which are often unknown and thus riskier borrowers. The Hadlock-Pierce index is independent on the amount or quality of firms' collateral, and as such it is particularly suited to test our hypothesis. The ratio of tangible assets is sometimes used as a measure of asymmetric information; however, empirically it is not a factor signaling constraints (Hadlock and Pierce [2010]), and the correlation with our measure is close to zero. To isolate supply from demand shocks in the model we include several controls for firms' demand for finance: tangible assets, size, profitability, and lagged leverage; and also country and industry-fixed effects, and a number of country-specific controls.

In our benchmark analysis we estimate a nonlinear (Tobit) model over subsamples of firms perceived as riskier (and consequently with strong financing constraints in international markets); and as safer (and thus with weaker constraints). The subsample of strongly (weakly) constrained firms comprises the top (bottom) 25% of firms, classified according to the Hadlock-Pierce index (since higher values reflect stronger constraints). To address the various problems of defining subsamples using ad-hoc thresholds, we interact the Hadlock-Pierce index with the excess bond premium. We also conduct subsample estimations with formally identified thresholds, adapting the likelihood-ratio tests applied by Hansen [1999]. The results are stronger when we exclude countries Switzerland and, in particular, the United Kingdom, whose firms are more financially integrated in global markets.

The results are consistent with our expectation. International borrowing by firms with a very con-

strained access to global markets strongly respond to shifts in global lending standards; the size of the response decreases as firms become less constrained; and it is negligible for firms with weak constraints. Similarly in the threshold estimation we find that the impact of global financial conditions is much stronger for firms identified as constrained.

We conduct a number of robustness checks. We check the sensitivity of our results to: (1) the exclusion of energy and utility firms, whose funding patterns in international markets can be related to their foreign currency asset-side exposures; (2) alternative measures of global financial conditions -VIX, MOVE, and US dollar term premium; and (3) alternative measures of constraints in global markets: firm-size, the Whited-Wu index, and the Kaplan-Zingales index. The results are broadly consistent with our hypothesis.[4] As a robustness check, we use the number of analysts covering each company to assess if firms' access to international markets is constrained; firms with less coverage are less well known, and thus more constrained. We reach similar conclusions. Next we demonstrate that risk appetite does not translate into stronger issuances in domestic corporate bond markets. This underscores that the impact of risk appetite occurs through additional offshore borrowing.

Our measure of firms' credit risks is independent on their capital structure. Accordingly risk-taking by global investors are not apparent on ex-ante balance-sheet metrics. But balance-sheet vulnerabilities can build up later on. Thus we examine how international bond issuance impacts on firms' balance-sheets using a standard model (Kim and Weisbach [2008], Bruno and Shin [2015]). Our objective is to gauge if global risk appetite has a stronger impact on the balance-sheets of firms with a more constrained access to global markets due to their uncertain credit quality; these are the firms borrowing offshore when global financing conditions are favourable. The evidence is consistent with the hypothesis: international borrowing raised in response to strong risk appetite has a higher impact on smallar and younger firms: leverage increases, resulting in higher capital expenditures and

[4]But in several cases the results lose quantitative importance. Consistent with previous research the results are poor when we use the Kaplan-Zingales index to measure firms' constraints.

particularly cash holdings. These results suggest there is a link between greater global risk appetite in international bond markets, and the gradual build-up of domestic vulnerabilities.

Our paper is primarly a contribution to the literature on cross-border capital flows. Recent research has shown that extreme swings in cross-border gross capital inflows are caused by global financial factors. There is a subsequent literature using micro-level data to investigate how global financial conditions are transmitted into domestic economies. This literature has underscored that the transmission through the domestic banking sector strongly depends on some cross-sectional aspects such as bank-specific attributes (Baskaya et al. [2017a]); or certain features of domestic banks' loan portfolio (De Jonghe et al. [2016]). Research on the transmission through global corporate bond markets has highlighted the importance of carry-trade incentives; certain features make firms more likely to engage in such activity: ex ante high cash holdings (Bruno and Shin [2017]); debt capacity (Acharya and Vij [2017]); or ability to arbitrage capital controls (Caballero et al. [2016]). Currency mismatches also enhance the positive impact of exchange rates appreciations on leverage due to net worth effects (Kalemli-Ozcan et al. [2018]). Our contribution to this literature consists in showing that risk-taking by international investors is also transmitted into local economies through additional borrowing by firms of higher credit risk. The findings are consistent with the patterns identified in the US economy. Greenwood and Hanson [2013] show that issuers' credit quality deteriorates in response to decreases in the pricing of credit risk in US corporate bond markets. A difference is that they measure issuers' credit quality with ratings and EDF; instead we exploit measures unrelated to capital structure (size, age, and analysts coverage). The variables they use are encompassing measures of credit risk, which account for balance-sheet vulnerabilities; data limitations prevent us from conducting that exercise. Our findings are thus more specific: we show a deterioration in issuers' quality which would go unnoticed in ratio analyses.

The rest of the paper is structured as follows. Section 2 reviews related literature and discusses the theoretical rationale. Section 3 describes the data. Section 4 discusses the empirical setup. Section

5 examines the influence on constraints on international borrowing. In section 6 we examine the impact on capital structure. Finally, section 7 summarizes the main conclusions.

2 Constrained access to international markets

Literature review

This paper is related to two strands of the literature: drivers of capital flows, and capital structure.

Most recent research on capital flows has underscored the importance of global financial factors as driver of gross capital flows (Forbes and Warnock [2012],Broner et al. [2013], Miranda-Agrippino and Rey [2013], Bruno and Shin [2015] , Milesi-Ferretti and Tille [2011], McCauley et al. [2015] , Lo-Duca et al. [2016], Feyen et al. [2015] or Rodriguez-Bastos et al. [2015]). However Cerruti et al. [2017] find that the quantitative importance of common shocks is not that large. Besides some papers have found that this importance has varied over time, and highlighted it depends on policy initiatives on creditor countries (Avdjiev et al. [2017]); or on country-level fundamentals during stress (Fraztchter [2012]). These findings underscore the importance of understanding the micro-level link between global conditions and capital flows.

In response the literature is growingly using firm-specific data to investigating the issue, which is also the approached follow in this paper. Several studies use country-level data to better investigate aspects of the transmission through the banking sector. Baskaya et al. [2017a] use Turkish data to show that the transmission through the domestic banking sector depends on bank-specific attributes: positive shocks have a positive impact on lending, which is stronger for larger, more capitalised banks, with higher non-core liabilities. Baskaya et al. [2017b] find that this impact is reflected on lower rates, since banks with higher non-core funding price loans more aggressively. De Jonghe et al. [2016] use

data for Belgium and show that banks credit reallocation after an external funding shock is tilted towards low-risk firms and core sectors. Ongena et al. [2015] construct a matched firm-bank dataset for 14 emerging economies and find that international shocks spread to domestic credit; though, credit-dependent firms suffer more from global financial shocks. There are several papers that match firm and bond level data to investigate companies' bond issuance decisions. On a cross-country setup, Bruno and Shin [2017] highlight that interest rate differentials and exchange rate strength increase firms' propensity to hoard cash; they find that firms with high cash holdings are more likely to borrow in response to dollar carry-trade opportunities. Caballero et al. [2016] underscore the relevance of capital controls as determinant of such carry trade activity. Acharya and Vij [2017] use detailed data on Indian companies and find that low-leverage firms are more likely to respond to easy global financial conditions by issuing foreign currency liabilities. On the other hand, Kalemli-Ozcan et al. [2018] use a large sample of Asian firms, and highlight the importance of the net-worth effects of exchange rate appreciations: firms with higher foreign currency debt increase their leverage more in response to appreciations. Finally, Calomiris et al. [2018] investigate the impact of foreign equity inflows on firms'equity issuances; they find that inflows have a stronger impact on issuances by large and liquid firms.

Our research is also related to the literature investigating the impact of credit supply shocks on firms' borrowing decisions. Some papers have explored the impact of shocks to specific sources of capital. For instance Lemmon and Roberts [2010] investigate US firms' response to exogenous contractions in the supply of below-investment-grade credit; below-investment grade firms responded by decreasing net issuances, since were not able to substitute towards alternative sources of funding. Leary [2009] shows that bank-dependent firms decreased their net funding in response to bank loans contraction, whereas firms with access to public bond markets are resilient. Our paper is particularly close to Greenwood and Hanson [2013], that explore shifts in the pricing of credit risk; they demonstrate that in the US economy this type of supply shock has a stronger impact on borrowing by low-quality

firms -measured with credit ratings and EDFs.

Hypothesis development

Our hypothesis is that global risk appetite particularly fosters the international borrowing of firms which, as a result of their credit risk, have a more constrained access to international markets.

We emphasize the role of informational asymmetries as a source of constraints. International investors find difficult to assess the credit risk of some firms -young and small. As a result, they require a higher premium for bearing additional credit risk. This premium is reflected in an upward-sloping supply of external funds -ie it reveals a constrained access to markets. When the price that investors charge for bearing risk decreases (risk aversion is low), the slope of the supply of funds flattens. The funding cost of risky firms falls, and they react by increasing their borrowing. In contrast low-risk firms do not borrow additional funds in response to reductions in the price of credit risk. Since they can always raise additional debt without paying an extra premium, the price of risk does not affect their funding costs.

Our expectation is that shifts in global risk appetite impact on international borrowing, and not on domestic or aggregate borrowing. It derives from the following assumption: investors in international and domestic corporate bond markets are segmented.

The assumption means that international investors do not buy corporate bonds issued in domestic markets.[5] Thus constrained firms need to issue in international markets to benefit from low global risk aversion.

[5]Given our sample selection, domestic corporate bond markets are the local markets of small open economies. International investors are those based outside small open economies. Section 3.1 for more details.

Our assumption is not implausible. A similar segmentation of investors with different preferences in credit markets has been assumed by some recent literature (Liao [2016], Ma [2016]). The evidence suggests that international investors exibit home bias, and are unlikely to buy corporate bonds issued in the local bond markets of small open economies (Maggiori et al. [2018]). Moreover international and domestic securities differ in important dimensions: currency, maturity, or average size (Gozzi et al. [2015]); this suggests that international and local investors have different preferences, and are effectively segmented.

Moreover, the bias introduced if the assumption does not hold goes against finding results. If international investors buy bonds issued in domestic corporate markets, stronger risk appetite should foster domestic bond issuance. The channel we suggest would be weaker.

3 Data

3.1 Firm-level data

We use a firm-level panel for the period 2000-2015. The original sample comprises firms listed in the main equity indexes worldwide.[6] The total number of firms is 10,917 companies. After removing financial companies, the total number of firms in our sample is 8,708. We further restrict the sample to focus on firms headquartered in small open economies.[7] The final number of firms is 2,781 firms, based in 40 countries, emerging and advanced.

[6]Data is obtained from Reuters. The firms are those listed in September 2016. See Appendix A for a description. Given the large number of firms listed in emerging economies indexes, we restrict the sample to 1,000 non-financial companies. The number of firms selected in each emerging market index is proportional to its GDP (we select the largest, including at least 15 firms per country).

[7]Thus we drop firms from the US, euro area, Japan, and China. Besides we leave aside Singapore and Hong-Kong, since are more akin to offshore centres than to small open economies.

Table 1: **Number of Firms. Breakdown by industry and headquarters**

	Latin America	Emerging Europe	Emerging Asia	Africa Middle East	Advanced
Materials	95	51	99	80	91
Comm.	26	21	67	23	64
Discr.	68	46	182	55	119
Staples	75	32	191	72	172
Energy	24	35	71	18	75
Health Care	4	5	15	10	2
Industrial	47	32	217	50	225
Technology	4	6	51	3	47
Utilities	75	41	53	9	33
Total	418	269	946	320	828

For each company we record the items included in the consolidated financial statements, as well as key non-financial information, such as country of incorporation of the issuer, nationality of the firm, sector, year of incorporation, among others. Besides we retrieve several common identifiers: CUSIP, ISIN, SEDOL, LEI, equity ticker and the organization ID. All of them are unique identifiers: each firm has its own identifer, and viceversa. However they are not always available.

We determine the nationality of the firm using the country of headquarters of the company.[8] The jurisdictions covered include Latin America, Emerging Europe, Africa and Middle East, Emerging asia, and the universe of small advanced economies.[9] We classify firms' industry by the sector of the guarantor, using the MSCI-GICS classification. Firms are classified into 9 groups: Materials, Communications, Consumer Discretionary, Consumer Staples, Energy, Health Care, Industrials, Ma-

[8]In our dataset this is a time-invariant variable, although firms can change the location of their headquarters (Avdjiev et al. [2018b]).

[9]Latin America: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela; Emerging Europe: Bulgaria, Bosnia, Croatia, Estonia, Hungary, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey and Ukraine; Africa and Middle East: Egypt, Morocco, Nigeria, Saudi Arabia, South Africa and the United Arab Emirates; Emerging Asia: India, Indonesia, Malaysia, the Philippines, Thailand and South Korea; and advanced economies: Australia, Canada, Denmark, New Zealand; Norway, Sweden, Switzerland and United Kingdom. We keep in the sample some countries that joined the euro area in the succesive enlargements (Estonia, Lithuania, Slovakia and Slovenia); in robustness checks we make sure this aspect does not affect our results, removing them from the estimations.

terials, Technology, Utilities. The cross-tabulation of firms by region and industry is shown in Table 1.

In the main analyses we use all firms. In robustness checks we remove firms with missing data in more than half of the years, which leaves us with 1,928 firms. The qualitative results shown below do not change when we use this alternative, balanced sample.

3.2 Bond-level data

We collect data on all bonds issued by non-financial firms based in the 40 jurisdictions covered, in the period 2000-2015. We measure firms' international bond borrowing on a consolidated basis. For each firm we gather all the bonds guaranteed, even when they have been issued by its affiliates.[10]

More specifically we assume a bond is ultimately a liability of the company with an explicit legal exposure to it (ie legally liable in case of default); if this information is not available we assume it is the ultimate parent company of the issuer; if the latter is not available, we assume it is the direct issuer. This rule differs from consolidation at the ultimate parent level when firms have affiliates that guarantee liabilities, acting as standalone entities. Appendix A provides an example. Bond-level data are obtained from Reuters. We retrieve the aforementioned common identifiers for each company: CUSIP, ISIN, SEDOL, LEI, equity ticker, and the organization ID.[11]

Besides we obtain certain non-financial information (industry, country of incorporation, etc). We use it to classify bonds according to the nationality and industry of the company. A debt issuance is

[10] See Appendix A for details. Other studies of different dimensions of firms' funding and investment decisions on a consolidated basis include Bruno and Shin [2017] and Caballero et al. [2016].

[11] We proceed as follows. For each bond we obtain the bond ISIN (when available) and the SDC CUSIP of the issuer. First we identify the common identifiers of the company with an explicit legal exposure to the bond (identified by the ISIN). Second we retrieve the common identifiers of the ultimate parent company of the issuer (identified by the SDC CUSIP). Finally we retrieve the common identifiers of the issuer.

classified as domestic when the company issues in its local bond market, and as international when it does not. We classify bonds according to the primary market of issuance, following the methodology of the BIS international debt securities (BIS IDS).[12]

In our sample selection we leave aside firms based in the major economies. Consequently there is a clear distinction between domestic and international bond issuances. We implicitely assume that fluctuations in global risk appetite do not directly impact on funding costs in domestic corporate bond issuances, since we assume segmentation between investors in domestic and international markets. Overall we identify 49,094 bonds with a total value of 5.5 USD trillion.

While we exploit this data on a firm-level basis, the aggregate volume is roughly similar in size to the corresponding series in the BIS IDS (Figure 1). The differences between both series can be explained by differences in data coverage, and by some methodological differences.[13]

Table 2 summarizes the patterns of bond issuance by region. Our focus is on international bonds, marketed outside the local jurisdiction. Panel A shows that, throughout the period, firms have issued a total of 3.2 USD trillion in international markets. International bond issuance outweights domestic placements in terms of volume in most countries, with the exception of Emerging Asia.

The bulk of international bond issuance is denominated in foreign currency. But the breakdown by region shows that some of the firms based in advanced economies issue overseas in domestic currency. In terms of number of bonds, the pattern is slightly different: there are more deals in local makets, underscoring a smaller average size (Table 2, Panel B). This pattern is similar in all regions, although sharper in Asia -where local markets are more developed.

[12]We assume that bond markets are perfectly integrated in the euro area, but not in the EU. For instance, a bond issued by a German firm in Luxembourg is considered a domestic issuance: in contrast a bond by a British firm in Luxembourg market is considered an international issuance. Since British firms account for a substantial fraction of total issuances, we confirm that our results are robust to their exclusion.

[13]See Gruic and Wooldridge [2012] for an exposition. The BIS IDS identify the primary market using the registration domain (ISIN); the listing; and the governing law. Our measure seems exclusively related to the registration domain.

Figure 1: **Bond-level data and the BIS International Debt Securities:** The graph compares an aggregate measure of our bond-level dataset with the BIS international bond issuances by nationality (sector: non-financial corporations)

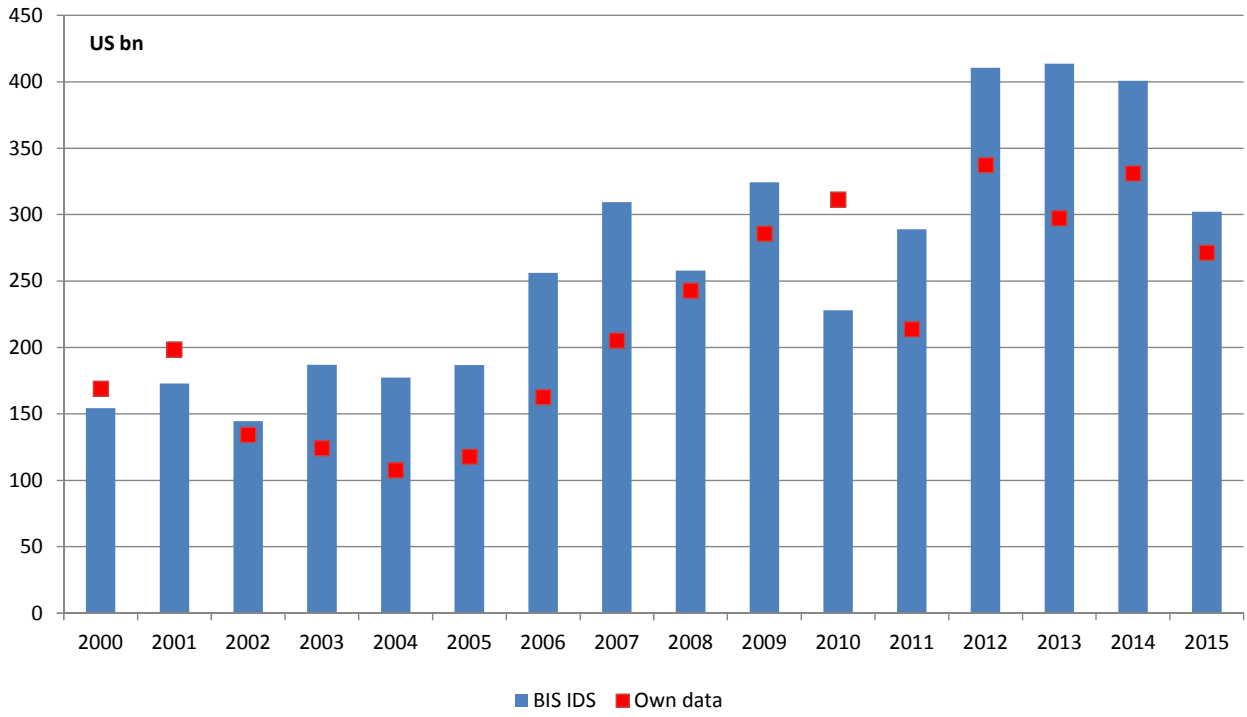


Table 2: **Summary statistics. Firms'bond issuances by region:** Bond issuances in the period 2000-2015 by region, measured in USD bn. Domestic includes firms'issuances in their local jurisdiction. International includes issuances overseas. The latter are further broken down by currency: FC/LC refer to issuances in foreign/local currency in international markets.

(a) **Total volume**

	Total	Domestic	International	ow: FC	ow: DC
Advanced	4,159	1,415	2,741	2,205	535
Latam	1,038	446	587	574	13
Asia	1,319	1,058	256	253	3
Europe	389	164	224	218	6
Africa-Middle East	144	10	134	118	16
Total	7,048	3,093	3,941	3,368	573

(b) **Number of bonds**

	Total	Domestic	International	ow: FC	ow: DC
Advanced	11,490	4,248	7,231	5,356	1,875
Latam	4,500	3,440	1,050	1,024	26
Asia	20,901	19,781	1,104	998	106
Europe	1,200	763	435	392	43
Africa-Middle East	376	41	332	194	138
Total	38,467	28,273	10,152	7,964	2,188

Table 3: **Summary statistics. Bond issuances by industry:** Bond issuances in the period 2000-2015 by sector, measured in USD bn. Domestic includes firms'issuances in their local jurisdiction. International includes issuances overseas. The latter are further broken down by currency: FC/LC refer to issuances in foreign/local currency in international markets.

(a) **Total volume**

	Total	Domestic	International	ow: FC	ow: DC
Communications	844	361	481	446	36
Discretionary	181	76	104	89	16
Energy	2,375	1,065	1,307	1,116	191
Healthcare	250	45	204	175	29
Industrials	1,213	660	546	447	99
Materials	994	437	555	537	17
Staples	816	264	552	407	145
Technology	376	185	191	150	40
Total	7,048	3,093	3,941	3,368	1

(b) **Number of bonds**

	Total	Domestic	International	ow: FC	ow: DC
Communications	2,206	1,412	793	696	97
Discretionary	1,532	1,011	521	359	162
Energy	9,122	6,129	2,984	2,209	775
Healthcare	794	532	262	217	45
Industrials	11,684	9,634	2,031	1,576	455
Materials	5,392	4,025	1,357	1,276	81
Staples	5,048	3,466	1,581	1,138	443
Technology	2,689	2,064	623	493	130
Total	38,467	28,273	10,152	7,964	2,188

Table 3 summarizes the patterns of funding by industry. There are remarkable differences accross industries, which seem related to their (technological) demand for external finance. Industries with more needs of external funds -such as energy, industry, and utilities companies- raise more funds than the others. Energy firms raise a substantial fraction of total international bonds, mostly in foreign currency. The bulk of international bond issuances in local currency is carried out by utilities and industrials.

3.3 Merging the datasets

In both datasets we have retrieved firms' information on a consolidated basis. Thus we can merge them using the common identifiers of the company, which are available in both datasets. We have different options, since we have retrieved several identifiers.

We illustrate the procedure with Korea Electric Power Corp. This company is included, for instance, in the Bloomberg World Index -its weight as of October 2016 was 0.063994%. As a result the company is part of our sample, and we have detailed information on financial statements, cash-flow statements, and non-financial items. The company has the following common identifiers: CUSIP, Y48406105; ISIN, KR7015760002; SEDOL, 6495730; LEI, 988400QG33WS7JEIV602; ticker, 015760; and organization ID, 4295881588. In this particular case we can use any of them to merge both datasets. In the period covered, Korea Electric Power Corp has backed 51 bonds issued in international markets, which amount for 16 US billion.

However, some common identifiers are not always available. For instance CUSIP, SEDOL and ISIN are missing in around 10% of the firms. This percentage increases to 53% in the case of the LEI. In contrast the ticker and the organization ID are available for all firms. Thus we opt to use the latter.

The 2,781 firms in our sample have issued 58% of the 5.5 US trillion guaranteed by firms based in

the countries covered in the analysis. The total number of bonds they have guaranteed is 17,005, and the total amount guaranted is 3.2 US trillion. 2 US trillion were issued in international markets, and the remaining 1.2 US trillion in domestic markets. The proportion of the total amount issued in international markets by firms in our sample rises to 62% of the total, and the total number of international bonds is 4,507 (45% of the total).

To make sure we are not losing meaningful information, we examine the type of firms guaranteeing international bonds issued in the period, but not included in our sample of companies. Since we are covering listed firms, we expect the majority of these firms to be unlisted companies.We sort the 2,809 companies which have guaranteed international bonds and are not in our sample according to the total amount they have backed. We focus on the 1,091 companies which have issued bonds for an amount higher than 100 US million. These companies account for 98% of the total amount raised in international markets by companies not in our sample. Consistent with our expectations, 811 of them are unlisted companies, which account for 89% of the amount issued in international markets not in our sample; listed firms not in our sample account for the remaining 11%.

3.4 Informational asymmetries

International investors require a premium on firms perceived as risky, due to informational asymetries. This spread results in a constrained access to international debt markets, in the sense that firms cannot borrow as much as desired unless they pay a premium to compensate investors.

We cannot observe if a firm suffers such constrained access to international debt markets, and there is no agreed procedure to assess this. Some papers use certain firm-level characteristic which expectedly signal that companies have problems to raise external finance: firm size (Almeida et al. [2004], Baum et al. [2011], Devereaux and Schiantarelli [1990], Hennessy and Whited [2007]), age (Lyandres

[2007] and Devereaux and Schiantarelli [1990]), payout policy (Almeida et al. [2004], Fazzari et al. [1988],Baum et al. [2011], Farre-Mensa and Ljungqvist [2013] and Hennessy and Whited [2007]), credit rating (Lemmon and Roberts [2010]), or existence of a rating on a bond (Almeida et al. [2004], Farre-Mensa and Ljungqvist [2013], and Whited [1991]).[14] This literature assumes that firms are more likely to have a constrained access if they are small, young, not paying dividends, have a poor credit rating, or do not have an outstanding bond with public rating.

Instead of using a single variable, we decide to use the Hadlock and Pierce [2010] index. Hadlock and Pierce [2010] related qualitative information on firms' access to finance with observable characteristics. Firms' status were categorized reading statements made by managers in SEC filings, on a random sample of US firms. Managers discussing liquidity problems or losses of sources of credit were revealing constraints in access to finance. These assessments were related to observable characteristics. Constraints depended negatively on size and age, and positively on the quadratic term of size: older and larger firms are bettter known, so have a less constrained access to debt markets (ie, a lower cost of external finance). Based on their results, Lamont et al. [2001] defined the following index:

$$HadlockPierce = -0.737 * Size + 0.043 * Size^2 - 0.04 * Age$$

Higher values reveal more costly access to debt markets. Following their approach, we measure size with total assets, deflated with US CPI. They cap size and age at percentile 95, which in their sample are respectively 4.5 US billion and thirty-seven years. In our sample these values are 4.9 US billion and sixty-eight years. Our firms are older, but in our main analyses we follow their approach and cap values at percentile 95. We cross-check that the results are not sensitive to alternative definitions.

[14] This list is not exhaustive. See Beck et al. [2006] for a survey.

In Table 4 we provide descriptive statistics for firms with weak and strong constraints in international debt markets (respectively, bottom and top 25% of the distribution). By construction firms with weak constraints are larger and older. They have higher leverage ratios, and lower cash to capital ratios (as in Hadlock and Pierce [2010]). Thus the index is not clearly related to standard measures of balance-sheet vulnerabilities.

Table 4: **Financial ratios using Hadlock-Pierce index classification:**Size is measured with firms' total assets. Cash flow to fixed assets ratio is the cash flow from operating activities to lagged gross fixed assets. Tobin's Q is the ratio of the market value of a firm to the replacement cost of the firms' assets. Tangible assets are measured as net fixed assets to lagged total assets. Book leverage is lagged total debt to lagged total assets. Cash to fixed assets ratio is current assets to lagged total assets. Hadlock-Pierce index is defined in the main text. Age is the current year minus the year of incorporation of the firm. Table A3 describes each item.

Weak constraints	mean	p25	p50	p75	sd
Size (Assets, US mn)	18,125	3,248	7,740	18,198	34,209
Cash flow to fixed assets ratio	0.60	0.38	0.55	0.75	0.38
Tobin's Q	9.48	1.06	1.33	1.81	72.01
Tangible assets	0.74	0.39	0.69	1	0.45
Book leverage	0.26	0.15	0.26	0.37	0.15
Cash to fixed assets ratio	0.4	0.2	0.34	0.54	0.25
Hadlock-Pierce index	-2.61	-3	-2.5	-2.16	0.52
Age	48.74	24	43	67	30.9
Strong constraints	mean	p25	p50	p75	sd
Size (Assets, US mn)	148	47	104	213	135
Cash flow to fixed assets ratio	0.67	0.35	0.62	0.85	0.62
Tobin's Q	3.59	1.07	1.56	2.68	23.15
Tangible assets	0.64	0.25	0.53	0.9	0.52
Book leverage	0.19	0.02	0.15	0.32	0.18
Cash to fixed assets ratio	0.60	0.37	0.56	0.8	0.31
Hadlock-Pierce Index	1.46	0.58	1.12	1.95	1.26
Age	19.67	6	12	21	24.05

In this paper we do not attempt to explore if the factors suggesting a constrained access to inter-

national markets (ie size or age) are somehow explained by home country factors. The important aspect is that in our sample the distribution of firms across groups in each region is broadly similar, as shown in Table 5 (Table A7 reports the country-level breakdown). If anything it is worth noting an overrepresentation of strong firms in Latin America, and of weak firms in Emerging Europe.

Table 5: **Number of firms. Breakdown by severity of constraints and headquarters:**

	Latin America	Emerging Europe	Emerging Asia	Africa & Middle	Advanced
Strong	33%	12%	26%	21%	26%
Normal	51%	50%	51%	58%	48%
Weak	16%	39%	22%	21%	26%

The Hadlock-Pierce index is unevenly distributed across industries. Energy and utility companies have low values, since are often large (see Table A8); and technology companies have high values, reflecting they tend to be small. In robustness checks we make sure this does not distort our results.

This index has advantages over the two other major alternatives: the Kaplan-Zingales (Kaplan and Zingales [1997])[15] and the Whited-Wu index (Whited and Wu [2006]).[16]

The main drawback of the Kaplan-Zingales index is that Kaplan and Zingales [1997] used balance-sheet information to categorize firms' financial constraints, as a way of complementing qualitative information on firms' statements. By construction, the subset of financially constrained firms defined

[15]Lamont et al. [2001] define an index, based on their results. The index loads negatively on cash flows to capital, cash to capital, and dividends payment; and positively on Tobin's q and debt to total capital.

$$\begin{aligned} KL &= -1.002 * CashFlow/FixedCapital + 0.283 * Q + 3.139 * Debt/Liabilies - \\ &\quad -39.368 * Dividends/FixedCapital - 1.315 * Cash/FixedCapital \end{aligned}$$

[16]The correlation between the Hadlock-Pierce and the Whited-Wu index is positive, but not high (see Table A6). The correlation with the Kaplan-Zingales index is weak, consistent with previous research (Farre-Mensa and Ljungqvist [2013]).

by Kaplan and Zingales [1997] has low cash ratios, hight debt, low dividends. The Kaplan-Zingales index seems to measure of the need for external finance (Hennessy and Whited [2007]).

The drawback of the Whited and Wu [2006] is their assumption that that higher investment-cash sensitivities reveal higher financial constraints -since they investigated how investment-cash sensitivities relate to observable characteristics.[17] Research suggests that the assumption is strong (Kaplan and Zingales [2000],Almeida and Campello [2007],Cleary et al. [2007],Lyandres [2007]).

3.5 Global risk appetite

We use the excess bond premium (Gilchrist and Zakrajsek [2012]) to measure global risk appetite. We interpret it reflects the price of credit charged by investors in global corporate capital markets; it reveals the level of lending standards, independently of shifts in companies' credit risks.

Most previous research uses the VIX (implied volatility of S&P 500 equity index options) to measure global risk appetite, due to its strong impact on cross-border capital flows (Forbes and Warnock [2012]).[18] Other potential measures are the Merrill-Lynch Option Volatility Estimate (MOVE) Index, and the US dollar term premium. The MOVE index measures the implied volatility of the 1-month Treasury options, and can be considered as the counterpart of the VIX in bond markets, capturing the risk of holding Treasury securities. The US dollar term premium is interpreted as a measure of

[17] They found that firms with lower cash flows, smaller size, not paying dividends, with low sales growth and in a high sales growth industry were more likely to be constrained:

$$\begin{aligned} WW &= -0.091 * CashFlow/FixedCapital - 0.062 * DummyDividend + 0.021 * Debt/FixedCapital - \\ &\quad -0.044 * Size + 0.102 * IndustrySalesGrowth - 0.035 * SalesGrowth \end{aligned}$$

[18] It has a strong connection with global banks' leverage, and subsequently was used as determinant of cross-border bank flows (Bruno and Shin [2015]). It is used more generally as determinant of other capital flows, including international bond issuances (Feyen et al. [2015], Lo-Duca et al. [2016]).

investors' appetite in bond markets, since it reflects the compensation which investors receive for holding long-term US treasuries.

These three variables are imperfect measures of the price of credit, since also reflect how default risks fluctuate along the financial cycle. Consequently they are not useful to identify supply shocks; for instance, a negative relationship between the VIX and firms' borrowing could reflect how higher default risks translate into lower demand for funds.

To address this identification problem Gilchrist and Zakrajsek [2012] decomposed firms' credit spreads into two time-varying measures: a measure of firms' credit risk; and the effective price of bearing exposure to risk required by US financial intermediaries. The latter measure is the excess bond premium, reflecting investor sentiment or risk appetite. It is positively correlated with the three mesaures described above, but the coefficient is below one.[19]

The excess bond premium is computed using US corporate bond markets data. Given the importance of US financial intermediaries we assume it measures risk appetite in global corporate bond markets. When the excess bond premium is low, credit spreads compress, the capital supply curve of constrained companies flattens.

4 Econometric framework

4.1 Model

Our empirical model to investigate the hypothesis is based on the model of determinants of change in leverage developed by Rajan and Zingales [1995], and subsequently adapted by Baker and Wurgler

[19]Besides the excess bond premium exhibits the strongest unconditional relationship with firms' international bond issuances (see Table B2); the MOVE and the VIX exhibit a similar relation with firms' international bond issuances.

[2002], Farre-Mensa and Ljungqvist [2016] or Lemmon and Roberts [2010]. In this model we define the dependent variable y_{it} as the total amount of international bond issuance of firm i, relative to total assets in the previous year.

$$y_{it} = \beta' x_{it} + \gamma_1 BP_t + \alpha_I + \alpha_C + \varepsilon_{it} \tag{1}$$

In the vector of controls x_{it} we include firm-level determinants of borrowing: tangible assets, size, profitability, and leverage, as in Baker and Wurgler [2002]. Tangible assets is defined as the sum of property, plant and equipment to lagged total assets. Size is the logarithm of total assets, CPI adjusted and measured at 2000 USD prices. Firm profitability is measured with the lagged return-on-assets. Book leverage is defined as book debt (sum of short and long-term debt) to lagged total assets, and it is introduced lagged. In the equation we include as well industry and country-level controls. At the country-level we include a country's GDP per capita, financial depth and sovereign rating, as factors which can affect a company's demand for finance. We treat unobserved heterogeneity at the industry level α_I and the country level α_C as fixed effects. Finally, we include global GDP growth.

To test the hypothesis we include in equation 1 our measure of global financial conditions BP_t, the excess bond premium index. Since the dependent variable is censored, we estimate a two-equations Tobit model by maximum-likelihood. As it is customary in the capital structure literature, we first test the hypothesis estimating the model for three subsamples: firms with strong, normal, and weak constraints in international debt markets[20]:

$$\overset{*}{y_{it}} = \begin{cases} y_{it} & if \quad y_{it} > 0 \\ 0 & if \quad y_{it} \leq 0 \end{cases} \tag{2}$$

[20]Firms with strong constraints are the top 25% of the distribution. Firms with weak constraints are the bottom 25% of the distribution. Normal firms are those in between.

$$y_{it} = \beta' x_{it} + \gamma_1 BP_t + \alpha_I + \alpha_C + \varepsilon_{it} \tag{3}$$

We expect international borrowing by constrained firms to exhibit a stronger response to shifts in the excess bond premium. Thus we expect γ_1 to be negative, and higher in absolute terms for the subsample of constrained firms. In all models standard errors are clustered at the year level.

4.2 Identification issues

There are four potential identification problems. First that supply and demand shock may be confounded. This happens for instance when shifts in global financial conditions also reflect changes in firms' default risks. Since we are covering firms based in small open economies, we consider it is extremely unlikely that unexpected shifts in the firm-level demand for finance affect the price of risk in global markets.[21] Besides we have addressed this potential problem using the excess bond premia (Gilchrist and Zakrajsek [2012]). Finally, to account for firms' demand for finance we have included several observable firm-level determinants of firms' demand for finance: tangible assets ratio, size, profitability, and lagged leverage (inversely related to net worth). Overall we consider this problem is not important.

The second issue is the measurement of constraints in access to international markets. The Hadlock-Pierce index appears to be the best way of gauging if firms face a high cost of external finance, but this measure has been critized on empirical grounds. Using a sample of US firms Farre-Mensa and Ljungqvist [2013] find that firms categorized as constrained using this variable behave as if they were unconstrained; they find similar drawbacks in the other measures examined in this paper (size,

[21] Formaly, that would mean that $cov(\varepsilon_{it}, BP_t) \neq 0$; this would require unexpected economic prospects on a specific company (eg, Petrobras Brazil) to impact negatively on the lending ability of global investors, or willigness to absorb risks. Since global investors (eg, Allianz) are large and well-diversified this is very unlikely.

Kaplan-Zingales, and Whited-Wu index). Instead we find that firms classified as constrained behave as if they were constrained. Following Farre-Mensa and Ljungqvist [2016] heuristical assessment we consider that high values of the Hadlock-Pierce index do signal a constrained access to international markets. As a robustness check, we use as an alternative the number of analysts covering a company; we will assume that better analyst coverage reduces informational asymmetries, and thus signals that companies have an easier access to international markets.

Third, we have defined the dependent variable as the total amount of international bond issuance relative to total assets in the previous year, and not as the change in net leverage (as done by Baker and Wurgler [2002], Farre-Mensa and Ljungqvist [2013] or Lemmon and Roberts [2010]). Since international and domestic markets are partially segmented, as shown by Gozzi et al. [2010], these sources of finance are not perfect substitutes. It follows that shocks to the price of risk should affect firms' international bond borrowing -and only through this on their aggregate borrowing.

Finally, in our first exercise we have defined subsamples of strongly/weakly constrained companies using arbitrary thresholds. This is standard practice in the capital structure literature. However this has drawbacks, since results can be sensitive to alternative thresholds. Moreover splitting the sample diminishes the power of the model. We tackle the issue in two different ways. One is to interact the financial constraint measure and the excess bond premium. Another is to split the sample between strongly and weakly constrained firms estimating the thresholds as suggested by Hansen [2000]. Once the threshold is identified we augment a linear model with an interaction between the excess bond premium and an indicator variable which takes value 1 if firms' financial constraints are above a certain threshold.

5 Impact on international borrowing

5.1 Main results

Table 6 reports the results obtained using the Hadlock-Pierce index to gauge firms' financial constraints in international bond markets. The first column reports the results of estimating the model defined by 2 and 3 for the full sample. As expected the excess bond premium has a negative impact on firms' borrowing (the coefficient γ_1 on BP_t is negative), and the impact of the excess bond premium is negative also in the three subsamples (columns 2, 3 and 4). Consistent with our expected the size of the impact depends on cross-sectional differences in firms' degree of financial constraints: it is smallest for firms with weak constraints (column 2), and it is largest for companies with strong financial constraints in international markets (column 4). It is worth noting, however, that few firms with strongly constrained access to international bond markets are able to tap international markets. Thus the results of this subsample can be unstable. More generally, the results can be sensitive to alternative definitions of the subsamples.

Since the results of the subsample estimations are not reliable, we estimate a model with an interaction between the excess bond premium and the Hadlock-Pierce index, modifying Equation 3 :

Table 6: **Financial constraints measured with Hadlock-Pierce index:** The dependent variable are international bond issuaces relative to lagged total assets. Firms' financial constraints are measured with the Hadlock-Pierce index). Weakly (W) and Strongly (S) constrained firms are those at the bottom and top quartile; firms with normal constraints are those in between. The excess bond premium is measured as standard deviations. $I[\tau^{HP}]$ is a binary variable taking value 1 if firms are constrained (ie have Hadlock-Pierce index values above the estimated threshold; this value is 1.15, and corresponds to percentile 88th). All models include country and industry fixed effects. Standard errors are clustered at the year-level; t-statistics reported in parentheses.

	(1) Baseline	(2) W	(3) Normal	(4) S	(5) Interaction	(6) Threshold
Tangible Assets	0.109	0.004	0.103*	12.196***	0.095	0.102**
	(1.43)	(0.35)	(2.38)	(11.68)	(1.27)	(2.59)
Size	0.294***	0.042***	0.253***	−0.174	0.256***	0.306***
	(3.84)	(16.35)	(7.35)	(−0.50)	(3.95)	(21.63)
ROE	0.001	0.000	0.002*	−0.360***	0.000	0.000
	(0.80)	(0.27)	(2.25)	(−16.47)	(0.48)	(0.39)
Book Leverage	0.812**	0.181***	0.665***	44.952***	0.841**	0.859***
	(3.12)	(9.27)	(5.02)	(16.76)	(3.17)	(8.61)
GDP per capita	−0.101	0.006	−0.123**	−37.018***	−0.091	−0.089
	(−1.75)	(0.58)	(−3.13)	(−24.31)	(−1.55)	(−1.88)
ΔGDP	0.001	−0.004	0.065	−1.469	0.003	0.005
	(0.04)	(−0.72)	(1.42)	(−1.78)	(0.11)	(0.13)
ΔWorldGDP	−0.034	−0.000	−0.051	−3.356***	−0.034	−0.035
	(−1.41)	(−0.13)	(−1.37)	(−7.66)	(−1.42)	(−1.18)
Sovereign Rating	−0.020	−0.012**	0.009	21.996***	−0.035	−0.037
	(−0.89)	(−2.82)	(0.22)	(209.35)	(−1.46)	(−1.58)
FD	−0.052	−0.025	−0.002	−7.830***	−0.051	−0.053
	(−0.52)	(−1.87)	(−0.02)	(−5.26)	(−0.44)	(−0.78)
BP	−0.069*	−0.004	−0.062*	−5.640***	−0.143*	−0.064**
	(−2.36)	(−1.66)	(−2.13)	(−6.78)	(−2.39)	(−2.58)
HadlockPierce					−0.142	
					(−1.59)	
BP*HadlockPierce					−0.090*	
					(−2.21)	
$I[\tau^{HP}]$*BP						−0.814***
						(−5.55)
Observations	20142	5708	9965	3674	19347	19347
Uncensored	1193	843	299	6	1148	1148
Censored	18949	4865	9666	3668	18199	18199
R-squared	0.226	0.346	0.236	0.323	0.231	0.231

$$y_{it} = \beta' x_{it} + \gamma_1 BP_t + \gamma_2 HadlockPierce_{it} + \gamma_3 BP_t * HadlockPierce_{it} + \alpha_I + \alpha_C + \varepsilon_{it} \tag{4}$$

The impact of shifts in global financial conditions on the censored outcome is given by the partial effect of the excess bond premium:

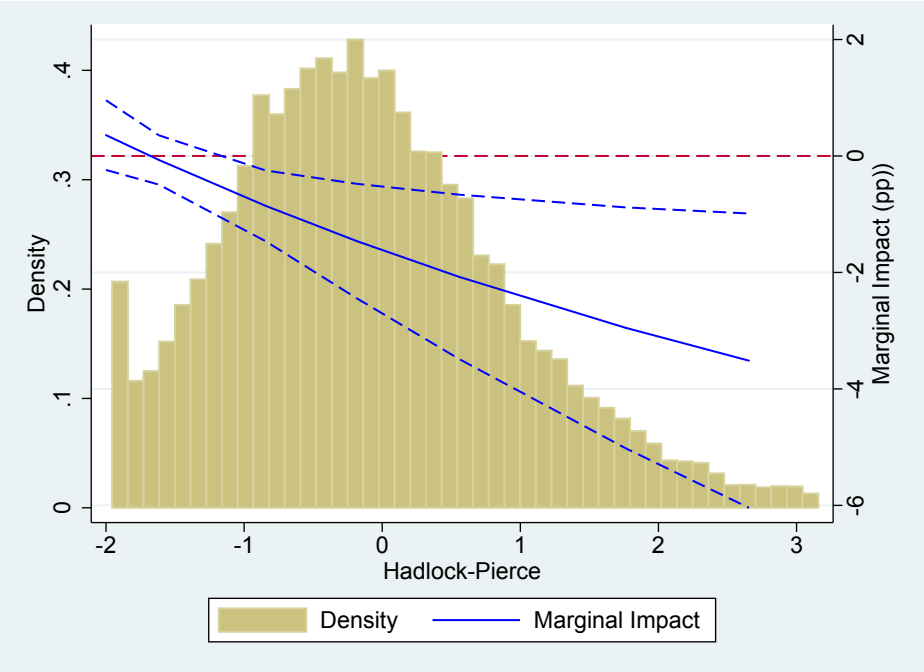
$$\frac{dy_{it}}{dBP_t} = [\gamma_1 + \gamma_3 HadlockPierce_{it}] \Phi \left(\frac{\alpha' x_{it}}{\sigma} \right) \tag{5}$$

The necessary condition for our hypothesis to hold is that γ_3 is negative: this indicates that the impact of the excess bond premium on firms' international borrowing increases as financial constraints become more binding. Since $HadlockPierce_{it}$ is continuous, the statistical significance of the impact is different from a Wald test on γ_3. The confidence interval depends on $cov(\gamma_1, \gamma_3)$, so the statistical significance can change substantially with the value of financial constraints. The excess bond premium has a negative impact, and the coefficient of the interaction is also negative: firms' international borrowing becomes more sensitive to the excess bond premium the more constrained companies are. As a way of summarizing this result, we plot the partial effect of the excess bond premium. The range leaves aside the top and bottom 1% of the distribution-. The solid blue line represents the partial effect, and the dashed lines 95% confidence intervals. We overlay a histogram on the distribution of the Hadlock-Pierce index. For companies with a very easy access to markets (Hadlock-Pierce index is 2 standard deviations below the mean) the impact of the excess bond premium is not different from zero.

Next we split the sample with estimated thresholds.[22] Using the estimated threshold τ^{HP} we define a

[22] Appendix D describes the method in detail. In a nutshell, the threshold is identified as follows. We estimate the model for 500 thresholds, equally distributed in the domain of each financial constraint measure (leaving aside the 10% of observations in the tails). Then we construct the likelihood ratio function which by construction is zero at its minimum. This is the value identified as a potential threshold, and we test if it is statistically significant by comparing it with tabulated critical values.

Figure 2: **Partial effect of excess bond premium on international bond issuance, Hadlock-Pierce index classification:** These charts show the marginal impact of one standard deviation change in the excess bond premium (BP) on international bond issuance. The solid blue line depicts the estimated impact; the dash blue lines measure the confidence intervals at 95%. The impact is a function of the Hadlock-Pierce Index. The red dash line is plotted at y=0 thus indicating when the impact of the excess bond premium is statistically significant from zero.



binary variable $I\left[\tau^{HP}\right]$ taking value 1 for firms with Hadlock-Pierce indexes above it (ie, constrained firms), and zero otherwise. The set of equations we estimate are now given by (6) and (7)

$$\overset{*}{y}_{it} = \begin{cases} y_{it} & if \quad y_{it} > 0 \\ 0 & if \quad y_{it} \leq 0 \end{cases} \tag{6}$$

$$y_{it} = \beta' x_{it} + \gamma_1 BP_t + \gamma_4 I\left[\tau^{HP}\right] * BP_t + \alpha_I + \alpha_C + \varepsilon_{it} \tag{7}$$

γ_1 captures the impact of shifts in the excess bond premium on firms' international borrowing. Our focus is on γ_4 , which is the incremental impact on firms classified as constrained in international markets. A negative sign would indicate that shifts of the excess bond premium particularly impact on borrowing by financially-constrained firms. The results are consistent with the hypothesis: γ_1 is negative, underscoring that firms'international borrowing is negatively impacted by increases in global risk aversion; and γ_4 is also negative, indicating that this impact is stronger for financially constrained firms. The results are economically important: for firms weak constraints one standard deviation of the excess bond premium translates into a 6.4% decrease in the ratio of international borrowing to total assets; this impact is multiplied by 13 for firms with constraints above the identified threshold.[23]

We check that our results are not sensitive to the inclusion of the United Kingdom and Switzerland. Both countries have a relatively higher degree of financial integration with global markets (for instance, local investors are likely to be active internationally). Accordingly the excess bond premium is unlikely to be a good measure of offshore risk appetite. Moreover, British and Swiss firms account for a sizable fraction of total international bond borrowing (22% and 11%, respectively). To make

[23]For a constrained firm the total impact is equal to -0.878 ($\gamma_1 + \gamma_4 = -0.064 - 0.814$).

sure that the results are not sensitive to their exclusion, removing each group at a time. Our results, shown in Table 7, are stronger when we remove these countries.

Table 7: **Results excluding influential countries:** Summary of the results of estimating the model with the interaction term (ie column 5 on Table 6) excluding firms based in United Kingdom (column 1); based in Switzerland (column 2); and in both countries (column 3). The coefficients of the rest of covariates are not shown. See notes on Table 6.

	(1) Excluding UK	(2) Excluding CH	(3) Excluding UK & CH
BP	−0.228**	−0.142*	−0.228**
	(−2.73)	(−2.39)	(−2.72)
HadlockPierce	−0.231	−0.151	−0.258
	(−1.70)	(−1.62)	(−1.74)
BP*HadlockPierce	−0.131*	−0.093*	−0.136*
	(−2.37)	(−2.21)	(−2.36)
Observations	16440	17614	14707
Uncensored	803	1083	738
Censored	15637	16531	13969
R-squared	0.215	0.222	0.205

These results indicate that firms with higher credit risk borrow more in international markets in response to strong risk appetite. Our measure of credit risk is not related to firms' capital structure, so this pattern can be somehow unnoticed in financial ratio analyses.

5.2 Robustness checks

5.2.1 Influential sectors

We test whether our results are driven by influential sectors. Energy companies in particular need to borrow frequently in international markets to match the currency composition of assets and

liabilities. This issue might also affect utility companies. For these firms, international funding is likely to be less responsive to global risk appetite. Since energy and utility firms are large, typically they are categorized as low risk borrowers (ie weakly constrained) using the Hadlock-Pierce index (see Table A8). This could result in a spurious relation beween low risk and lack of sensitivity to global risk appetite. However our results hold when we remove energy or utility firms; and also when we simultaneously remove both (in particular in this case, they are slightly stronger).

5.2.2 Financial constraints measures

We estimate the model using other variables which can signal constrained access to global markets: firm-size, the Whited-Wu, and Kaplan-Zingales index. The results are similar using firm-size, and are weaker using the Whited-Wu and particularly the Kaplan-Zingales index (Tables C1 C2 and C3 in Appendix C).

We find that higher values of the Kaplan-Zingales index are associated to higher international bond borrowing, reflecting that these firms borrow more than their counterparts in international markets. Firms classified as constrained using the Kaplan-Zingales index seem to have high funding needs, and not necessarily a high *cost* of external finance, which is our interest (Hennessy and Whited [2007]). For this reason we conclude that the results are not inconsistent with the hypothesis.

5.2.3 Global risk appetite measures

We use the VIX, the MOVE, and the US dollar term premium as our measure of global financial conditions. Although as discussed earlier these measures may confound demand and supply effects, it is worth checking the results obtained using them. In particular the VIX is still the most popular measure of risk appetite. We find that in all cases the results hold qualitatively, although the

quantitative importance is smaller in some instances. They are particularly weaker when we US dollar term premium. We think it is not a major problem, given the low unconditional impact of this variable on firms' international bond borrowing (see Table B1).

5.3 Analysts coverage

We use the number of analysts covering each firm to assess informational asymmetries in international markets. Existing empirical evidence suggests that extensive coverage by analysts signals low asymmetries: good coverage reduces informational asymmetries; and analysts tend to extend coverage to more transparent firms (Chang et al. [2016]). We assume that less analyst coverage reflect more uncertainty surrounding the firm. Thus less analyst coverage should be associated to a more costly access to international markets.

To examine the importance of analysts coverage, we split firms into two groups: firms with good (bad) coverage are those with a number of analysts above (below) the average.

Stronger risk appetite leads to higher international borrowing by firms with bad coverage, but does not alter borrowing by firms with good coverage. These results further validate our conclusion: firms perceived as riskier disproportionally borrow when the price of risk is low in international markets.

Table 8: **Informational asymmetries measured with analysts coverage:** The dependent variable are international bond issuances relative to lagged total assets. The first column includes only firms with information on analysts' coverage (so the number of observatins is lower than in Table 6). The second column reports estimations for the subsample of firms with bad coverage (number of analysts covering the firm below the mean). The third column reports estimations for firms with good coverage (number of analysts covering the firm above the median). Models include country and industry fixed effects, and the controls reported in Table 6. Standard errors are clustered at the year-level; t-statistics reported in parentheses.

	(1) Full Sample	(2) Bad Coverage	(3) Good Coverage
BP	−0.064*	−0.111*	−0.006
	(−2.08)	(−2.03)	(−0.64)
Observations	17319	9440	7879
Uncensored	1074	664	410
Censored	16245	8776	7469
R-squared	0.228	0.211	0.350

5.4 Domestic markets

Our hypothesis is based on the premise that domestic and international corporate bond markets are segmented, in the sense that international investors do not acquire securities into domestic corporate bond markets.

We explore if this assumption is sensible re-estimating the main results using as dependent variable domestic (instead of international) bond issuance.

Table 9: **Impact of global risk appetite on domestic corporate bond markets:** See notes on Table 6.

	(1) Baseline	(2) W	(3) Normal	(4) S
BP	0.021	0.008	0.039***	−0.059***
	(1.57)	(1.64)	(17.06)	(−6.82)
Observations	20142	5708	9965	3674
Uncensored	1728	936	692	57
Censored	18414	4772	9273	3617
R-squared	0.184	0.315	0.146	0.242

The results show that global risk appetite does not have a negative impact on international borrowing by the average firm (column 1). This finding validates our assumption.

However we do find a different reaction by firms with normal and strong constraints. The former react by increasing bond issuance in local markets (column 3), while the latter decrese them (column 4). We do not further explore the finding. However it suggests that global risk appetite could indirectly enhance domestic borrowing of firms with high risk. This would ocurr if firms with medium constraints decreased their domestic borrowing, in response to easier access to overseas funding.[24]

[24] A similar indirect effect of global risk appetite into domestic economies have been documented in some emerging economies (Carabin et al. [2015]).

5.5 Discussion

Our findings point out that global risk appetite is transmitted into local economies through the offshore borrowing of smaller, younger companies. These firms are typically more unknown, and are charged a premium by international investors. This measure of credit risk is not related to collateral availability, since the tangible assets ratio has a very low correlation with the Hadlock-Pierce index. Thus risk-taking can ocurr without an apparent increase in issuers' balance-sheet vulnerabilities.

We acknowledge that exchange rates appreciations vis-a-vis the currency of denomination of liabilities can ease funding costs in the presence of currency mismatches between assets and liabilities (Avdjiev et al. [2018a]). We cannot check the issue since lack of data on the currency composition of assets (see Kalemli-Ozcan et al. [2018] for a paper exploring this channel). However we think that our results are not biased, since the strength of the effective exchange rate has a very low correlation with the excess bond premium.[25]

Finally it might seem strange that we have not measured firms' effective credit risk with credit ratings -as in Greenwood and Hanson [2013]. However measuring firms' effective credit risk is challenging in our sample. Credit ratings are rarely available (only in 14% of the firm-year observations). If global risk appetite leads to more borrowing by firms with high expected default risks merits further investigation, but we leave it for further research.

5.6 Limitations

Time-invariant unobserved heterogeneity across firms could potentially bias our results, because we cannot include firm fixed-effects in the Tobit model due to the incidental parameter problem. We have

[25] If we measure the strength of the effective exchange rate as the deviation of the BIS-constructed debt-weighted exchange rates (el Berger [2016]), relative to the last four years moving average.

tried, as a robustness checks, to estimate the model with the correlated random effect estimator, which includes the average of firm-specific variables to account for time-invariant unobserved heterogeneity. However, the maximum-likelihood function did not converge. This is a limitation of our analysis.

6 Onshore transmission: Impact on capital structure

Recent research (Baker [2009]) underscores that credit market developments strongly impact on firms' capital structure. Accordingly we examine how firms' balance-sheets change when risk appetite fosters borrowing in international markets. These changes would reflect the transmission of global risk appetite into domestic activity.[26]

Presumably the effects will be stronger for firms with a more constrained access to international debt markets. To shed light on this issue, we investigate companies' use of proceeds over a three-year horizon, adapting a standard model (see Kim and Weisbach [2008] and Bruno and Shin [2017]) :

$$\begin{aligned} y_{it} &= \beta_1 Assets_{it} + \quad \beta_1 Proceeds_{it} + \beta_2 Revenues_{it} + \\ &+ \quad \beta_3 HadlockPierce_{it} + \beta_4 BP_t + \beta_5 BP_t * Proceeds_{it} + \\ &+ \quad \beta_6 BP_{it} * Revenues_{it} + \\ &+ \quad \alpha_I + \alpha_C + \varepsilon_{it} \end{aligned} \tag{8}$$

[26]This statement is based on the assumption that the bulk of firms' activities are carried out domestically. It can be somehow restrictive, since we measure firms' balance-sheets on a consolidated basis, and some global firms conduct a large fraction of their activities overseas (Avdjiev et al. [2018b]). Accordingly international borrowing could be used to fund offshore operations (for instance, proceeds could be kept overseas, or firms could engage in cross-border takeovers).

The dependent variable y_{it} is, alternatively, the change in net book leverage, the change in cash holdings, and (cumulated) capital expenditures between t and t-3.[27] $Assets_{it}$ is the logarithm of assets measured at t-3. $Proceeds_{it}$ measures international bond proceeds over the last three years (between t and t-3). $Revenues_{it}$ is defined as the cash obtained by the firm in regular operations (ie cash from operations) in the same period. $HadlockPierce_{it}$ is the average Hadlock-Pierce index over the last three years. BP_t is our measure of global risk appetite: the excess bond premium over the last three years (it is standardized, as in the previous section). We restrict the estimation to observations with positive values of international bond proceeds at t-3.

To examine the impact of global risk appetite on firms' use of proceeds, we interact $Proceeds_{it}$ with BP_t. A negative coefficient in the interaction term β_5 would indicate that the impact of international borrowing on firms' capital structure is stronger when risk appetite is high. It is worth mentioning that in this model we are not allowing the impact of global risk appetite to depend on firms' credit risks. In all models we include country and industry fixed effects.

Columns 4, 5 and 6 in Table 10 reports the results (columns 1 to 3 show results of a model without the interaction terms). The impact of international bond proceeds on net book leverage (β_1) is, as expected, positive. We find that the impact is higher if bonds are raised when the market-wide price of risk is cheap (ie the coefficient β_5 of the interaction term has a negative and statistically significant sign). Expansions in risk appetite positively impact on firms' leverage through international borrowing. This impact is reflected in higher firms' capital expenditures and cash holdings.

Next we examine if this impact is stronger on firms with higher credit risk (ie more costly access to international markets); we include two additional terms on the equation:

[27] Leverage and cash holdings are stock variables so the dependent variable is defined as $y_{it} = ln\left[\left(\left(V_t - V_{t-3}\right)/assets_{t-3}\right)+1\right]$, while capital expenditures is a flow variable and it is defined as $y_{it} = ln\left[\left(\sum_{i=1}^{3} V_{t-i}/assets_{t-3}\right)+1\right]$.

$$\beta_7 I[\tau^{HP}] * Proceeds_{it} * BP_{it}$$

$$\beta_8 I[\tau^{HP}] * Revenues_{it} * BP_{it}$$

where $I\left[\tau^{HP}\right]$is a binary variable taking value 1 for firms with limited access to global markets (ie firms with Hadlock-Pierce index above the threshold identified in section 5). β_7 measures the incremental impact (if any) of global financial conditions on the capital structure of strongly constrained firms, through the distinct use they make of international bond proceeds.[28] A negative β_7 would indicate a stronger impact for severely constrained firms. Results are reported in columns 7,8 and 9.

We find the expected result, since β_7 is negative and highly significant: firms with higher credit risk issuing bonds during periods of easy global financial conditions experience a sharper increase in leverage than the rest of firms; this translates into higher cash holdings, and (to a lower extent) capital expenditures. The marginal effects are shown in Table 11.

We conclude that balance-sheet vulnerabilities build up when funding constraints in global bond markets are relaxed due to stronger risk appetite.

[28] β_6 has a similar interpretation, for the use of cash from regular operations.

Table 10: **Use of bonds proceeds:** Results from an use of funds regression where the dependent variable is alternatively change in net leverage, cash holdings, and (cumulated) capital expenditures. I[τ^{HP}] is a binary variable taking value 1 if firms are constrained (ie have Hadlock-Pierce index values above the estimated threshold; this value is 1.15, and corresponds to percentile 88th). 3-year impact. All models include industry and country dummies.* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors are clustered at the year-level; t-statistics reported in parentheses.

	(1) Leverage	(2) Cash	(3) CAPEX	(4) Leverage	(5) Cash	(6) CAPEX	(7) Leverage	(8) Cash	(9) CAPEX
Proceeds	0.399***	0.235***	0.100**	0.376***	0.218***	0.078***	0.366***	0.198***	0.070***
	(6.93)	(4.25)	(3.05)	(8.24)	(5.38)	(3.84)	(10.33)	(6.08)	(4.28)
Revenues	−0.076**	0.305***	0.250***	−0.089**	0.306***	0.242***	−0.092**	0.302***	0.241***
	(−2.62)	(12.37)	(11.54)	(−3.21)	(12.35)	(11.04)	(−3.24)	(12.40)	(10.95)
Assets	0.008	−0.031***	0.011**	0.008	−0.031***	0.012**	0.008	−0.031***	0.012**
	(1.74)	(−8.95)	(2.97)	(1.85)	(−8.93)	(3.06)	(1.78)	(−8.89)	(2.99)
HadlockPierce	0.031**	0.066***	0.082***	0.032**	0.066***	0.082***	0.030**	0.064***	0.082***
	(3.09)	(7.99)	(8.63)	(3.11)	(8.00)	(8.58)	(2.91)	(7.71)	(8.21)
BP	−0.003	−0.025**	0.006	0.024*	−0.025	0.022*	0.012	−0.038*	0.020*
	(−0.50)	(−2.70)	(1.16)	(2.06)	(−1.77)	(2.41)	(0.92)	(−2.52)	(2.34)
BP*Revenues				−0.077*	0.007	−0.045	−0.031	0.053	−0.038
				(−2.21)	(0.24)	(−1.58)	(−0.73)	(1.71)	(−1.84)
BP*Proceeds				−0.148*	−0.104	−0.100**	−0.074	−0.004	−0.048*
				(−2.29)	(−1.43)	(−2.91)	(−1.48)	(−0.08)	(−2.11)
I[τ^{HP}]*BP*Revenues							−0.109*	−0.095	−0.014
							(−2.07)	(−1.88)	(−0.26)
I[τ^{HP}]*BP*Proceeds							−0.276**	−0.286*	−0.147*
							(−2.80)	(−2.32)	(−2.03)
Observations	23804	24581	24075	23804	24581	24075	23804	24581	24075
R-squared	0.033	0.242	0.268	0.035	0.243	0.271	0.037	0.245	0.271
Clusters	482	482	478	482	482	478	482	482	478

Table 11: **Marginal effects:** Marginal effects obtained using the coefficients of columns 3, 6 and 9 in Table 9. Impact of one standard deviation in international bond issuance on the change in net leverage, cash holdings, and cumulated capital expenditures in 3-year impact. This impacted is evaluated at three values of the excess bond premia: easy (1 sd below median), normal (median), and high (1 sd above median); and separately for strongly and weakly constrained firms (ie Hadlock-Pierce index above/below the threshold identified in section 5). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

	A. Leverage		B. Cash		C. CAPEX	
	Weakly	Strongly	Weakly	Strongly	Weakly	Strongly
Easy	0.40***	0.55***	0.20***	0.35***	0.09***	0.17***
Normal	0.39***	0.46***	0.20***	0.27***	0.08***	0.12***
Tight	0.32***	0.14**	0.20***	0.01	0.04	−0.06

7 Conclusions

We use cross-country, micro-level data to better understand the transmission mechanism of global risk appetite across borders.

We document that firms with higher credit risks help to transmit onshore the financial conditions prevailing in international bond markets. Our findings show that small and young firms tend to tap global bond markets when the price of risk is low; in contrast borrowing by larger and older firms is less sensitive to the price of risk. This distinct sensitivity to the price of risk is a consequence of differences in credit spreads. Due to severe informational asymmetries, spreads are generally higher for small and young firms.

These results are consistent with previous research that finds that cycles of international borrowing are strongly related to global risk appetite. Our contribution consists in showing that this response varies across firms; in particular we stress the importance of informational asymmetries between firms and international investors.

Our findings show that global risk appetite can trigger an influx of risky firms in international bond markets. This pattern can remain unnoticed in financial ratio analyses, since the measures of firms' credit quality which we exploit are independent of firms'capital structure. However, we find that international bond issuances lead, over a three-year horizon, to some deterioration in the financial ratios of risky borrowers.

These results unveil a micro-level link between risk appetite in international corporate bond markets, and the build-up of domestic risks. Through their fund raising in international bond markets, firms with higher credit risk link their local economy with the global financial cycle.

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A Data description

A.1 Data definition. Macro and global controls

Table A1: **Summary Statistics:**

	Mean	Median	SD	Min	Max
Macro Variables					
GDP per capita	2.7	2.1	2.3	0.046	0.1
GDP growth	3.3	3.2	2.8	−13	14
Sovereign Rating	17	20	4.9	0	21
Interest Rate	5	3.6	5.9	−64	66
Industry Variables					
Industry ROA	4.6	4.1	2.6	−7.3	12
Industry ROE	13	13	6.2	−16	29
Global Factors					
World GDP growth	2.7	2.8	1.4	−.86	4
VIX	23	19	11	11	58
MOVE	96	93	35	60	208
US term premia	1.2	1.4	0.83	0.081	2.3
Financial Depth(% GDP)					
Bank Credit)	90	96	53	1.2	200
Corporate Bonds	4.3	2.8	4.9	0	34
Financial Depth	102	122	54	1.2	200
Financial Depth	106	117	55	6	218
Offshore Lending	110	127	56	6	219

Table A2: **Description Variables**

Variable	Description	Source
Global factors		
VIX	Chicago Board Options Exchange Volatility Index	CBOE
MOVE	Merrill Lynch Option Volatility Estimate	Merril Lynch
Dollar term premia (DTP)	10 year treasury term premia	NY Fed
Excess bond premium (BP)	Risk appetite in the US corporate bond market	Gilchrist-Zakrajsek (2012)
World GDP growth	Year-over-year growth, on a quarterly basis.	Nat.accounts
Industry Variables		
ROA	Median constituents SP1200 (rating above A), Dec. 2015	Bloomberg
ROE	Median constituents SP1200 (rating above A), Dec. 2015	Bloomberg
Financial Depth		
Bank credit	Outstanding bank claims on private sector (%GDP)	IFS, WEO
Equity market	Stock market capitalisation (%GDP)	WDI, WEO
Bonds market	Outstanding volume of corporate bonds (%GDP)	Bloomberg, WEO
Domestic financial depth	Bank credit plus bonds oustanding (%GDP)	IFS, WDI, BIS, WEO
Macro variables		
GDP per capita	GDP in per capita termsç	WEO
Domestic GDP growth	Year-over-year growth, on a quarterly basis.	National accounts
Sovereign rating	S&P rating	S&P
Financial Depth	Bank credit plus size bond markets	IFS, WDI, BIS, WEO

A.2 Bond data

Consolidated information

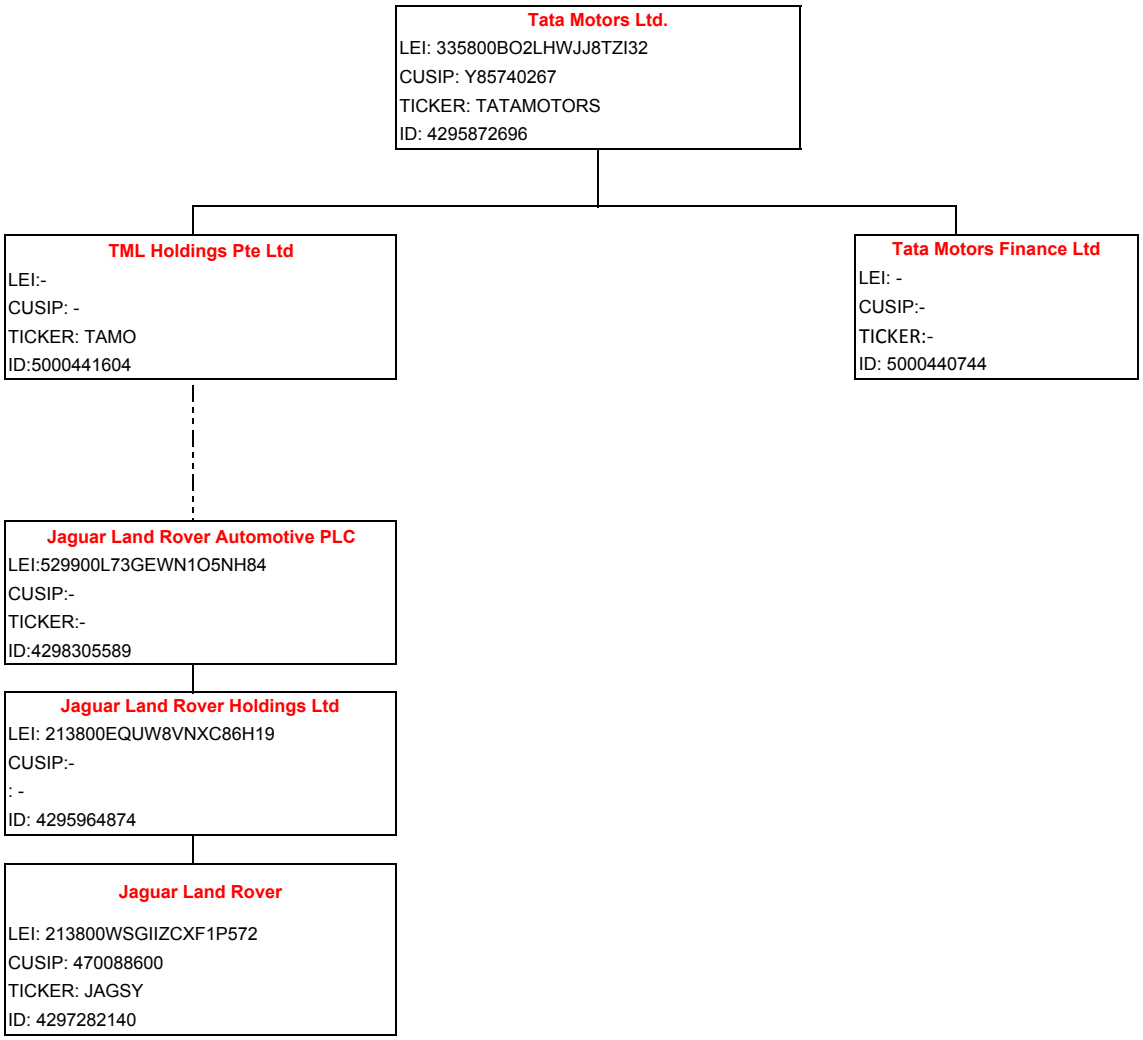
We measure firms' bond issuance at a consolidated level. We decide to gather all bonds explicitely guaranteed by a company, including those issued by affiliates. But we leave aside bonds issued by affiliates, when the liabilities do not have explicit guarantee from their parent company.

Graph A1 illustrates this criterion using as an example the Tata Motors Ltd. group.Tata Motlrs Ltd. owns Jaguar Land Rover, through a holding company incorporated in Singapore (TML Holdings Pte Ltd.). Bonds issued by Jaguard Land Rover Automotive PLC (or its affiliates) are not guaranteed by Tata Motors Ltd. Accordingly it is treated as a standalone company (this is reflected in the dash line linking both entities). In contrast Tata Motors Ltd. guarantees bonds raised by Tata Motors Finance Ltd.

Market classification

We define international bonds as those issued in a market different from the country of incorporation of the company (ie the entity backing the bond). We use the primary market to classify bonds as domestic or international securities. Accordingly a bond issued by a Chilean company in New York, and subsequently listed in Chile is an international bond.

Figure A1: **Firms 'organizational structure and complexity in funding patterns:** Jaguard Land Rover Automotive PLC is ultimately owned by Tata Motor Ltd. However its debt is not guaranteed by Tata.



A.3 Firm-level data

Table A3: **Description key firm-level items:**

Short-term debt Includes bank overdrafts, short-term debts and borrowings, repurchase agreements (repos) and reverse repos, short-term portion of long-term borrowings, current obligations under capital (finance) leases,current portion of hire purchase creditors, trust receipts, bills payable, bills of exchange, bankers acceptances, interest bearing loans, and short term mandatory redeemable preferred stock.
Long-term debt All interest-bearing financial obligations that are not due within a year. Includes convertible, redeemable, retractable debentures, bonds, loans, mortgage debts, sinking funds, and long-term bank overdrafts.
Total debt Sum of short-term and long-term debt.
Net income The profit after all expenses have been deducted. Includes the effects of all one-time, non-recurring, and extraordinary gains, losses, or charges.
Depreciation The total expense over time that reduces the book value of fixed assets, subtracted from gross fixed assets to arrive at net fixed assets.
Gross fixed assets Those assets of a permanent nature required for the normal conduct of a business, and which will not normally be converted into cash during the ensuring fiscal period. May include investment properties if disclosed under net fixed assets by the company. May include intangible fixed assets such as easements and land rights.
Net fixed assets Gross fixed Assets less amounts of Accumulated Depreciation.
Total equity Firm's total assets minus its total liabilities
Current assets The total of all Current Assets as reported. This is the summation of cash, cash equivalents, marketable securities, other short-term investments, accounts, notes receivable,inventories, and other current assets. Includes accrued income.
Net sales Calculated by adding Sales/Revenue/Turnover for the last four quarters, two semi annuals, or annual.
Total assets The total of all short and long-term assets as reported on the Balance Sheet.
Tobin's Q Ratio of the market value of a firm to the replacement cost of the firm's assets: (Market capitalisation + Total liabilities + Preferred equity + Minority interest) / Total assets
Dividends Includes dividends actually paid out as cash disbursements for both common shareholders and preferred shareholders. May include dividends paid to minority interests and dividends paid by subsidiaries if they are not disclosed separately.
Year incorporation Year of incorporation

Table A4: **Description main indexes:**

Bloomberg European 500 Index: free float capitalization-weighted index of the 500 most highly liquid capitalized European companies.
MSCI Pan-Euro Index: subset of the broader MSCI Europe Index. It was created to serve as the basis for derivative contracts, exchange traded funds and other passive investment products. The index comprises large and liquid securities with the goal of capturing 90% of the capitalization of the broader benchmark.
FTSE 350: capitalization-weighted index comprising of all the components of the FTSE 100 and the FTSE 250. The index represents approximately 90% of the U.K. equity market by capitalization.
Bloomberg World Index: capitalization-weighted index of all equities included in the Bloomberg World Index Series. Equities in the series are in the top 85% market capitalization of their respective classification sector.
CRSP US Total Market Index: index blending advancements in academic research with current commercial practice in a fundamentally sound manner under the premise that an index must reflect the way in which money managers actually invest. Includes securities traded on NYSE, NYSE Amex, NASDAQ or NYSE Arca.
S&P Emerging BMI: all companies domiciled in the emerging markets within the S&P Global BMI with a float-adjusted market capitalization of at least US$ 100 million and a minimum annual trading liquidity of US$ 50 million.
S&P/ASX 200 Index: measures the performance of the 200 largest index-eligible stocks listed on the ASX by float-adjusted market capitalization. Representative liquid and tradable, it is widely considered Australia's preeminent benchmark index.
OMX Stockholm 30 Index: consists of the 30 most actively traded stocks on the Stockholm Stock Exchange and is a market weighted price index. The composition of the OMXS30 index is revised twice a year.
FTSE All-Share Index: capitalization-weighted index comprising of the FTSE 350 and the FTSE SmallCap Indices. The index was developed with a base value of 100.00 as of April 10, 1962.
New Zealand Exchange 50 Gross Index: modified market capitalization weighted index. This index consists of the top 50 companies by free float adjusted market capitalization that are listed on the New Zealand Exchange Limited.
FTSE Australia Index: free float market capitalization weighted index. FTSE World Indices include constituents of the Large and Mid capitalization universe for Developed and Emerging Market segments. Base Value 100 as at December 31, 1986.
S&P/Toronto Stock Exchange Composite Index: capitalization-weighted index designed to measure market activity of stocks listed on the TSX. The index was developed with a base level of 1000 as of 1975.
FTSE Canada Index: free float market capitalization weighted index. FTSE World Indices include constituents of the Large and Mid capitalization universe for Developed and Emerging Market segments.
Swiss Market Index: an index of the largest and most liquid stocks traded on the Geneva, Zurich, and Basel Stock Exchanges.

Table A5: **Description firm-level financial ratios:**

Size (Total assets, US mn): logarithm of total assets measured at US 2000 dollars, and capped at percentile 95.
Age: Difference between current year and year of incorporation, capped at percentile 95.
Tangible assets: Net fixed assets to lagged total assets.
Return-on-Equity (ROE): Net income to lagged total assets.
Book leverage: Total debt (sum of short and long-term debt) divided by lagged total assets.
Cash flow to capital ratio: cash flows from operations divided by lagged total assets.
Debt to capital flow ratio: total debt divided by total debt plus equity.
Cash to capital ratio: current assets to lagged total assets.

Table A6: **Correlation financial constraint indexes:**

	Kaplan-Zingales	**Whited-Wu**	**Hadlock-Pierce**
Kaplan-Zingales	1		
Whited-Wu	-0.0252	1	
Hadlock-Pierce	-0.1889	0.3953	1

Table A7: **Severity of financial constraints in international markets. Firm-year observations by category and country of headquarters:** Firms classified according to the Hadlock-Pierce index; weakly(strongly) constrained firms are those in the bottom (top) of constraints. We use the Hadlock-Pierce to measure constraints in international markets due to informational asymmetries.

	Full sample	**Weakly constrained**	**Normal**	**Strongly constrained**
AE	435	72	262	101
AR	382	49	230	103
AU	1000	359	543	98
BG	96	0	11	85
BR	2195	1036	999	160
CA	2592	842	1373	377
CH	2302	537	1087	678
CL	269	83	178	8
CO	313	146	135	32
DK	1081	183	420	478
EC	64	2	21	41
EE	135	0	16	119
EG	261	19	164	78
GB	4010	1115	2192	703
HU	156	24	54	78
ID	938	115	543	280
IN	4798	1066	2501	1231
KR	988	617	336	35
LT	173	0	1	172
MA	193	24	121	48
MX	364	179	170	15
MY	1481	218	786	477
NG	346	14	203	129
NO	232	87	133	12
NZ	434	72	247	115
PE	310	13	195	102
PH	542	138	259	145
PL	509	30	251	228
RO	37	8	29	0
RS	138	0	16	122
RU	1038	277	679	82
SA	381	63	287	31
SE	2462	513	702	1247
SI	74	0	74	0
SK	48	0	20	28
TH	1254	54	696	504
TR	818	194	470	154
UA	118	0	79	39
VE	32	8	23	1
ZA	1269	410	628	231

Table A8: **Hadlock-Pierce index, by sector:** This table reports the average, median, and percentiles 25 and 75 of the Hadlock-Pierce index by firms in each industry.

	mean	p50	p25	p75
Basic Materials	-0.1987	-0.3039	-0.8725	0.2979
Communications	-0.1447	-0.3374	-0.8063	0.3605
Consumer Discretionary	0.1152	0.0648	-0.5240	0.6330
Consumer Staples	0.1494	0.0434	-0.5606	0.7343
Energy	-0.3903	-0.5107	-1.0100	0.0368
Health Care	0.0466	0.0647	-0.4994	0.5921
Industrial	0.0632	-0.0309	-0.5638	0.6059
Technology	0.5929	0.5848	-0.2810	1.4200
Utilities	-0.5331	-0.5683	-1.0920	-0.0409
Total	-0.0097	-0.1185	-0.7048	0.5436

B Global risk appetite: Stylized facts

Table B1: **Correlation matrix. Global risk appetite:** VIX is the Chicago Board Options Exchange Volatility Index; MOVE is the Merrill Lynch Volatility Estimate; DTP is the 10 year treasury term premium; BP is the excess bond premium, obtained from Gilchrist and Zakrajsek (2012)

	VIX	MOVE	DTP	BP
VIX	1			
MOVE	0.8403	1		
DTP	0.5071	0.682	1	
BP	0.8433	0.7128	0.3438	1

Table B2: **Global risk appetite and firms' international bond borrowing:** Coefficients of a plain Tobit estimation of international bond issuance on different measures of global credit supply: the VIX, MOVE and US term premium (DTP), and the excess bond premium (BP).

	(1) VIX	(2) MOVE	(3) DTP	(4) BP
model				
β	-119.4^{***}	-129.9^{***}	-39.44	-152.6^{***}
	(-4.31)	(-4.77)	(-1.50)	(-5.38)
N	25597	25597	25597	24795

C Additional results

Figure C1: **Distribution of the Hadlock-Pierce index for firms issuing international bonds:**The chart compares the density function of the Hadlock-Pierce index of firms issuing bonds during periods of strong and weak risk appetite; these periods correspond to the 10 quarters when the excess bond premium is lower and higher. The chart shows that when risk appetite is strong the distribution shifts to the right; this underscores that firms issuing international bonds when risk appetite is high are riskier.

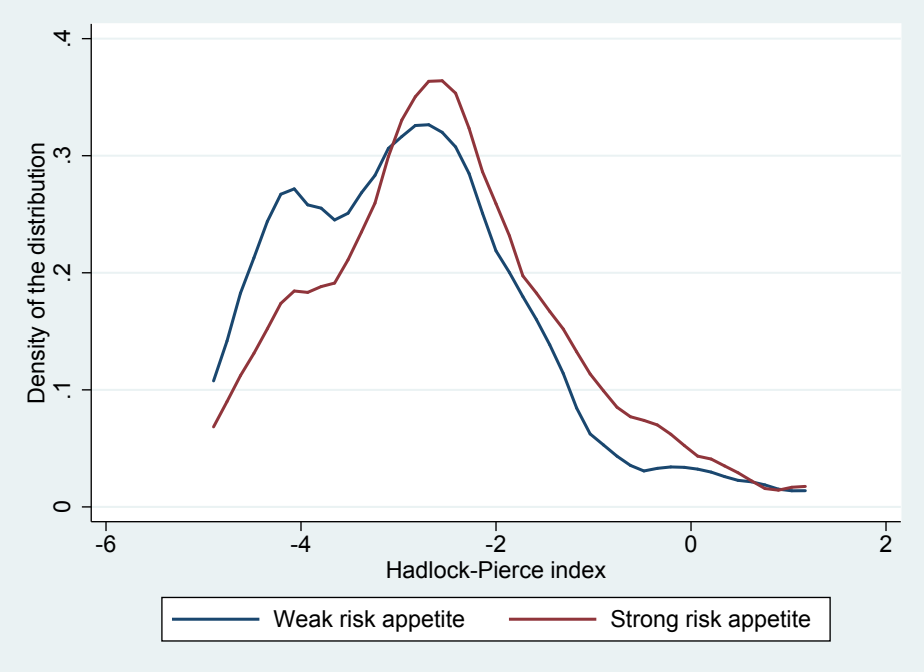


Table C1: **Financial constraints measured with firms' size:** See notes to Table 6.

	(1) Baseline	(2) W	(3) Normal	(4) S	(5) Interaction	(6) Threshold
Tangible Assets	0.109	0.009	0.493	−2.476**	0.107	0.103**
	(1.43)	(1.26)	(1.73)	(−2.81)	(1.43)	(2.76)
ROE	0.001	0.000	0.011*	−0.237***	0.001	0.001
	(0.80)	(0.93)	(2.40)	(−57.67)	(0.77)	(0.56)
Book Leverage	0.812**	0.174***	2.750*	34.989***	0.810**	0.826***
	(3.12)	(8.04)	(2.49)	(17.63)	(3.10)	(8.68)
GDP per capita	−0.101	−0.013	−0.888	1.093	−0.105	−0.094*
	(−1.75)	(−1.18)	(−1.53)	(1.42)	(−1.73)	(−2.07)
ΔGDP	0.001	0.006	−0.361	1.849***	0.005	0.008
	(0.04)	(0.96)	(−1.11)	(3.72)	(0.18)	(0.21)
ΔWorldGDP	−0.034	−0.008*	0.211	−5.108***	−0.034	−0.037
	(−1.41)	(−2.07)	(0.80)	(−25.37)	(−1.35)	(−1.33)
Sovereign Rating	−0.020	−0.008	0.192	14.405***	−0.020	−0.023
	(−0.89)	(−1.92)	(0.69)	(201.10)	(−0.91)	(−1.05)
FD	−0.052	−0.017	−0.406	−32.353***	−0.067	−0.064
	(−0.52)	(−1.30)	(−1.05)	(−53.93)	(−0.70)	(−1.00)
BP	−0.069*	−0.006*	−0.265	−8.017***	−0.157*	−0.057*
	(−2.36)	(−2.17)	(−1.29)	(−14.98)	(−2.35)	(−2.40)
BP*Size					0.095*	
					(2.23)	
I[τ^{Size}]*BP						−1.107***
						(−9.95)
Observations	20142	8036	6937	5167	20142	20142
Uncensored	1193	1083	104	6	1193	1193
Censored	18949	6953	6833	5161	18949	18949
R-squared	0.226	0.278	0.113	0.460	0.228	0.234

Table C2: **Financial constraints measured with Whited-Wu index:** See notes to Table 6.

	(1) Baseline	(2) W	(3) Normal	(4) S	(5) Interaction	(6) Threshold
Tangible Assets	0.109	0.039	0.170***	0.372	0.246	0.250***
	(1.43)	(1.89)	(10.48)	(1.62)	(1.61)	(3.92)
Size	0.294***	0.075***	0.208***	1.298***	0.401**	0.371***
	(3.84)	(8.28)	(96.63)	(59.73)	(2.80)	(15.00)
ROE	0.001	0.010	0.017*	0.196*	−0.052	−0.060
	(0.80)	(0.67)	(2.44)	(1.99)	(−0.68)	(−1.02)
Book Leverage	0.812**	0.204***	0.981***	3.839***	0.905**	0.923***
	(3.12)	(3.32)	(23.35)	(8.46)	(2.93)	(5.68)
GDP per capita	−0.101	−0.013	−0.015	−0.507***	−0.081	−0.090
	(−1.75)	(−0.40)	(−1.78)	(−5.17)	(−1.08)	(−1.28)
ΔGDP	0.001	0.021	−0.044***	−0.977***	−0.026	−0.025
	(0.04)	(1.43)	(−6.68)	(−11.51)	(−0.68)	(−0.40)
ΔWorldGDP	−0.034	−0.016	−0.001	0.216***	−0.027	−0.026
	(−1.41)	(−1.01)	(−0.29)	(3.69)	(−0.72)	(−0.56)
Sovereign Rating	−0.020	0.007	0.037***	−0.124***	0.035	0.033
	(−0.89)	(0.77)	(36.74)	(−10.60)	(0.73)	(0.81)
FD	−0.052	−0.089*	−0.014	0.743***	−0.130	−0.129
	(−0.52)	(−2.41)	(−1.50)	(4.97)	(−0.69)	(−1.13)
BP	−0.069*	−0.018	−0.024***	−0.256***	−0.100	−0.070
	(−2.36)	(−1.40)	(−5.72)	(−4.34)	(−1.92)	(−1.61)
Whited-Wu					0.182	
					(0.68)	
BP*WhitedWu					−0.016	
					(−0.51)	
I[τ^{WW}]*BP						−0.115
						(−1.58)
Observations	20142	3048	3050	2842	8940	8940
Uncensored	1193	434	171	70	675	675
Censored	18949	2614	2879	2772	8265	8265
R-squared	0.226	0.231	0.199	0.248	0.167	0.167

Table C3: **Financial constraints measured with Kaplan-Zingales index:** See notes to Table 6.

	(1) Baseline	(2) W	(3) Normal	(4) S	(5) Interaction	(6) Threshold
Tangible Assets	0.109	0.091***	0.346	0.187	0.227	0.256***
	(1.43)	(4.75)	(1.03)	(1.58)	(1.42)	(3.76)
Size	0.294***	0.162***	0.343**	0.307*	0.308***	0.328***
	(3.84)	(64.28)	(2.77)	(2.42)	(4.05)	(12.28)
ROE	0.001	0.401***	−1.442	−0.033	−0.097	−0.129
	(0.80)	(18.61)	(−1.09)	(−0.41)	(−0.73)	(−1.62)
Book Leverage	0.812**	0.176*	0.731	0.230	0.092	0.771***
	(3.12)	(2.04)	(1.09)	(0.82)	(0.43)	(4.37)
GDP per capita	−0.101	0.009	−0.163	−0.036	−0.066	−0.075
	(−1.75)	(0.92)	(−1.07)	(−0.38)	(−0.80)	(−0.92)
ΔGDP	0.001	0.031*	−0.071	0.006	−0.019	−0.024
	(0.04)	(2.38)	(−0.58)	(0.10)	(−0.46)	(−0.36)
ΔWorldGDP	−0.034	−0.070***	−0.026	0.031	−0.030	−0.022
	(−1.41)	(−24.49)	(−0.29)	(0.87)	(−0.76)	(−0.45)
Sovereign Rating	−0.020	−0.062***	0.065	0.072	0.050	0.045
	(−0.89)	(−49.07)	(0.83)	(1.11)	(0.99)	(1.06)
FD	−0.052	0.217***	0.110	−0.405	−0.105	−0.118
	(−0.52)	(22.62)	(0.30)	(−1.50)	(−0.50)	(−0.98)
BP	−0.069*	−0.044***	−0.189	−0.029	−0.079	0.086
	(−2.36)	(−10.56)	(−1.44)	(−0.85)	(−1.90)	(0.99)
Kaplan-Zingales					0.220	
					(1.82)	
BP*KaplanZingales					−0.040	
					(−0.95)	
I[τ^{KZ}]*BP						−0.196*
						(−2.25)
Observations	20142	2173	2544	2515	7232	7232
Uncensored	1193	86	246	297	629	629
Censored	18949	2087	2298	2218	6603	6603
R-squared	0.226	0.353	0.140	0.131	0.150	0.147

D Threshold identification. Methodology

We formally identify thresholds adapting the methodology put forward by Hansen [1999]. The method, implemented by adapting likelihood ratio tests, consists in estimating the model defined by equations (2) and (10)

$$\overset{*}{y}_{ijt} = \begin{cases} y_{ijt} & if \quad y_{ijt} > 0 \\ 0 & if \quad y_{ijt} \leq 0 \end{cases} \tag{9}$$

$$y_{it} = \beta' x_{ijt} + \gamma_1 BP_t + \gamma_2 BP * I\left[\tau^{FC}\right] + \alpha_k + \alpha_j + \varepsilon_{ijt} \tag{10}$$

for a large number of thresholds, along the domain of financial constraints. The potential threshold $\tau^*$is the value of τ^{FC}which minimizes the sum of squared residual -$SSR(\tau^*)$-. To test if the threshold is significant, the likelihood ratio function is constructed:

$$LR(\tau) = \frac{SSR(\tau) - SSR(\tau^*)}{\sigma^2} \tag{11}$$

where $SSR(\tau)$is the sum of squared errors of the model estimated for τ; $SSR(\tau^*)$is the minimum sum of squared errors; and σ^2 is the variance of the model estimated without the interaction between the excess bond premium and the threshold (linear model). The critical values are tabulated and obtained as $c(\alpha) = -2 * log\left(1 - (1-\alpha)^{\frac{1}{2}}\right)$. In our case, we divide the domain of the measure into 500 data points, comprised between percentiles 10 and 90[29].

[29]Following recommendations, we avoid identifying thresholds on the tail, since the aim is to break the domain into samples with material importance.

Figure D1: **Likelihood ratio function:** Likelihood ratio function plotted over the domain of each financial constraint measure, and agaisnt the histogram of that variable. Panels A, B, C and D exhibit respectively the results when financial constraints are measured with firm size, Kaplan-Zingales, Whited-Wu, and Hadlock-Pierce indexes. In each panel the threshold is the point where the function takes its lowest value -by construction, zero. Standard errors are clustered at the year-level; t-statistics reported in parentheses.

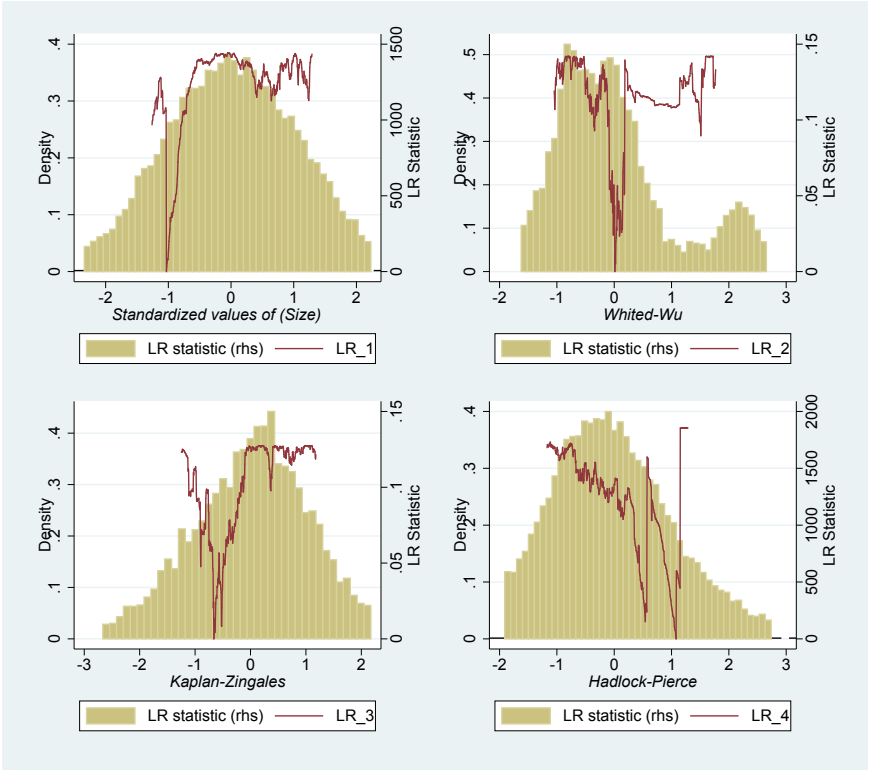


Table D1: **Subsamples defined using estimated thresholds. Hadlock-Pierce Index:**The threshold with the Hadlock-Pierce is -0.02, and the proportion of constrained firms is 57% (also, higher values of the HP index). See Table 4 for a description of the variables.

Below threshold (weakly constrained)	mean	p25	p50	p75	sd
Size (Assets, US mn)	13253	2477	5412	12695	26517
Cash Flow to Fixed Assets Ratio	0.61	0.37	0.55	0.75	0.4
Tobin's Q	10.17	1.01	1.29	1.84	84.68
Tangible Assets	0.81	0.47	0.75	1.07	0.47
Book Leverage	0.27	0.15	0.27	0.38	0.16
Cash to Fixed Assets Ratio	0.41	0.23	0.37	0.55	0.24
Hadlock Pierce Index	-2.05	-2.57	-1.99	-1.48	0.68
Age	31.92	13	28	45	23.24
Above threshold (strongly constrained)	mean	p25	p50	p75	sd
Size (Assets, US mn)	576	135	360	817	622
Cash Flow to Fixed Assets Ratio	0.74	0.44	0.63	0.91	0.5
Tobin's Q	7.3	0.96	1.34	2.17	61.18
Tangible Assets	0.84	0.45	0.74	1.12	0.53
Book Leverage	0.21	0.05	0.17	0.32	0.2
Cash to Fixed Assets Ratio	0.52	0.28	0.47	0.71	0.3
Hadlock Pierce Index	0.45	-0.51	0.02	0.92	1.39
Age	17.75	7	13	21	16.4

The results are summarized graphically in Graph D1, which plots the likelihood-ratio function against the distribution of financial constraints, as well as critical values at 1%. The bottom-right panel plots the results the threshold identified for the Hadlock-Pierce index (at a value of 0.02, and statistically significant).[30] 12% of the firms are below the threshold, and classified as constrained (ie, with values of the Hadlock-Pierce index below this value). Table D1 compares firms below and above the threshold identified for the Hadlock-Pierce index: by construction unconstrained firms have lower Hadlock-Pierce indexes, being older and larger.

[30]This is a test of the statistical significance of the threshold, assuming it exists. Testing the existence of the threshold is complex, since the asymptotic distribution of the relevant F-statistic is non-standard, and critical values cannot be tabulated (Hansen [1999]).

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