Insolvency resolution and the missing high yield bond markets

Bo Becker and Jens Josephson*

Abstract. In many countries, costly bankruptcy procedures force insolvent firms to restructure out of court. We develop a model where dispersed bond investors as well as large banks provide credit to firms. Banks have a bargaining advantage out of court, but convex capital costs. The model predicts that all firms use bank financing. Among large firms, safer firms always issue bonds (alongside loan financing). Riskier firms only use the bond market when bankruptcy works well (because bondholders dislike out of court negotiations). The model matches empirical patterns: across countries, efficient bankruptcy is associated with more bond issuance by risky, but not by safe, borrowers. We use insolvency reforms as natural experiments to confirm this pattern within countries.

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Most external financing to corporations is debt, i.e. financing with a fixed horizon and a predetermined repayment schedule. And most corporate debt, in most countries, is bank loans. In a small number of countries, however, corporate bonds make up a large share of corporate debt. Prominent among these countries is the US. Publicly listed US firms get more funding from bonds than from loans.[1] This is not typical: European publicly listed companies have twice the amount of loans outstanding as bonds. For Asian firms, bank loans are far more important than bonds as a source of financing (see Figure 2).

This international variation in the corporate debt mix cannot easily be explained by standard models of bank loan-bond choice, which focus on the superior monitoring ability of banks (Diamond 1991) or the fixed costs associated with bond issuance (e.g. Bhagat and Frost 1986). These forces do not vary in an obvious way across countries, especially not on the scale that could plausibly cause these wide differences in debt mix. After all, firms need monitoring both in France and Canada, and banks presumably screen and monitor their small and large borrowers with approximately the same technology in different countries.[2] Additionally, standard models struggle with the willingness of large firms to switch between bond and loan markets (Becker and Ivashina 2014) and their tendency to use both loans and bonds simultaneously.

We propose that an explanation of both cross-firm and cross-country patterns is offered by variation in how insolvency and default is handled. Countries exhibit substantial differences in how creditors in insolvent firms are treated: recovery rates in a relatively simple bankruptcy of a firm with tangible assets range from negligible to

[1] In the United States, non-financial non-farm corporate business had $3.0 trillion of loans and $5.6 trillion of bonds and commercial paper outstanding at the end of the third quarter of 2012 (Flow of Funds 2012Q3).

[2] These theories do much better in explaining cross-firm variation in the debt mix, such as the fact that large firms issue bonds but small firms do not.

above 90% (Djankov, Hart, McLiesh and Shleifer 2008).[3] The differences in bankruptcy recoveries can be traced to poor liquidation decisions by courts; sluggish and bureaucratic decision-making in firms during bankruptcy proceedings; legal delays; lack of funding while in bankruptcy (perhaps reflecting debt overhang); as well as the direct costs of the process, including fees to lawyers, administrators and professionals. Most insolvencies are handled outside of court in places where bankruptcy is very inefficient.[5]

To understand the effects of poor bankruptcy on corporate debt markets, we model the effect of insolvency resolution on firms that can chose between two forms of debt, bank loans and bonds, and which can chose to resolve any insolvency in or out of court. Banks have relatively higher funding costs (due to a convex cost of capital), but a bargaining advantage in default. When a firm is in distress, it can either resolve the situation in bankruptcy, or out of court, where more total value is produced but sharing depends on bargaining power which favors concentrated lenders (banks). Crucially, we model in-court bankruptcy as fair – i.e. respecting of dispersed bondholders' rights. If the formal bankruptcy system delivers good overall payoffs, insolvency can be resolved in court and weak claimants such as bondholders get fair treatment. But if the bankruptcy system is poor, insolvency has to be resolved out of court. In this setting, bargaining power favors banks over bond holders, and banks can extract some value

[3] We use the term bankruptcy to refer to any in-court procedure for resolving insolvency. This corresponds to US terminology. Many countries use different names for different procedures (e.g. "Scheme of Arrangement" in the UK). The legal variations are many and complex, but all in-court procedures tend to grant some parties rights that they lack outside of court, and most involve some ability to "cram down" a restructuring plan that not all creditors agree to. Oversight of managers is always involved, either by court or by a court-appointed officer, and is sometimes considerable.

[5] See for example Jostarndt and Sautner (2010), who undertake a detailed study of distressed German firms. Germany had low efficiency according to the World Bank measure we use: only 57% average creditor recovery in 2005. Jornstarndt and Sautner show both that restructuring is frequently accomplished out of court, and that bankruptcy tends to result in liquidation. This is consistent with the mechanism we emphasize.

from bondholders (by forcing them to make concessions).[7] Ex ante, bond holders require higher promised payments (a high interest rate) as compensation. In this model, safe firms tend to issue bonds to take advantage of risk sharing benefits while, high-risk firms (for which insolvency is more likely) will tend to issue bonds when bankruptcy is efficient, but are forced to rely more on bank loans when bankruptcy is inefficient.

Our model is consistent with two key stylized facts: (1) that small firms never issue bonds, and (2) that firms which issue bonds typically also have bank loans. In a large international panel data set, we confirm that firms with outstanding bonds tend to maintain non-trivial bank debt on their balance sheets. This finding implies that for large firms, theories that predict a bang-bang choice of first bank loans and then bonds struggle to fit the data.[10] However, the result does not necessarily reject possible information advantages of banks.[11]

Our model also makes two novel predictions: (1) low-risk firms are able to use bonds regardless of the quality of the bankruptcy system and (2) high-risk firms will issue bonds if the bankruptcy system works well (to take advantage of the low cost of bond financing) but rely on loans if the bankruptcy system works poorly (because firms find it expensive to compensate bondholders for the expropriation by banks that they suffer in distress). In a large panel of countries containing several large changes in how bankruptcy works due to legal reforms, we document that both cross-sectional

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[7] Although perhaps intuitively appealing, our assumption that large players have better bargaining power than small dispersed players is not universally true in bargaining games. We discuss this issue below.

[10] Our model is not unique in predicting a mix. Boot and Thakor (1997) discuss a possible extension of their model where they envision that firms optimally *"balance the benefits of bank monitoring and financial market information aggregation"* so that firms with high moral hazard problems chose more bank debt and those with less asymmetric information use market debt. In this model, firms may mix bonds and loans. Our model goes further: all firms will have a little bit of bank loans. Hackbarth, Henessy and Leland (2007) develop a model of bank debt, equity and bonds which also has the feature that larger firms tend to mix bonds and loans. These models do not link the mix to cross-country variation in the overall efficiency of bankruptcy (see the next paragraph).

[11] According to Diamond (1991), better known firms are more likely to issue bonds. In our panel data, we find evidence directionally consistent with this theory, but not with a bang-bang solution.

differences in bankruptcy recovery rates and patterns around bankruptcy reforms are associated with these predictions. Measures of bankruptcy efficiency explain the debt mix of high risk firms, but are much less correlated with the debt mix of safer firms. Reforms that are associated with improvements in bankruptcy recovery rates increase bond usage. This pattern applies to the capital structure of riskier firms.

Our model abstracts from a large set of potential determinants of the size of bank loan and bond markets. For example, banks may be used as vehicles of government subsidies (to the extent that this only affects average cost of funding and not the risk aversion of banks, it is consistent with our model). Bond markets may require certain institutional arrangements, transparency and liquidity, and the existence of institutional investors.[15] However, the corporate bond market is well integrated internationally. Many bonds of European issuers are issued in the UK and many bonds of global issuers are issued in the US. Furthermore, the legal formats (covenant structure, debentures etc.) tend to be standardized internationally, many corporate bonds are issued in just a handful of international currencies, and many bond investors buy foreign-issued bonds. This limits the scope for issuers' nationality to affect market liquidity and depth. Bankruptcy rules are different: insolvency is almost universally resolved in the home country.[16] Thus, bankruptcy offers a possible source of cross-country variation in bond market development even if trading is organized in a global market.

Additionally, business cycles may affect the corporate debt mix, since bonds are less pro-cyclical than bank loans (Becker and Ivashina 2014). However, our results hold

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[15] Indirect evidence of the importance of liquidity can be gleaned from the pricing of bonds: more liquid corporate bonds trade at lower yields. See, e.g. Bao, Pan and Wang (2011).

[16] In many countries, this practice follows the Model Law on Cross-Border Insolvency promulgated by the United Nations Commission on International Trade Law ("UNCITRAL"). See http://www.uncitral.org/uncitral/en/uncitral_texts/insolvency.html for the initial 1997 model law and subsequent updates as well as a list of adopting countries. The European Union has different law, but embraces similar principles. There exist a few notable exceptions where firms have resolved distress abroad.

in a cross-section of countries, for a multi-year period, and so do not appear to be time specific.

We argue that endogeneity of bankruptcy reforms -- that reform may happen at a time when bond markets are developing without causing this development -- is unlikely to explain the empirical patterns that we document, simply because of the complexity of insolvency law. In recent years, bankruptcy reform all over the world has often been compelled by a desire to make liquidation less frequent, inspired by the US experience with Chapter 11 (which was introduced in 1978). The process of adapting and adjusting US legal concepts (such as debtor-in-possession financing) to new legal environments has proven technically challenging. Thus, reform has been slow and deliberate.[17] For this reason, the local macro-economy is unlikely to be a short-term driver of bankruptcy reform. We discuss some specific bankruptcy reform efforts in more detail below.

Our conclusions about the link between bankruptcy and bond markets have important policy implications. Using a back-of-the envelope calculation, bringing all countries up to US bankruptcy efficiency would increase the corporate bond market size by almost $1 trillion, or around a quarter of the current size (in our sample, which excludes several countries). Much of this increase would happen in high yield bonds. Assuming that this new bond dent would displace bank loans, this would constitute a large change of corporate debt structures. In fact, such a shift would close around half the gap in debt mix between the US and other countries. In this sense, insolvency resolution appears to be one of the main drivers behind "missing" corporate bond markets in many countries. Increasing the share of bonds in corporate debt could offer several potential benefits: (a) reduce exposure of firm funding to the relatively large cycles in the bank loan supply (see e.g. Becker and Ivashina 2014; Chava and

[17] An example of the lengthy process of bankruptcy reform is given by the US A congressional commission introduced a legislative proposal in 1973, but it took another five years before congress passed The Bankruptcy Reform Act of 1978.

Purnandam 2009; and Jiménez, Ongena, Peydro, and Saurina 2012); (b) allow better risk sharing, since bonds can be held more widely than bank loans; and (c) remove large concentrated credit risks from the banking system, making regulation and oversight of the banking system easier. Thus, apart from any direct benefits of better bankruptcy decisions, potentially large additional benefits stem from the impact this may have on credit market structure.

1. Bonds, bank loans and corporate credit

In this section, we briefly discuss the various forms of corporate credit and research that bears on the distinctions between the forms of credit. Debt contracts vary considerably in terms, monitoring intensity and diversification of risk. Much of the variation is related to the whether credit is intermediated or not. Fama (1985) suggests that banks face costs that markets do not, and that their existence and importance is a sign of some countervailing advantage that banks must have.[18] Academic research has largely proceeded on the assumption that the main challenge in understanding credit is to identify the advantages banks have (over credit markets), permitting them to exist in the face of their higher costs. One possible such advantage is that firms raising debt from banks economize on the reporting, regulatory and underwriting costs associated with issuing public debt (Bhagat and Frost 1986, Smith 1986, Blackwell and Kidwell 1988, and Carey et al 1993). These are largely fixed costs (e.g. a firm has to file a 10-K form with the SEC regardless of the amount of public debt it has outstanding). If fixed costs are significant, small firms will borrow from banks and large firms issue bonds, based on cost minimization.

[18] These costs may include low returns on required reserves (Black 1975), other costs of regulatory limits to risk taking and operations, the costs of operating a branch network (Besanko and Kanatas 1993, Holmström and Tirole 1997) and agency costs between banks and depositors (Diamond 1984).

Regulation may differ across types of credit: bank loans are typically made by government-insured and heavily regulated deposit-taking institutions[20] whereas bonds are held by mostly passive institutional investors which are much less regulated.[21]

Another possible key advantage of banks over bond markets is their ability to produce information about borrowers. This information production allows them to perform both ex-ante screening and ex-post monitoring of corporate borrowers.[22] Theories of information advantages predict that firms which require monitoring will rely on bank loans, whereas those that are sufficiently well known, because they are large (Fama 1985) or because they have a good track record of repaying debt (Diamond 1991), can turn to bond markets.

The group of theories that start from banks' costs disadvantage - both those based on scale and those based on information - predict a strong link between firm size and the form of debt: small firms will rely exclusively on bank debt, whereas large firms will exclusively use the bond market. This matches a well-known stylized fact: small firms rely exclusively on banks and larger firms are more likely to issue bonds (Hale and Santos 2002, and Petersen and Rajan 1994). Also, older firms are more likely to use bonds (Johnson 1997, and Rajan 1992). However, these theories struggle to explain the co-existence of bank loans and bonds in firms' capital structures. In our sample, covering 37 countries for a ten-year period, this is widespread: 84% of firms with bonds

[20] Not all intermediated credit is supplied by deposit-taking banks, although these represent the majority of corporate lending. See Denis and Mihov (2003) about the role of non-bank loans.

[21] The distinction between bank loans and bonds in these dimensions is not as clear as it used to be (Thomas and Wang 2004). For example, the growth of the syndicated loan market has increased the amount of diversification of lenders (Benmelech, Dlugosz and Ivashina 2013). We discuss what our model predicts about syndicated loans below.

[22] Information-based theories of banks include Diamond (1984, 1991), Besanko and Kanatas (1993) and Boot and Thakor (1997) (banks monitor or screen borrowers), Petersen and Rajan (1994) (lenders gather information about their borrowers over time); Repullo and Suarez (1998) (banks provide a sharper threat of liquidation) and Bolton Freixas 2000 (banks have a superior ability to renegotiate). See James (1987), Houston and James (1997) and Hadlock and James (2002) for evidence consistent with the existence of informational advantages for banks.

outstanding also have bank debt on their balance sheet.[23] Thus, these theories are unable to completely match the key empirical patterns. As pointed out in the introduction, this does not reject an informational advantage of banks, but suggest other forces must also be relevant.

Several theories consider the role of default and firm's debt mix. Gertner and Scharfstein (1991), Bolton and Scharfstein (1996), Berglöf and von Thadden (1994) and Hege and Mella-Barral (2005) all build on the idea that dispersed creditors find it difficult to coordinate. In some cases, this makes them 'tougher' than a concentrated creditor because they cannot agree to be lenient (it is individually better for bondholders to require full and immediate repayment and let others be lenient). This coordination failure can have ex-ante *benefits* if it dissuades firms from strategic default or allows creditors to extract more ex-post value from distressed firms.

Our model builds on this literature in that we focus on the role of creditor bargaining power in distress. Our model differs in that concentrated creditors have a negotiating *advantage*. This is the key point of difference in our model, and deserves some motivation. Grossman and Hart (1980) introduced the problem of free riding among dispersed investors. In their model, small shareholders can free-ride on a potential raider's improvement of a firm, thereby reducing the raider's profit. Gertner and Scharfstein (1991) applied the same coordination problem to dispersed creditors of a distressed firm, predicting that small creditors can extract value from such firms by being tougher (they won't make concessions ex post, which improves ex ante bargaining). Hackbarth, Henessy and Leland (2007) offer a model which follows this earlier literature in assuming that dispersion makes bondholders less flexible in renegotiations, reducing ex post efficiency for distressed firms which have bonds

[23] This is consistent with Johnson (1997), who reports that "41% of firms with access to public debt markets have some long-term bank debt" in a smaller and older sample of US firms. Becker and Ivashina (2013) report that new bank loans are frequent in their sample of firms with recent bond issues.

outstanding. They assume that distressed firms can have weak or strong bargaining power in an out-of-court restructuring. If a firm has strong bargaining power, it can capture the entire surplus in excess of the bank's bankruptcy payoff. This limits the amount of bank financing and forces the firm to obtain additional funds from bond investors. The key driver of firms' debt mix in their model is the extent of absolute priority (APR) violations in bankruptcy. If the bankruptcy process is soft, in the sense of allowing substantial absolute priority violations, then firms chose a higher fraction of bond financing. Their model, like ours, predicts that small firms initially use bank debt but resort to a combination of bank loans and bonds as they grow larger. However, the two models make different predictions about which features of bankruptcy law matter for the corporate debt mix. Our model predicts that firms will rely more on the bond market in countries with efficient bankruptcy (in the Djankov et al sense of producing high aggregate payoffs). In Hackbarth et al, the key driver of corporate debt mixes is APR violations. A "tough" system which doesn't allow APR violations – they use German and British bankruptcy as examples – is good because it limits the ability of firms and bondholders to take advantage of banks. Their prediction is that "soft" bankruptcy systems – their example is the US – will have more bonds.[24]

We depart from the "strong bonds, soft banks" approach. First, Djankov et al show very low overall recoveries in many countries. It would seem that how the pie is split may not matter if the total payoff is very low. Thus, we believe that our model examines the most important dimension in the broad cross-section of countries (APR violations may well be more important among the smaller set of countries with really good aggregate outcomes, such as the UK and the US). Second, we feel that being small and dispersed (e.g. less likely to be pivotal) and uninformed can be a disadvantage

[24] Bris, Welch and Zhu (2006) report that APR violations in Chapter 11 are a smaller than they used to be. This would seem to suggest an increasing bank share in US corporate debt under the Hackbarth et al model. Our data set is too short to allow a test of this.

when negotiating, for example because it may put an agent at an informational disadvantage. More abstractly, there are likely some scale economies in any process that aims to improve bargaining power, such as gathering information. In our model, bondholders are weak because of these problems. Philosophically, we follow Berglöf, Roland and von Thadden (2000) and Bris and Welch (2005) who predict that large creditors may be strong vis-à-vis management. We make the parallel argument that large creditors may be strong vis-à-vis small creditors. We provide some supporting evidence for bondholders' weak ex-post bargaining position below. Using Moody's default data, we document that bondholders often suffer larger losses than banks in restructurings, both in formal bankruptcy and out-of-court, holding seniority fixed.

2. Theory

A firm has demand for capital given by the function $D(r) = A - Br$, where $A, B > 0$ and r is the interest rate. The firm can obtain financing either from a continuum of identical risk-neutral bond investors of measure $M > 0$ or from $n > 1$ identical risk-neutral banks with convex cost of capital. There are no other sources of financing.

Each bond investors is willing to provide one unit of capital as long the interest rate is not below the break-even rate r^* at which her expected net return is zero. We denote the demand at this interest rate by D and assume $M > D > 0$, i.e. at bond-investors' break-even interest rate, demand is positive and it can be fully satisfied by bond investors.

Denoting the loan amount from bank i by L_i, we assume each bank i has a cost function of capital of the following form: $C(L_i) = L_i + cL_i^2/2$, where c is a positive constant.[26] The convex cost function is meant to capture the idea that making large loans

[26] The demand function could be generalized to a decreasing differentiable function with decreasing marginal revenue and the cost function to a function $C(L_i) = L_i + c(L_i)$, such that $c(L_i)$ is a differentiable increasing and convex function with $c(0) = 0$.

is costly. For example, large loans expose banks to unwanted idiosyncratic risks which can be costly due to owners' preferences, managerial risk aversion, or regulatory capital requirements.[27]

The firm chooses which funding to accept. When there are multiple lenders, we assume that the interest rate is determined in a Cournot fashion – i.e. firms submit loan offers and the total is matched to firm demand for financing. We assume that the inverse demand-function is $R(K) = (A - K)/B$, where K is the total amount of credit provided by all banks and bond investors.

After the firm has been financed, its operations produce a cash flow. With probability $q > 0$ the firm defaults and with probability $1 - q > 0$ it can repay its debts in full.[28] The implicit assumption behind the demand function is that the firm's managers (or owners) chose the debt mix in order to minimize the interest rate payments when the firm remains solvent. In contrast, how much is paid to various claimants in a default (where the owners get nothing) does not matter to their decision.

If the firm defaults, either an out-of-court restructuring (OOC) or an in-court bankruptcy procedure (BCY) takes place. An OOC generates a total value of $K(1 - \beta)$, where $0 < \beta < 1$. A BCY generates a total value of $K(1 - \beta - \sigma)$, where $1 - \beta \geq \sigma > 0$. Hence, the default event always implies a credit loss compared to no default, but an OOC entails a welfare gain compared to a BCY.

In a BCY, all the firm's creditors share the available value pro rata. We abstract from security rights and other contractual determinants of priority.[29] An OOC requires active participation by at least one creditor. Active participation entails a small fixed cost $f > 0$. This cost may represent costs of expert advice, time and effort required to

[27] By considering a convex cost of capital but not formally modelling risk aversion we can simplify the analysis considerably. This also means that the model is consistent with other reasons for bank aversion to large loans (e.g. due to capital regulation).

[28] For simplicity, we assume funding does not impact default risk. This situation could come about because the project pays of either zero or in full.

[29] Seniority is discussed in detail below.

participate actively, or more abstractly, coordination costs. Creditors incurring this cost will share the difference in firm value between an OOC and a BCY, $K\sigma$, pro rata. Hence, in an OOC passive creditors will receive their bankruptcy payoff, whereas active creditor in addition will receive their share of the incremental firm value, net of the fixed cost of participation.[30]

Without loss of generality we set the risk-free to zero. We also assume $cB \leq (n-1)(1-q)$, which is a sufficient condition for existence and uniqueness of the symmetric equilibria we will study. The intuition for this condition is that when the curvature of banks' cost functions and the slope of the demand function are not too large, banks do not have incentives to make large deviations from the symmetric equilibrium candidate.

The structure of this game of perfect information is common knowledge and can be described as follows:

1. Banks simultaneously decide how much to lend to the firm.
2. Bond investors simultaneously decide whether to lend to the firm or not.
3. Nature decides whether the firm can repay its debt or not. If the firm is solvent, all debts are paid and the game ends.
4. If the firm is insolvent, all creditors simultaneously decide whether or not to actively participate in an OOC. If no creditor decides to participate, a BCY is performed and the game ends. Otherwise, an OOC is performed, where passive creditors receive their BCY payoffs whereas active creditors in addition receive their share of the incremental firm value.

[30] This could be motivated by a dynamic bargaining model where it is so costly or takes so long to present a revised out-of-court restructuring proposal that the discounted value of the firm is no greater than what would have been obtained in bankruptcy. In the theoretical takeover literature there are several examples of models where small shareholders accept offers below the post-takeover value per share. Among these are models where the bid is conditional on the squeeze-out threshold (Yarrow 1985; Amihud et al. 2004), models with debt-financing (Mueller and Panunzi 2004), asymmetric information (At. et al 2007), and mixed strategies of shareholders (Bebchuk 1989).

A key element of this setup is that creditor bargaining power is unimportant in BCY. We have in mind the fact that BCY offers a highly structured environment whose formal rules tend to protect the integrity and order of claims, shares and organizes information among all parties, and protect priority among claims. By comparison, an OOC is much less organized. Gilson (1997) points to several features of in court bankruptcy that are especially beneficial for creditors with weak innate bargaining power, including rules that reduce creditors' ability to block reorganization plans (i.e. cramdowns) and mandatory disclosure. Such features of the bankruptcy law are widespread outside the US as well. For example, Djankov et al (2008) report that 82% of countries have some form of automatic stay on a bankrupt firm's assets.

The other key element in this model is that banks have stronger bargaining power than bond investors, captured by the nature of step 5 of the game, which gives active creditors the right to make take-it-or-leave-it offers out of court. There are several reasons why concentrated creditors like banks are likely to be strong in out of court situations. Their advantage may reflect the fact that bank loans are held in more concentrated positions than bonds, providing banks stronger incentives to monitor than dispersed bondholders.[31] Banks may also be better informed than other creditors. Loan agreements often include reporting covenants and visitation rights (which bonds rarely have). Bank loans often have more stringent default definitions, meaning that defaults occur earlier for loans than for bonds, giving banks a first mover advantage in distress. Finally, banks tend to be experienced in handling distress, and typically have departments devoted to loan workouts.

Although plausible for the above reasons, our assumption that bondholders suffer in out-of-court restructurings is untested. We examine the assumption's realism by comparing bond and bank loan outcomes in defaults that take place in and out of

[31] Ivashina (2009) demonstrates how bank loan syndicates are designed to ensure that the lead bank has an incentives to be active.

court. Using Moody's Default and Recovery Database (DRD), which contains outcome data for all claimants in restructurings of rated entities in and out of court, we calculate the frequency with which recoveries deviate by more than 10% points from what would have obtained had absolute priority been respected. We restrict the sample to US firms because data coverage is best there. Figure 3 reports the frequency of deviations, separately for bankruptcy and out of court, as well as for senior bonds (i.e. bonds which are not subordinated) and (senior) bank loans. Whereas bank loans quite often experience APR violations in bankruptcy (27% of the time) they very rarely do out of court (7%). Bonds are marginally more likely to experience APR violations in court (38% vs. 27%), perhaps reflecting factors such as banks' willingness to offer DIP financing in Chapter 11. However, and in contrast to bank loans, bonds are quite likely to experience APR violations out of court. In fact, APR violations are six times as common for bonds as for bank loans out of court. This evidence appears consistent with our assumption that OOC restructurings favor banks relative to bond holders.

2.A Results

We will look for a subgame-perfect equilibrium (SPE) in pure strategies of the above game which is symmetric in banks' strategies under the assumption that f is small.[32] We solve the game backwards.

In stage 4, there are two cases to consider. If bank loans of positive measure were provided in stage 1, then in equilibrium the corresponding banks participate actively, but no other creditors. In particular, bond investors do not find it in their interest to participate actively as their share of the additional firm value will always be smaller than the fixed cost of active participation. This implies that their break-even rate in will be given by the equation $(1-q)r^{*} - q(\beta+\sigma) = 0$, giving

$$r^{*} = q(\beta+\sigma)/(1-q). \tag{1}$$

[32] More precisely, we assume $f < \min\{\frac{D\sigma(n+1)}{2n^2}, \left(\frac{1-q}{B} + \frac{c}{2}\right)\frac{L^{**2}}{qn^2}\}$, where L^{**} is defined below.

If, on the other hand, no bank loans of positive measure were provided in stage 1 (we show in the Appendix that this does not occur in a SPE), then the corresponding subgame has an equilibrium where a finite number of bond holders participate actively.

In stage 2, there are also two cases to consider. If $L \leq D$, where L is the sum of bank loans, any Nash equilibrium must have a measure $D - L$ of bond investors supplying one unit of capital each. If a larger measure of investors provide funds, then the interest rate will be below r^*, implying that investors do not break even. If a smaller measure of investors provide funds, then the interest rate will be above r^*, implying that additional investors could earn a positive return by lending to the firm. If $L > D$, no bond investor will lend to the firm since the interest rate will be below r^*.

Given the above, the interest rate as of function of total bank lending will be flat and equal to bond-investors break-even rate, $R(D) = \frac{q(\beta+\sigma)}{1-q}$, for $L \leq D$, and decreasing and equal to the inverse demand function, $R(L) = (A - L)/B$, for $L > D$. A bank i, lending L_i when the other banks lend a total of L_{-i} will thus earn expected profits of:

$$U(L_i, L_{-i}) = (1-q)R(\max\{D, L\})L_i + q(-(\beta+\sigma)L_i + \max\{D, L\}\,\sigma L_i/L\} - f) - cL_i{}^2/2. \tag{2}$$

We will look for symmetric equilibria where all banks provide loans of equal size:

$$\hat{L}_i \in \max_{L_i \geq 0} U\big(L_i, (n-1)\hat{L}_i\big) \text{ for all } i. \tag{3}$$

We proceed by maximizing function (2) with respect to L_i for a given L_{-i} and thereafter setting $L_i = L/n$ for all i. Because of the kink in the interest rate as a function of bank lending, we obtain three different equilibrium candidates corresponding to the three cases $L < D$, $L > D$, and $L = D$. The first two can be calculated directly from binding first-order conditions, whereas the last one is a corner solution.

$$L^* = \sqrt{q\sigma(n-1)D/c} \qquad \text{if } D > q\sigma(n-1)/c \tag{4}$$

$$L^{**} = n((1-q)D + Bq\sigma)/(cB + (1-q)(n+1)) \text{ if } D < \sigma nq/(c + (1-q)/B)) \tag{5}$$

$$L^{***} = D \text{ if } q\sigma(n-1)/c \geq D \geq q\sigma n/(c + (1-q)/B)) \tag{6}$$

In the Appendix we prove that these are indeed equilibria. Note that the assumption $cB \leq (n-1)(1-q)$, is equivalent to:

$$q\sigma(n-1)/c \geq q\sigma n/(c+(1-q)/B)). \tag{7}$$

Hence, the three equilibria will never coexist for the same set of parameters.

In order to obtain comparative statics with respect to the size of the firm, we write $A = as$ and $B = bs$, where $s > 0$ is a scale parameter and a and b are positive constants. Using this notation, the demand for capital at bond-investors' break-even rate can be written: $D = as - bs\frac{q(\beta+\sigma)}{1-q}$.

Proposition 1: The symmetric equilibrium has only bank financing if s is small enough that $D \leq q\sigma(n-1)/c$, and both bank and bond financing if s is large enough that $D > q\sigma(n-1)/c$.

Under the assumption of a small cost of active participation, banks will thus provide financing to all firms, whereas the bond market will only be tapped by firms above a critical size.

Proposition 2: In the symmetric equilibrium, the interest rate is increasing in s if s is small enough that $D < \sigma nq/(c+(1-q)/B))$ and constant at $\frac{q(\beta+\sigma)}{1-q}$ if s is large enough that $D \geq \sigma nq/(c+(1-q)/B))$.

Proposition 2 implies that firms that reach the critical size where they want to tap the bond market, will not experience a lower cost of debt. Figure 1 illustrates how firm size affects bank lending, bond issuance, and the interest rate.

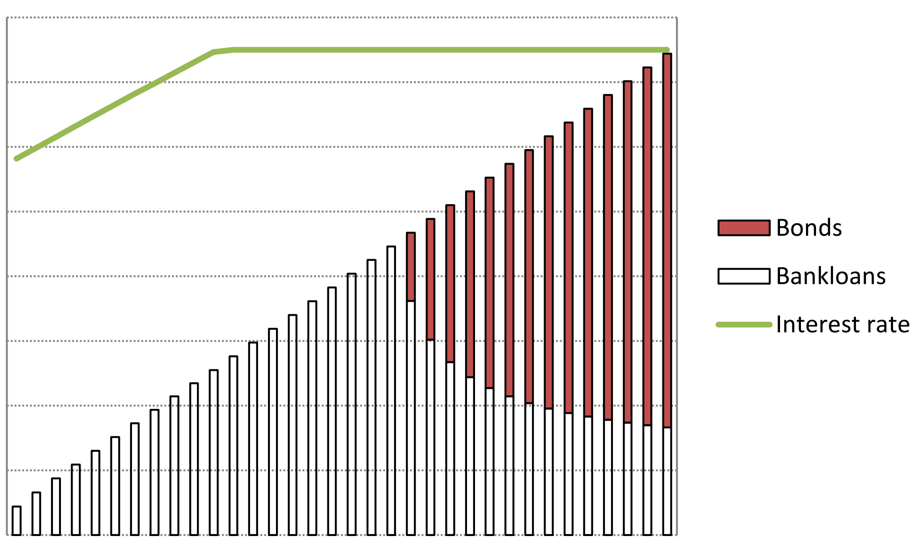

Figure 1: Interest rate, bonds, and bank loans as a function of the size of the firm.

By computing the partial derivatives of the equilibrium fraction of bank loans in the case with both bank and bond financing, we obtain local comparative statics in a straight-forward fashion.

Proposition 3: If $q\sigma(n-1)/c < D$, the symmetric equilibrium has both bond and bank financing and the fraction of bank loans is increasing in q and σ and decreasing in s and c.

In words, the fraction of bank financing is increasing in the default probability and the additional firm value with an OOC, but decreasing in the size of the firm and the convexity of the cost function.

Taking the cross partial of the fraction of bank loans, we also obtain the following result, which implies that the positive effect on the fraction of bank financing of increasing BCY efficiency is larger for firms with higher probability of default.

Proposition 4: If $q\sigma(n-1)/c < D$, the cross partial with respect to q and σ of the fraction of bank loans in the symmetric equilibrium is positive.

A final result concerns the profitability of bank loans of different default probability. In the symmetric equilibrium with both bank and bond financing, each bank earns expected profits of:

$$Dq\sigma(n+1)/(2n^2) - qf \qquad (8)$$

Expected profits are thus increasing in the size of the firm, s, and decreasing in the number of banks, n. More interestingly, they are a concave function of q. Maximizing with respect to q and letting f tend to zero gives the limit solution:

$$\hat{q} = 1 - \sqrt{\frac{1}{1+a/b(\sigma+\beta)}}. \qquad (9)$$

Hence, for small f there is a unique default probability such that each bank's expected profits are maximized. This default probability is independent of the size of the firm, but decreasing in the BCY loss, $\sigma + \beta$. In countries with more efficient BCY, banks are thus better off with riskier loans, up to some point. Put differently, the most profitable loans are not to the safest borrowers or to the riskiest, but to firms of intermediate risk.

The key predictions of the model are thus that (a) small firms rely on bank debt whereas large firms rely on a combination of bank debt and bonds, (b) the cost of debt does not decrease when the firm obtains bond financing, (c) the use of bonds is increasing in the efficiency of formal bankruptcy proceedings, and (d), especially for high risk firms. These are new predictions relative to standard models of bond and bank debt. The model is also consistent with several existing empirical patterns. For example, our theory can explain why large firms are so willing to shift between bond issuance and bank borrowing, as Becker and Ivashina (2014) and Adrian, Colla and Shin (2012) document for US firms. In our theory, the marginal cost of each kind of debt is the same for (many) large firms, so that willingness to substitute based on small differences in price is precisely what we should expect.

The model presented here abstracts from priority issues. In practice, bank loans are often senior to bonds. We explore this issue in detail in the Appendix. When the demand for capital is large enough that bonds are issued, giving banks seniority is inefficient since it increases the cost of debt, reducing the firm's demand for capital and leading to a higher level of costly bank financing. Hence, in this case, bonds are even more disadvantaged than the model without priority suggests.

A more fundamental concern is why, in our model as well as in reality, bonds are not given seniority so that they receive better treatment in bankruptcy. In our model, raising their BCY payoff improves bargaining outcomes in OOC restructurings, as well. In the Appendix we show that in our model it may indeed be welfare enhancing to give bond holders seniority, since it reduces the cost of debt and increases demand for capital while limiting the fraction of bank lending.

One reason bonds are rarely senior (and bank loans often are), is the coordination problem that would result if firms relied only on bond financing. In our model, we have assumed the fixed cost of active participation in the OOC is low enough to allow participation by all banks. However, if this cost is large or there are other fixed costs of lending to the firm, then banks may not find it in their interest to lend to the firm unless their claims are senior. In this case, the cost of active participation may be too large also for bond holders, or they may not be able to coordinate on who should participate.[33] Either way, the result would be a BCY rather an OOC.

Similarly, a reason for keeping bank loans senior is related to pre-distress monitoring. Our model gives no pre-insolvency function for creditors, but if there is one, it may favor concentrated creditors. Park (2000) argues that a single senior creditor is optimal to incentivize monitoring (of solvent firms). Contractually, making bonds senior may not always be feasible; some countries grant banks special treatment in the bankruptcy code.[34]

Perhaps most importantly, giving seniority to bond investors has only marginal effects on the debt mix when bankruptcy is very inefficient, since it has a minor effect on bond investors' threat point (in very inefficient bankruptcy, all creditors by necessity get low payoffs).[35] This relates to a more general issue, which is that debt contract provisions affecting bankruptcy payoffs are not very important when bankruptcy in general is very destructive.

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[33] If there are only bond investors lending to their firm, any pure-strategy equilibrium is asymmetric with respect to participation in the OOC.

[34] For example, the French Loi de Sauvegarde, an in-court procedure for restructuring insolvent firms, gives credit institutions (i.e., banks) stronger rights than other creditors (Esquiva-Hesse 2010).

[35] Despite all these valid arguments against senior bonds, our model does provide a reason for them. Although conventional wisdom says they are not the norm, we are not aware of any large sample tests of how often other arrangements occur.

3. Data

We collect data on restructuring payoffs for all different claimants in bankruptcies and out-of-court restructurings in Moody's Default and Recovery (DRD) data base. The sample to covers defaults occurring between 1995 and 2011. For each type of resolution (bankruptcy or restructuring out of court), claim size and recovery amount is reported for each security or class of securities (a security in this context may be a bank loan). Several securities may be of equal priority. Actual recovery is compared to hypothetical recovery if the absolute priority rule (APR) had been respected. The seniority structure reported in DRD reflects structural as well as contractual subordination. We then calculate the frequency with which recovery rates deviate from APR recovery by at least 10%. The sample covers a total of 698 events for 659 firms (39 firms defaulted twice). Payoffs are reported for a total of 2,644 securities, of which 2,191 were involved in bankruptcies and 453 in out-of-court restructurings. This data is used for Figure 3.

From the World Bank (2006), we collect a "composite bond market development" index for robustness tests.

We collect firm data from CapitalIQ. The data covers 2000-2011, and firms from 44 countries.[36] We exclude financial firms and utilities. Data collected from CapitalIQ include income statement and balance sheet data, S&P's industry classification (138 unique values), the volatility of the weekly stock price changes for the previous year, the trading volume of a firms shares (annual, as a share of market capitalization) and corporate credit ratings from Moody's and S&P. There are 107,941 firm-year observations with data on debt structure and our base line control variables.

[36] The 35 countries which are represented by more than 100 firm-year observations in our sample are: Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Russia, South Africa, Spain, Sweden, Switzerland, Taiwan, Turkey, United Kingdom, United States.

Leverage is the ratio of debt (book value) to assets (book value). Market leverage is the ratio of book value of debt to the sum of market value of equity and book value of debt. Market capitalization is the log of the firms market value of equity measured in US dollars. Book to market is the ratio of book value of equity to market value. Return on assets (ROA) is the ratio of EBITDA to sales. Cash over assets is total liquid assets divided by lagged book assets.

We also collect measures of firms' debt structures. We define the bond share as the ratio of bonds (book value) to total debt. For bonds, we use commercial paper and bonds. We also use the bank debt share, which combines term loans and revolving credit lines. For most purposes, we do not differentiate between commercial paper and longer term bonds, and just aggregate (commercial paper is rare and of little importance to our results). For revolvers, we count the amount drawn down, as the accounting data does when calculating firm liabilities (the actual debt is only the amount used). We also divide firms into investment grade and high yield, corresponding to a median rating of BBB+ and above (IG) or BB- and below (HY). We code ratings according to a scale from AAA=28 down to D=1, where each notch is one step.

When we lack a corporate credit rating (as we do for most firms), we estimate a linear regression model using cash over assets, interest payments over debt, return on assets, log of market cap (in USD), book to market ratio, stock price volatility, log of book assets, share trading volume, year fixed effects, country fixed effects and industry fixed effects to estimate the rating a firm would have. For the approximately nine thousand observations where we have ratings data, the R-squared of this regression is 0.74 (0.67 without fixed effects). We truncate estimated ratings at 1 and 28 (the limits of the actual scale), to avoid some small firms having outlying values. Using the un-truncated value of estimated ratings does not change our classification of firms into IG and HY, nor our regression results. We identify first-time bond issuers as firms with no bonds outstanding at any previous time in the sample. To increase accuracy, we exclude the first three years of the sample for tests using first-time bond issuers.

Summary statistics for various firm level variables are reproduced in Table 1, Panel A. On average, bonds constitute 19.7% of total debt. For investment grade firms (where we use estimated ratings in order to be able to classify all firms), bonds constitute 32.5% of debt, and for high yield firms, 16.7%. The overall average is closer to the high yield data point because most firms are high yield. This fact is also evident from the fact that imputed ratings are much lower on average (12.9, i.e. B) than actual ratings (18.0, i.e. BBB-). Summary statistics for country level variables are presented in Table 1, Panel B.

To examine the consequences of bankruptcy efficiency we require a measure of the aggregate value for firms filing for bankruptcy. To avoid being tainted by selection problems, the measure should not be influenced by the firms which actually enter bankruptcy in a country.[37] Djankov et al (2008) devised just such a measure, based on surveys of lawyers regarding the outcome in a hypothetical bankruptcy case. Lawyers in each country were asked to assess the outcome for all involved parties when a specific firm (a hotel) defaults on an interest payment. Since the exact same case was considered in each country, the measure should be free of selection issues.[38] The survey has subsequently been updated by the World Bank in the Doing Business survey, so that its data are available annually 2004-2013.[39] We use 2004 data for 2000-2003, and otherwise use each year's data. The main variable used to portray bankruptcy efficiency is the aggregate recovery of all creditors. The variable is measured in cents on the dollar, and ranges from 0 (Chad and Zimbabwe, in certain years) to 94.4 (Norway, 2004). Table 1, Panel B presents summary statistics across countries. As an alternative measure of the

[37] Otherwise, a country might appear to have low efficiency simply because very poor quality firms chose to file there.
[38] See Djankov et al (2008) for more detail on the hypothetical case.
[39] Accessed at http://www.doingbusiness.org.

overall nature of the bankruptcy system in a country, we use the time in years between filing and exit, also from the Cost of Doing Business database and based on Djankov et al. In recent years, bankruptcy reform has been widespread and, in many countries, profound. To illustrate this point, Table 2 describes four recent reform episodes. These episodes were all associated with significant changes in the measures of bankruptcy efficiency we use, although in different directions (Peru saw a drop in efficiency). Several of the episodes cover several years of new legislation and implementation, and this is often visible in the bankruptcy outcome measure. Two alternative measures of bankruptcy efficiency are also collected from Djankov et al: the time taken until insolvency has been resolved ("Bankruptcy delay") and an indicator for whether or not the bankruptcy procedure results in liquidation which by assumption is not efficient ("Inefficient liquidation").

We collect data on creditor rights, an index aggregating creditor rights, first produced by La Porta et al. (1998), and updated in Djankov et al. The index ranges from 0 to 4, where 4 represents stronger rights. We also collect average annual exchange rates from CapitalIQ and translate all accounting data to USD at year-end market rates.

4. Empirical results

In this section, we examine the predictions of our model and other theories of debt structure. First, we document broad empirical patterns in bond usage. Second, we track individual firms around first issuance, and compare this to various types of models of debt types. Third, we test our model's predictions about bankruptcy and bond market development in a multi-country panel. To address endogeneity concerns (the bankruptcy system may be better in countries that for other reasons have larger bond markets), we use bankruptcy reforms to identify the effect of bankruptcy through a difference-in-difference methodology.

4.A Corporate debt structures

We start by documenting some facts about firm level debt dynamics and compare them to our model. Our model predicts that firms will tend to maintain the use of bank debt even if they have access to the bond market. As discussed above, many theories of bank and bond debt predict the opposite: once a firm has access to the bond market, it will reduce or eliminate its bank debt (e.g. bonds are cheaper but have some fixed issuance cost). In Table 3, we examine some parameters of the joint distribution of bonds and bank loans. We are especially interested in whether, in general, bank loans are used by firms with outstanding bonds. We divide firm-year observations into two groups based on whether there are any bonds outstanding. Within each group, we then calculate what number of observations have outstanding bank loans worth at least 1%, 10% or 20% of assets. In aggregate, 49.4% of non-bond users and 72.6% of bond users have bank loans worth at least 1% of assets. Most firms have bank loans, but firms that use bonds are more likely to have bank loans than those that do not have bonds outstanding. This difference (23.1% of firm-years) is highly statistically significant. This suggests that firms tend to combine debt from different sources, rather than use only one type. However, the 1% cutoff may be so low that we include firms in the bank loan category that have small draw-downs on their credit lines, but for which bank loans are actually trivial. We thus compare how frequently firms have loans worth 10% or 20% of assets. In both cases, bond issuers show significantly higher use of bank loans. This evidence indicates that it is not uncommon for firms that use the bond market for funding to simultaneously borrow from banks. In other words, models that predict exclusive use of a single type of debt do not fit the data very well.

First-time bond issuers provide a particularly clear setting in which to examine the extent to which bonds replace bank debt for an individual firm that has access to the bond market for the first time. In our sample, there are 6,711 such first-time bond issuers between 2003 and 2011 (we lose the first few years of our sample because we require three years of previous data to make sure a firm has not issued bonds previously or at least recently).

In Figure 4, we track the debt structure and interest costs of firms around the first issuance of a bond from year -6 to year 6, counting the year of issuance as zero. All debt categories are normalized by the firm's total book assets. Three striking patterns emerge. First, at first bond issue, firms increase leverage substantially. Second, after the initial spike at first bond issue, there is a gradual contraction both of bonds and of total leverage. Third, there is no reduction in bank debt around first bond issues, and no subsequent reduction in bank debt over time. In other words, neither the level nor the growth rate of bank debt relative to assets is typically negative around first bond issues. [40]

We next consider prices. Our model predicts that the cost of debt should be no lower for a firm that issues bonds. Fixed costs models of bond market participation predict a drop in interest costs at first issuance (otherwise incurring the fixed cost would not be motivated). Although measuring the cost of debt is complicated by maturity and risk considerations, following the same firm through time reduces the concerns somewhat (as long as the maturity and risk is similar around a first bond issue). Figure 4b shows the 25th percentile, median, average and 75th percentile of interest costs. The figure suggests a modest uptick in the cost of debt when firms first issue a bond, following a slight decrease in the preceding years. Both of these small changes are statistically significant. The increase in interest cost appears inconsistent with predictions that bond markets should provide low interest rates (but high fixed costs, which mostly do not appear under interest in the income statement). An important caveat is that the large increase in leverage that we observe when a firm issues bonds for

[40] We also estimate regressions with firm fixed effects, to deal with changing sample composition over time in Figure 4b. The year-by-year coefficient estimates (not reported) are very similar to Figure 4b. Further, unreported, robustness tests include testing for a decline in bank debt around first bond issue for US firms exclusively, or for non-US firms exclusively. Results are similar across samples.

the first time may be a cause of costlier debt service due to increased credit risk. In regressions, we have added a rich set of firm controls (see Table 6) and three powers of both book and market leverage, finding a slight increase in interest cost at first issue.

Taken together, the results in Figures 4a and 4b show limited substitution out of bank debt for firms that enter the bond market for the first time. A large bond issuance is followed by a gradual decline in leverage and bond debt outstanding while bank debt is stable or slowly increasing. The pattern we document is consistent with models in which bonds are a marginal source of funding, used only after bank lending is exhausted or has become expensive. All of these findings are consistent with our model, which suggests the introduction of bonds into corporate debt structures will be gradual; that bonds are not particularly cheap (even disregarding fixed costs); that bond issuers should retain a certain amount of bank debt; and that this bank debt should in fact increase with increasing debt, although more slowly than bond debt. Some of these findings are also consistent with the model of Hackbarth et al (although how debt mix scales with size in their model is not as clear).

Could the patterns we observe reflect maturity differences as in Diamond (1993)? Similarly, can they be explained because bank debt is used by bond issuers as a temporary and flexible source of finance, whereas bond debt is lumpy and adjusted rarely? We do not observe actual maturities on the various debts, and so cannot test Diamond's predictions directly. However, we would argue that this force does not appear to be the major driver of the patterns in our data. First, we can exclude credit lines, and focus exclusively on term loans, which are longer maturity, and the pattern that bond issuers use more bank debt than non-issuers remains. Second, we can exploit the panel nature of our data to check the variability of the sources of financing. In fact, bond debt is no more stable than bank debt in firm capital structures. Thus, maturity differences do not appear to drive our results (although they may still matter to firms).

4.B Bankruptcy and bond market development: cross-country evidence

We now test how the efficiency of in-court insolvency procedures (bankruptcy) affect bond markets. Before turning to firm-level data, we consider some broad, aggregate patterns in the corporate use of bonds. We sort firms into five broad categories of credit quality: AAA through A, BBB, BB, B, and CCC through C (these groups are of comparable size). To simplify and illuminate broad cross-country differences, we sort countries into three groups: Asia, North America, and Europe. Of these, North America, quantitatively dominated by the US, is characterized by very good bankruptcy system, Europe has an intermediate efficiency, and Asia has the poorest bankruptcy efficiency (we will exploit the important within-region variation in bankruptcy efficiency in regression analysis below). Regional averages for the recovery measure (the average efficiency) are 79.8 (North America), 55.6 (Europe) and 35.4 (Asia). Does this correspond to differential use of bonds? The average share of bonds (in total debt) is compared across continents – separately for each category of credit risk -- in Figure 5. The difference between North American and European bond shares, and their ratio, are reported at the bottom of the figure. The use of bonds is declining in credit quality. However, this is much less pronounced for North American firms, while European and Asian firms almost cease the use of bonds in the low categories. The ratio of average bond share for US firms relative to European firms rises from 1.25 for high quality firms to 3.97 for the lowest quality firms. This implies that some quantitatively important determinant of the size of bond markets is related to credit quality, i.e. default risk. In particular, this pattern is consistent with our theory, which suggests that better bankruptcy (i.e. the US) should be associated with more bonds, which is more important for lower credit quality firms. If this pattern were absent at this very high level of aggregation, our theory would not matter for broad patterns even if it had some predictive power at the margin. Thus, this figure establishes the relevance of our theory. That said, the test is not necessarily very well identified (since we have not controlled for firm or country level factors that may relate to the use of bonds). To address this, we turn to regressions of individual firm-year level observations, exploiting the full variation of the bankruptcy efficiency measure (i.e. both differences between countries in the same region and between years within a country).

Regression results examining the link between bankruptcy and debt structure for the 2003-2011 period are presented in Table 4. In the base case, the dependent variable is the share of bonds in a firm's debt. The independent variable of interest is bankruptcy efficiency, which we predict will have a positive association with the use of bond debt. We control for a range of firm level variables including size, profitability, credit risk and stock market valuation ratios, as well as for institutional features of national credit markets, such as creditor rights. In column (1), many of the control variables predict bond debt as might be expected: larger firms with good credit ratings and high stock market turnover have more bonds in their debt mix. The coefficient on bankruptcy efficiency is positive and significant at the 5% level. The positive coefficient suggests that better bankruptcy systems are associated with increased use of bonds. This holds controlling for creditor rights (measured at the country level). The economic magnitude is large: a one standard deviation increase in bankruptcy efficiency (22.6) corresponds to increased bond issuance by 5.6%, approximately a quarter of the average level. If this coefficient reflects causality running from the performance of the bankruptcy system to bond market size (i.e. assuming it does not reflect reverse causality or omitted variables), the finding supports our main theoretical prediction.

A second prediction of the theory is that bankruptcy efficiency should matter more for weaker firms. In columns (2) and (3) we separate the sample based on firm credit risk. The positive coefficient on bankruptcy efficiency is slightly higher and much more significant among low credit quality firms. In column (4), we estimate the impact of firm strength in the full sample by including the interaction of credit risk and bankruptcy efficiency. The coefficient estimate implies that weaker firms' bond use is much more strongly related to bankruptcy efficiency. The regression estimates imply that the bond share in debt of firms of rating AA- and above is unrelated to bankruptcy efficiency, while the bond use of the weakest firms is twice as dependent on bankruptcy as that of the average firm.

Figure 6 illustrates the stronger effect of bankruptcy efficiency on weaker firms by sorting firms into deciles of credit quality. As we move toward weaker firms (lower credit quality), the effect of bankruptcy on the debt mix grows progressively stronger. The first decile where the effect is (individually) statistically significant at the 95% level is the fourth, corresponding to a rating of around BB-. The highest point estimate is for the weakest decile, and the largest t-statistic for the second to lowest decile. Both Table 4 and Figure 6 emphasize the key role of credit quality in mediating how bankruptcy efficiency is associated with bond use. Loosely put, strong firms issued bonds everywhere, but weak firms only do it in countries with good bankruptcy.

The US has the world's most developed corporate bond market, and also a sophisticated system for handling insolvent firms in court, and we interpret this as very consistent with our theory. However, the US is unusual on many dimensions, and if our predicted relationship could not be identified outside of the US, we would be less confident in the theory's relevance. To examine this, we exclude US firms from the sample, reducing sample size by a quarter. Regressions for the safe and risky subsamples of the non-US firms are reported in columns (5) and (6). Coefficient estimates are smaller when we exclude US firms, but the key prediction holds in this sample also: while not very important for safe firms, bankruptcy efficiency is strongly positively associated with the use of bonds by riskier firms. As for the full sample, a one standard deviation increase in bankruptcy efficiency corresponds to increased bond issuance of around a quarter of the average level.

The positive relation between bankruptcy and bond market development can be reproduced outside of our firm level data set. For this, we use a composite index of bond market efficiency, constructed by the World Bank (2006) based on data on size, breadth, liquidity, stability and other factors. A strong positive relation between bankruptcy efficiency and bond markets is apparent in Figure 7.

In Table 5, we present a number of further robustness tests. We first replace bankruptcy efficiency with two alternative measures of how well court-based insolvency works: the time required between filing and exit from bankruptcy, and an indicator for liquidation. Both of these variables capture well known concerns about bankruptcy codes: that they are slow, and that they have a bias toward excessive liquidation (see e.g., Kahl 2002). Both variables produce results similar to the efficiency variable: for riskier firms, better bankruptcy (low delays, no liquidation) is strongly associated with more use of bonds.

We next turn to an alternative dependent variable. Many of the sample firms have a stable debt mix, and many never issue bonds. Such firms might be passively focusing on bank loans, and may never consider bonds at all. The capital structure decision we are most interested in for testing our theory may therefore be the first issuance of bonds. In columns (5) and (6) of Table 5, we examine the sample of firms which have not previously had bonds on their balance sheet (within our sample). We regress an indicator for first bond issue on control variables, using a linear probability model.[41] Risky firms (but not safe firms) are more likely to issue bonds for the first time in countries with more efficient bankruptcy. A one standard deviation increase in bankruptcy efficiency (22.6) implies that the probability of issuing bonds is higher by 0.79% for high risk firms, which can be compared to the average probability of 4.4% per year. This result also holds without US firms (not reported).

Taken together, the cross-sectional evidence suggests that countries with better systems for organizing bankruptcy have larger corporate bond markets. Since we control both for creditor protection and for a multitude firm variables, we conclude that

[41] Results are very similar with logit and probit models.

this likely does not reflect some overall leverage effect. Because of the protracted and complex nature of bankruptcy reform, discussed above, we do not consider reverse causality a likely factor in this empirical setting. However, bankruptcy efficiency may be correlated with other institutional features that vary from one country to the next. In the next section, we address this identification challenge.

4.C Evidence from bankruptcy reforms

A narrower form of identification comes from bankruptcy reforms, when a country may see changes in efficiency over time while many other institutions and rules remain the same. Assuming that such hypothetical alternative institutions do not change at the same time, and in the same direction, as bankruptcy efficiency, we can use reforms as natural experiments to identify the effect of bankruptcy. The Doing Business Survey covers a ten-year period coinciding well with our firm data sample, and contains several changes in bankruptcy efficiency (in both directions). These changes in the measured recovery typically follow revisions of the bankruptcy code, such as those outlined in Table 2 (sometimes the organization of bankruptcy changes without a legal change). Overall, the large number of substantive legal reforms means that identification may work, even if typical reforms take some time to have their full impact on credit markets.

We collapse data by country-year and regress bond use on bankruptcy efficiency, firm and country fixed effects. Results are presented in Table 6. The identification in these tests comes exclusively from changes in bankruptcy efficiency. The positive coefficient on bankruptcy efficiency suggests that improvements in the bankruptcy code are followed by increased bond issuance (and that changes associated with reduced recovery tend to be followed by lower bond use, although this is rarer). This result holds both for the average bond share and its 90th percentile (i.e. across firms, what share of debt is bonds at the 90th percentile, a measure of more intensive users of the bond market), as well as for the propensity of non-bond users to issue for the first time. These results, although based on a smaller set of countries than the cross-sectional results, may be less affected by omitted variable bias or reverse causality, and therefore bolster the case that a good bankruptcy system helps the bond market.

5. Conclusions

We present a model of two forms of debt, bank debt and loans, which differ in terms of funding costs, and bargaining power in insolvency. From this model we derive the key predictions that the use of bond debt is favored by efficient in-court bankruptcies, especially for high risk borrowers.

We test the model's predictions using a comprehensive panel of publicly listed international firms. In accordance with the model, we find that firms that issue bonds for the first time maintain their bank debt. We also find that a modest uptick in the cost of debt when firms first issue a bond, following a slight decrease in the preceding years, inconsistent with models where bonds are cheaper than bank debt.

Our theory does well in matching aggregate country-level patterns. Countries with better bankruptcy systems, based on Djankov et al. (2008), tend to have larger bond markets, and this effect is largest for high risk firms. This effect can explain some of the large differences in debt mix between North America, Europe and Asia.

How much larger would the bond market be if the efficiency of formal bankruptcy improved? We can use the estimates in Table 4 to predict the effect on debt markets by bankruptcy reform. The cross-country standard deviation in recovery is 26.7. Based on the average coefficient estimate in Table 4, column (1), increasing recovery rates by one standard deviation everywhere would be predicted to raise the bond share of high risk issuers by 5 percentage points (or about a quarter of the average level of bond debt). This thought experiment may be too extreme, as some recovery rates are already close to 100 and cannot be expected to rise much. A more intricate thought experiment is to raise every country's recovery rate halfway toward 100, so that every country sees an improvement, but the improvement is larger for countries with the largest potential gains. In our sample (which is tilted toward countries with good bankruptcy systems), the average firm would experience an increase in recovery of 10.2 percentage points. Based on Column 1 of Table 4, this corresponds to a 2.4 percentage point increase in the bond share of debt, or 11% of current bond debt levels. Based on total corporate debt (in our sample) of $10.5 trillion in 2010 (see Figure 2), this corresponds to about $700 billion of new bonds.

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Appendix

Lemma 1: For f sufficiently small, there is no SPE with zero measure of bank financing.

Proof: If there is zero measure of bank financing, each bank earns zero profits. Consider a deviation by bank i to a loan of size $\hat{L}_i$, where $0 < \hat{L}_i < D$. Since the deviant bank will be the only creditor with a loan of positive measure, by participating actively it earns expected profits of $q(\sigma D - f) - c\hat{L}_i^2/2$, which are positive for $\hat{L}_i < \sqrt{q\sigma D(2n^2 - n - 1)/n^2 c}$ by the assumption on f in footnote 5. ■

Proof of Propositions 1 and 2: The proof of Propositions 1 and 2 follows from the argument in the text above and the following three lemmata.

Lemma 2: If and only if $D > q\sigma(n-1)/c$, there exists a symmetric equilibrium such that the fraction of bank financing is $\sqrt{\frac{q\sigma(n-1)}{Dc}} < 1$, and the interest rate is equal to bond-investors break-even rate, $\frac{q(\beta+\sigma)}{1-q}$.

Lemma 3: If and only if $D < q\sigma n/(c + (1-q)/B))$, there exists a symmetric equilibrium such that there is only bank financing, total bank loans are equal to $n((1-q)D + Bq\sigma)/(cB + (1-q)(n+1))$, and the interest rate is lower than bond-investors break-even rate.

Lemma 4: If and only if $q\sigma(n-1)/c \geq D \geq q\sigma n/(c + (1-q)/B))$, there exists a symmetric equilibrium such that there is only bank financing, total bank loans equal D, and the interest rate is equal to bond-investors break-even rate, $\frac{q(\beta+\sigma)}{1-q}$.

Proof of Lemma 2, 3, and 4: We will prove the statements of each lemma by first calculating the first-stage actions by the banks for equilibrium candidates with $L < D$

and $L > D$ respectively, thereafter showing that they are indeed equilibria, and finally proving the statement for equilibria where $L = D$.

Maximizing $U(L_i, L_{-i})$ with respect to L_i under the assumption that $L < D$ gives the first-order condition:

$$\frac{\mathrm{q}\mathrm{D}\sigma L_{-i}}{L^2} - cL_i = 0.$$

Plugging in $L_j = L/n$ for all j gives:

$$L^* = \sqrt{\frac{q\sigma(n-1)D}{c}}.$$

This expression is smaller than D if and only if $D > q\sigma(n-1)/c$. Moreover, expected bank profits for this profile are given by $\mathrm{q}(\mathrm{D}\sigma\frac{\mathrm{n}+1}{2\mathrm{n}^2} - \mathrm{f})$, which is positive by the assumption in footnote 5.

Maximizing $U(L_i, L_{-i})$ with respect to L_i under the assumption that $L > D$ gives the first-order condition:

$$(1-q)\big(R'(L)L_i + R(L)\big) - q\beta - cL_i = 0.$$

Plugging in $L_j = L/n$ for all j gives:

$$L^{**} = \frac{n\big((1-q)D + Bq\sigma\big)}{cB + (1-q)(n+1)}.$$

This expression is greater than D if and only if $D < \sigma nq/(c + (1-q)/B))$. Moreover, expected bank profits for this profile are given by $\left(\frac{1-q}{B} + \frac{c}{2}\right)\frac{L^{**2}}{n^2} - qf$, which is positive by footnote 5.

The function $U(L_i, L_{-i})$ is concave in L_i for $L \leq D$. Likewise, $U(L_i, L_{-i})$ is concave in L_i for $L \geq D$. Hence, there are no profitable deviations from $L_i^* = L^*/n$ in the set $[0, D - (n-1)\,L_i^*]$ or any profitable deviations from $L_i^{**} = L^{**}/n$ in the set $[\max\{D - (n-1)L_i^{**}, 0\}, \infty)$.

If $D \leq (n-1)L_i^{**}$, the last set covers the entire strategy set and hence it follows trivially that there are no profitable deviation from L_i^{**}. We will therefore consider the case where $D > (n-1)L_i^{**}$.

We need to show that there are no profitable deviations outside the sets defined above. We will do this by demonstrating that the right partial of $U(D-(n-1)\,L_i^*, (n-1)\,L_i^*)$ with respect to L_i is negative, and the left partial of $U(D-(n-1)\,L_i^{**}, (n-1)\,L_i^{**})$ with respect to L_i is positive under the conditions such that $nL_i^* < D$ and $nL_i^{**} > D$ respectively, and thereafter invoke local concavity of $U(L_i, L_{-i})$.

Calculating the right partial gives:

$$U'_{L_i+}(D-(n-1)L_i^*, (n-1)L_i^*) = -(D-(n-1)L_i^*)\left(\frac{1-q}{B}+c\right) + q\sigma$$
$$\leq -\frac{c}{n-1}\left(n(D-(n-1)L_i^*) - \frac{q\sigma(n-1)}{c}\right),$$

where the inequality follows from the assumption that $cB \leq (n-1)(1-q)$. Since $nL_i^* < D$, the last expression must be negative.

Calculating the left partial gives:

$$U'_{L_i-}(D-(n-1)L_i^{**}, (n-1)L_i^{**}) = \frac{q\sigma(n-1)L_i^{**}}{D}\text{-c}(D-(n-1)\,L_i^{**})$$
$$\geq c(n\,L_i^{**} - D),$$

where the equality follows from $q\sigma(n-1)/c \geq\ q\sigma n/(c+(1-q)/B)) > D$. It follows that the marginal profits are positive.

Since $U(L_i, L_{-i})$ is concave in L_i for $L \leq D$ and for $L \geq D$, it follows that there are no profitable deviations from L_i^* and L_i^{**}.

It remains to show that $L_j^{**} = D/n$ for all j is equilibrium if and only if $q\sigma(n-1)/c\ \geq D \geq\ q\sigma n/(c+(1-q)/B))$. We will do this by demonstrating that for this action profile the marginal profits from increasing L_i are nonpositive, and the marginal profits from reducing L_i are nonnegative if and only if the condition holds.

Calculating the right partial gives:

$$U'_{L_i+}(D/n,(n-1)D/n) = -\frac{D}{n}\left(\frac{1-q}{B}+c\right)+\ q\sigma,$$

which is nonpositive if and only if $D \geq\ q\sigma n/(c+(1-q)/B)$).

Calculating the left partial gives:

$U'_{L_i-}(D/n,(n-1)D/n) = \frac{q\sigma(n-1)}{n}$-c$(D/n)$,

which is nonnegative if and only if $\frac{q\sigma(n-1)}{c} \geq D$. Since the $U(L_i, L_{-i})$ is concave in L_i for $L \leq D$ and for $L \geq D$, it follows that there are no profitable deviations from L_i^{***}.

It is easy to see that expected bank profits are larger in this equilibrium than in than in the equilibrium of Lemma 3 and hence positive ■

Proof of Propositions 3 and 4: Using the result from Lemma 2 and taking the partials and cross partials of $L^*/D\ =\ \sqrt{q\sigma(n-1)/Dc}$, where $D = A - Bq(\beta+\sigma)/(1-q)$, immediately gives the results. ■

Bank seniority

We will next investigate the consequences of assuming bank loans are senior to bonds. For simplicity, we will focus on the case where the BCY payoff is so low that bond holders' claims are worthless in a BCY. For ease of exposition, define the functions $D_{sen}\!:= A - \frac{Bq}{1-q}$ and $x\!:= \sqrt{\frac{q(1-\beta)(n-1)}{cD_{sen}}}$. We will assume $D_{sen} > 0$.

Proposition 5: If bank loans are senior to bonds and $(1-q)(1-\beta-\sigma) \leq x < 1$, then, in a symmetric equilibrium, bond holders' claims are worthless in a BCY, the interest rate is given by $q/(1-q)$, and the fraction of bank loans is equal to x.

Proof: Suppose there is a symmetric equilibrium with both bank and bond financing where the BCY payoff is so low that banks obtain all of the remaining firm value in case of a BCY. It is clear that in such an equilibrium, bond holders' break-even rate must be given by $r_{sen} := q/(1-q)$ and subsequently the demand for capital D_{sen}=$A - Br_{sen}$. Moreover, each bank i earns expected profits of:

$$U(L_i, L_{-i}) = q(1-\beta)D_{sen}\, L_i/L\text{-c}L_i^2/2 - qf.$$

Maximizing $U(L_i, L_{-i})$ with respect to L_i under the assumption that $L < D_{sen}$ and setting $L_j = L/n$ for all j gives:

$$L^*_{sen} = \sqrt{\frac{q(1-\beta)D_{sen}(n-1)}{c}} \qquad \text{and} \qquad \frac{L^*_{sen}}{D_{sen}} = \sqrt{\frac{q(1-\beta)(n-1)}{cD_{sen}}} = x\,.$$

If $x < 1$, then bank financing will not satisfy the entire demand. Moreover, if $(1-q)(1-\beta-\sigma) \le x$, then $D_{sen}(1-\beta-\sigma) \le L^*_{sen}(1+r_{sen})$ such that bondholders' claims will be worthless in a BCY. Expected bank profits are given by q($D_{sen}(1-\beta)\frac{\mathrm{n}+1}{2\mathrm{n}^2} - \mathrm{f}$), which is positive by footnote 5 and the assumption that $D_{sen} > 0$.

It remains to show that it is not profitable for a bank to deviate unilaterally from the proposed equilibrium by offering a loan so large that $L \ge D_{sen}$. We will do this by demonstrating that the right partial of $U(D_{sen} - (n-1)\, L^*_{sen}/n, (n-1)\, L^*_{sen}/n)$ with respect to L_i is negative under the conditions such that $L^*_{sen} < D_{sen}$, and thereafter invoke concavity of $U(L_i, L_{-i})$ for $L \ge D_{sen}$.

Calculating the right partial gives:

$$\begin{aligned} &U'_{L_i+}(D_{sen} - (n-1)\, L^*_{sen}/n, (n-1)\, L^*_{sen}/n) \\ &\qquad = -\left(D_{sen} - \frac{(n-1)L^*_{sen}}{n}\right)\left(\frac{1-q}{B} + c\right) + q(1-\beta) \\ &\qquad \le -\frac{c}{n-1}\left(n(D_{sen} - (n-1)L^*_{sen}/n) - \frac{q(1-\beta)(n-1)}{c}\right), \end{aligned}$$

where the inequality follows from the assumption that $cB \le (n-1)(1-q)$. Since $L^*_{sen} < D_{sen}$, the last expression must be negative. ■

Since $1-\beta \ge \sigma$ by assumption, bank loans will be larger and total demand smaller with seniority. Since banks have a higher cost of capital, this implies that welfare, as measured by the sum of expected bank and firm profits, will be lower with bank seniority when there is both bank and bond financing.

Given that the threshold demand such that there will only be bank financing is smaller when banks are senior, one might wonder whether there are parameters such that the symmetric equilibrium under bank seniority has only bank financing whereas that under no seniority has both bank and bond financing, and the equilibrium interest rate is lower with seniority.

There will be both bank and bond financing without seniority only if $D > q\sigma(n-1)/c$, and the interest rate will be lower under seniority only if $D < \sigma nq/(c + (1-q)/B))$. However, by the assumption that $cB \leq (n-1)(1-q)$, these two conditions are incompatible.

In conclusion, if there were both bank and bond financing under equal priority, the interest rate would be lower and welfare higher under bank seniority. Otherwise, the outcome is the same under the two regimes. Subsequently, bank seniority is inefficient in our model.

Bond seniority

Finally, we will investigate the consequences of making bonds senior claimants. We will assume banks' claims are worthless in a BCY. If this were not the case, bond holders would not suffer any losses in a default, preventing bank participation in the first place.

Proposition 6: If bonds are senior to bank loans, $D > \frac{q\sigma(n-1)}{c}$, and f is sufficiently small, then there exists a $\gamma \in (\beta, \beta + \sigma)$ such that there is a symmetric equilibrium where banks' claims are worthless in a BCY, bond holders' BCY return is given by $-\gamma$, the interest rate is $q\gamma/(1-q)$, and the fraction of bank loans is $\sqrt{\frac{q(\gamma-\beta)(n-1)}{cD_{jun}}} < 1$, where $D_{jun} = A - Bq\gamma/(1-q)$.

Proof: Suppose there is a symmetric equilibrium with both bank and bond financing where bond holders are senior and earn a BCY return of $-\gamma \geq -\beta - \sigma$. This implies that their break-even rate must be given by $r_{jun} := q\gamma/(1-q)$ and subsequently that the demand for capital is D_{jun}:=$A - Br_{jun}$. Each bank i earns expected profits of:

$$U(L_i, L_{-i}) = q(\gamma - \beta)D_{jun}\, L_i/L\text{-c}L_i^2/2 - qf.$$

From this expression, we immediately see that γ must be larger than β for banks to participate. Maximizing $U(L_i, L_{-i})$ with respect to L_i under the assumption that $L < D_{jun}$ and setting $L_j = L/n$ for all j gives:

$$L^*_{jun} = \sqrt{\frac{q(\gamma-\beta)D_{jun}(n-1)}{c}} \qquad \text{and} \qquad \frac{L^*_{jun}}{D_{jun}} = \sqrt{\frac{q(\gamma-\beta)(n-1)}{cD_{jun}}}.$$

We need to show that there indeed exists a $\gamma \in (\beta, \beta+\sigma)$ such that:

$$1 - \beta - \sigma = (1-\gamma)(1 - \frac{L^*_{jun}}{D_{jun}}).$$

This follows since:

1. $\frac{L^*_{jun}}{D_{jun}}$ is a continuous and increasing function of γ for $\beta \leq \gamma < A(1-q)/Bq$, where $\frac{A(1-q)}{Bq} > \beta + \sigma$ by the initial assumption that $D > 0$. Subsequently the right-hand side of the above equation is a decreasing and continuous function of γ for such parameter values.
2. If $\gamma = \beta$, then $\frac{L^*_{jun}}{D_{jun}} = 0$ and the right-hand side is equal to $1 - \beta$.
3. If $\gamma = \beta + \sigma$, then $\frac{L^*_{jun}}{D_{jun}} = \frac{L^*}{D}$, which is smaller than one by the assumption that $D > \frac{q\sigma(n-1)}{c}$ and Lemma 2. Hence the right-hand side is strictly smaller than $1 - \beta - \sigma$.

The expected bank profits are given by $\text{q}(D_{jun}(\gamma-\beta)\frac{\text{n}+1}{2\text{n}^2} - \text{f})$, and they are thus positive for $f < D_{jun}(\gamma - \beta)\frac{\text{n}+1}{2\text{n}^2}$.

It remains to show that it is not profitable for a bank to deviate unilaterally from the proposed equilibrium by offering a loan so large that $L \geq D_{jun}$. We will do this by demonstrating that the right partial of $U(D_{jun} - (n-1)\, L^*_{jun}/n, (n-1)\, L^*_{jun}/n)$ with respect to L_i is negative under the conditions such that $L^*_{jun} < D_{jun}$, and thereafter invoke concavity of $U(L_i, L_{-i})$ for $L \geq D_{jun}$.

Calculating the right partial gives:

$$U'_{L_i+}\big(D_{jun} - (n-1)\, L^*_{jun}/n, (n-1)\, L^*_{jun}/n\big)$$

$$= -\left(D_{jun} - \frac{(n-1)L^*_{jun}}{n}\right)\left(\frac{1-q}{B} + c\right) + \ q(\gamma - \beta)$$

$$\leq -\frac{c}{n-1}\left(n\big(D_{jun} - (n-1)\, L^*_{jun}/n\big) - \frac{q\sigma(n-1)}{c}\right),$$

where the inequality follows from $\sigma > \gamma - \beta$ and the assumption that $cB \leq (n-1)(1-q)$. Since $L^*_{jun} < D_{jun}$ and $D_{jun} > D$, the last expression must be negative. ■

From the last proposition follows that if both bank and bond financing would be provided under equal priority, then both sources are tapped also when bonds are senior. Moreover, under bond seniority the interest rate and the fraction of bank loans are lower than under equal priority. The difference in expected total surplus (the sum of expected bank profits and firm surplus) between senior bonds and equal priority is larger than $qD(\beta + \sigma - \gamma)\left(1 - \frac{n+1}{2n^2}\right) > 0$. Hence, in our model efficiency is enhanced by bond seniority.

Figure 2. Debt outstanding, listed non-financial corporations, by region, 2010

The figure presents aggregate outstanding debt for publicly traded in thirty seven countries for the fiscal year 2010, aggregated by region. Amounts are translated to dollars at year-end market exchange rates. All numbers are in trillions of dollars. North America is Canada, Mexico, and the United States; Europe is Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the United Kingdom; Asia is India, Indonesia, Japan, South Korea, Malaysia, Philippines, Taiwan, and Turkey.

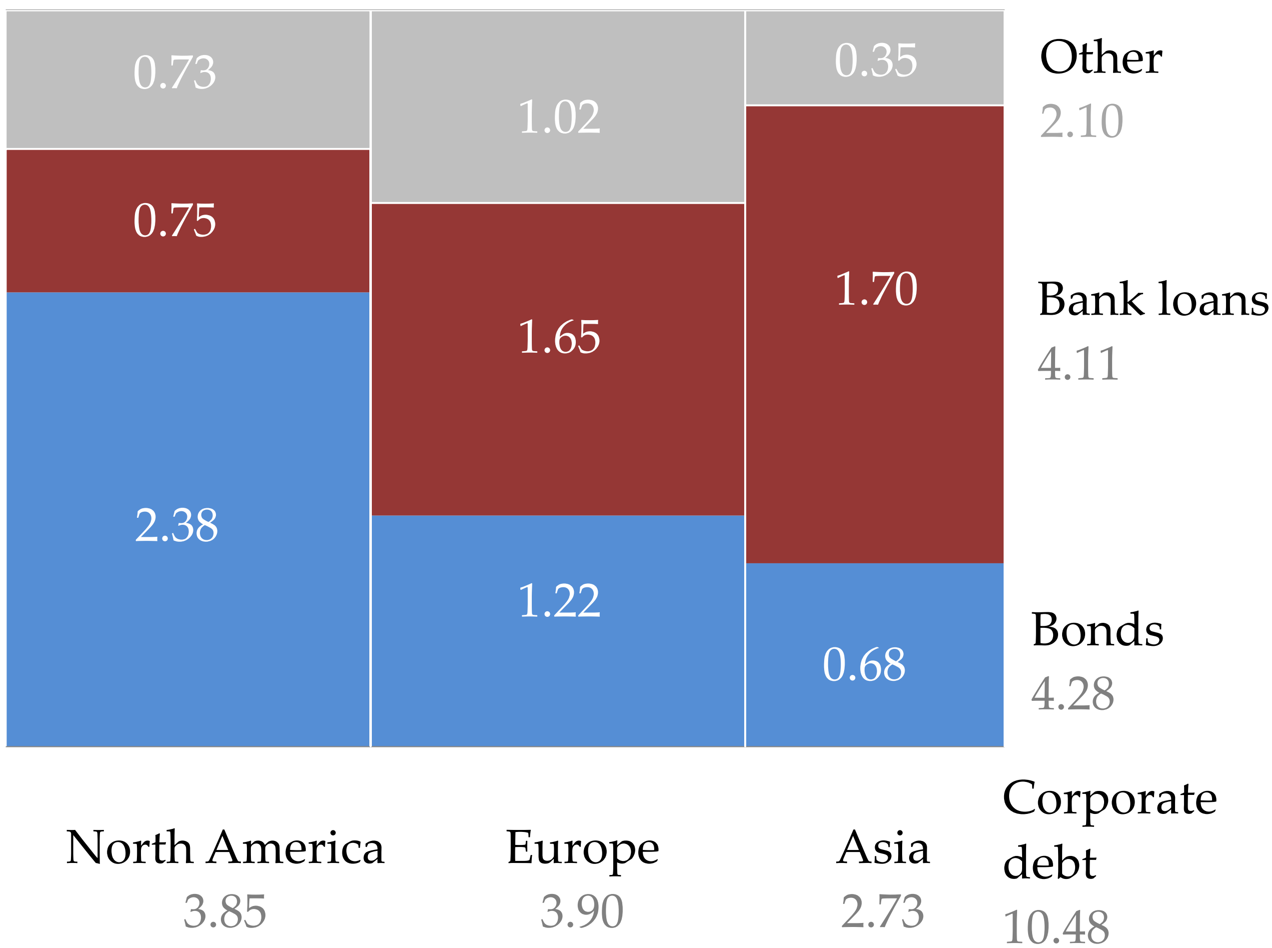


Figure 3. Absolute priority violations for senior debt in and out of court

This figure shows absolute priority violations in bankruptcy and restructurings. The graph reports the frequency with which bonds and loans receive recovery 10% or more below the recovery they would have received in case absolute priority had been respected. The sample is all securities involved in US defaults between 1995 and 2011 included in Moody's Default and Recovery Database (DRD). The sample is restricted to senior debt. Actual recovery is compared to hypothetical recovery following the absolute priority rule. The figure reports how frequently deviations larger than 10% of principal occur. 95% confidence intervals for the means are reported in bars.

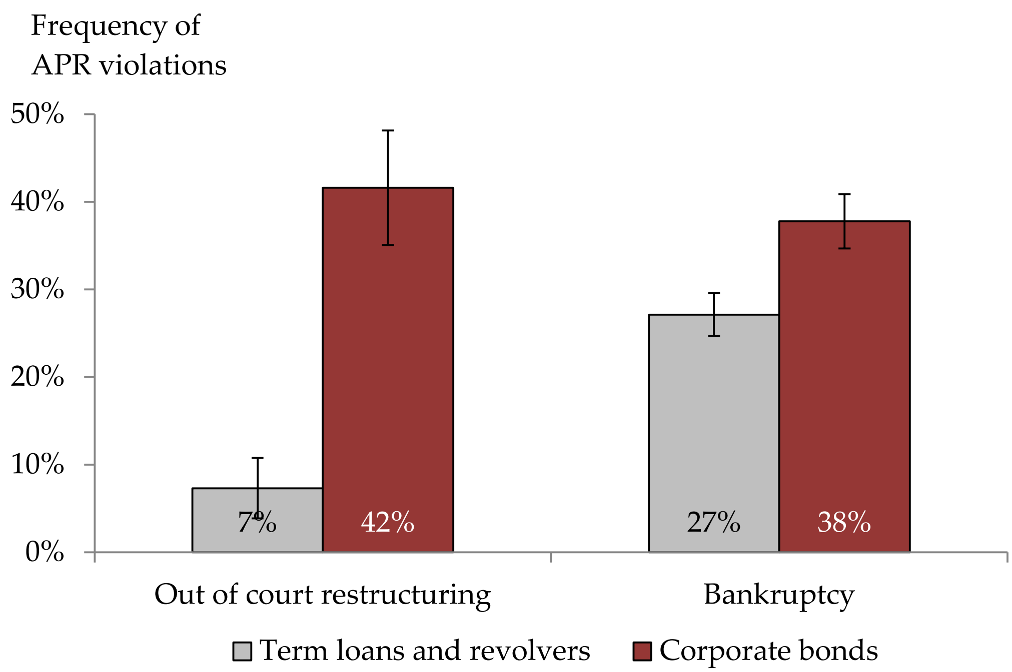


Figure 4. Debt structure and interest cost around first issuance of bonds

The figure presents the components of debt as a fraction of total assets, and interest costs, around the year of a first bond issue. There are 6,711 events in the sample, corresponding to firms issuing a bond, note or commercial paper in one of the years between 2003 and 2011, but which reports no such debt outstanding in previous sample years (the full sample covers 2000-2011). Interest costs (required to be less than 50%) is available for 2,397 observations. Countries with the most than events are: USA, Canada, Japan, India, Australia, United Kingdom, Malaysia, France, Germany, Poland, South Africa, Greece, Sweden, Hong Kong, Norway and Switzerland.

Figure 4a. Capital stucture

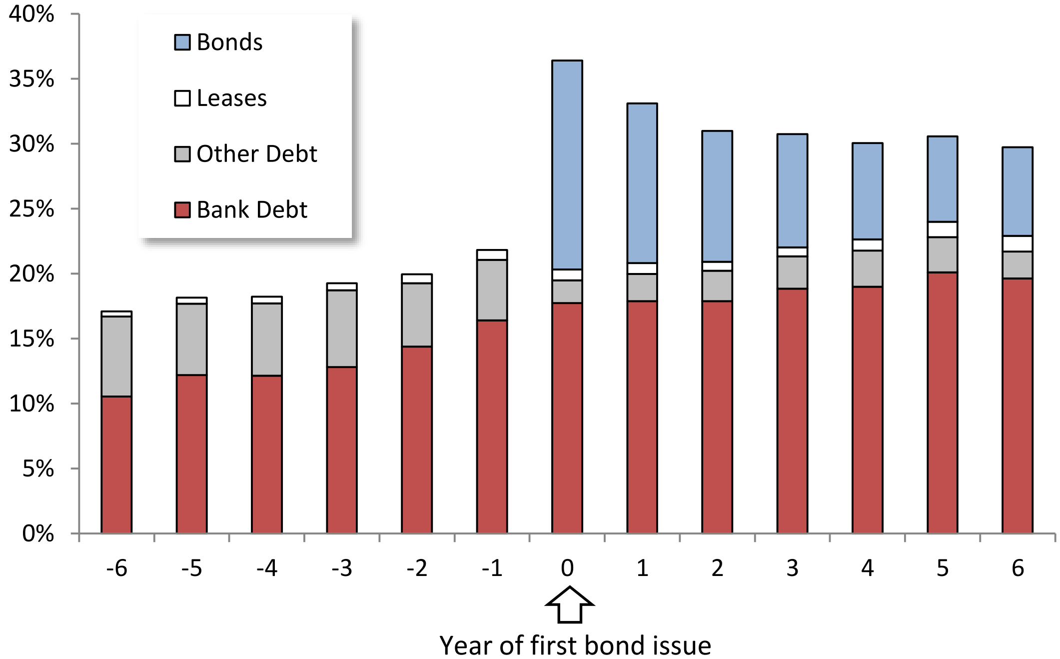


Figure 4b. Interest cost

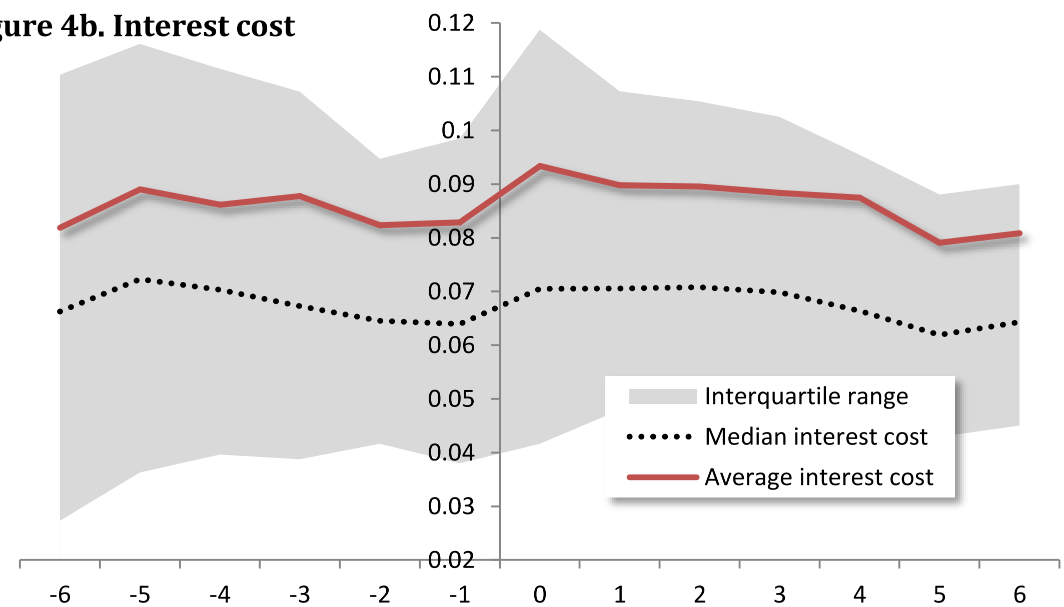
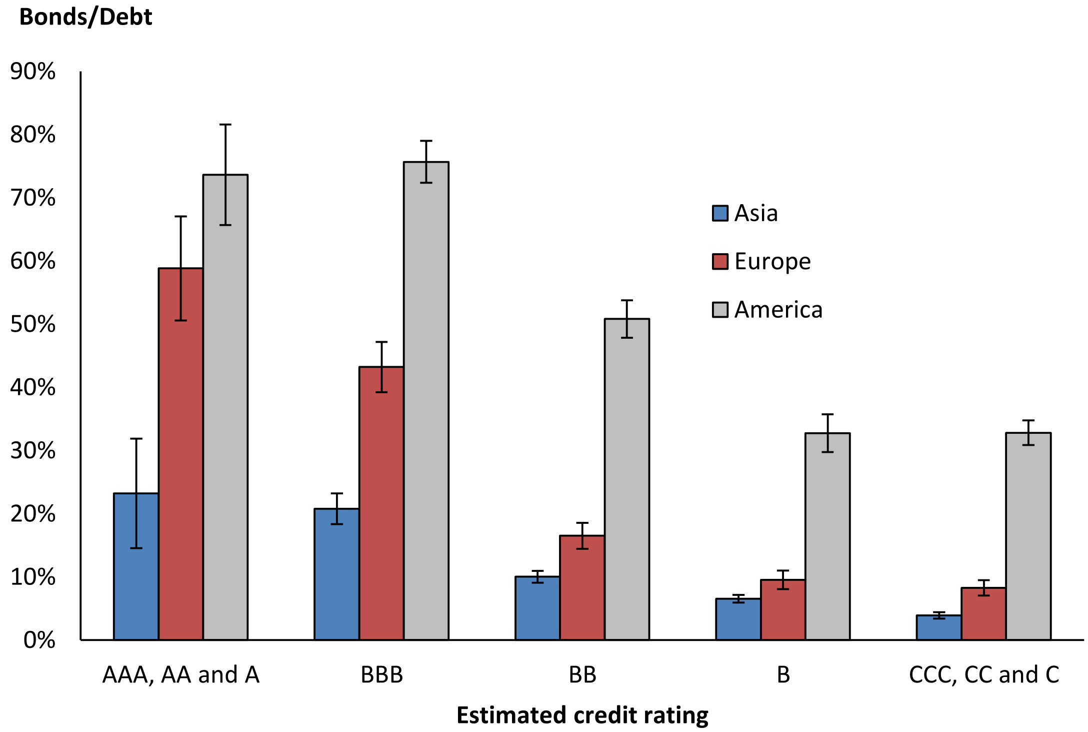


Figure 5. Debt structure by region and credit risk category

The figure presents the share of bonds in total debt for public firms, by region and credit risk category. Credit risk categories are based on estimated ratings using a linear regression estimate (most of the sample firms are not rated). The figure is based on 2010 data. 95% confidence intervals, assuming cross-sectional independence, are reported with bars around each column. * represents significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.



	AAA, AA and A	BBB	BB	B	CCC, CC and C
N.Am./Europe ratio	1.25**	1.75***	3.08***	3.44***	3.97***
N.Am.-Europe difference	14.8%***	32.5%***	34.3%***	23.2%***	24.6%***

Figure 6. Efficiency of bankruptcy: effect on corporate bond stock

This figure shows the estimated effect of bankruptcy recovery rates by credit quality. Observations are sorted into deciles of credit ratings (14.3 thousand firm-years each). The effect of bankruptcy efficiency (the recovery rate) is estimated separately for each decile (the regression otherwise corresponds to those reported in Table 4). This table reports the coefficient estimate for each decile, multiplied with one cross-country standard deviation of recovery rates (22.3). 95% confidence intervals are indicated with bars for each decile.

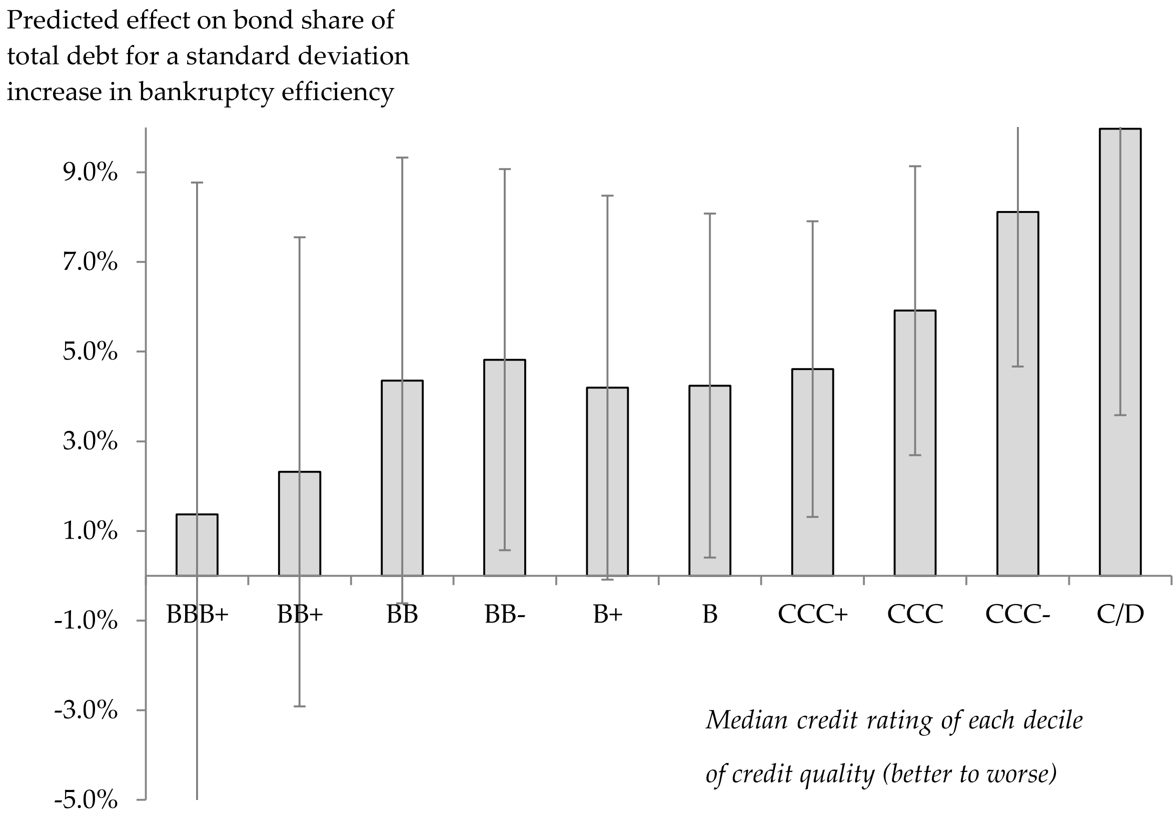


Figure 7. Bond market development and bankruptcy: using World Bank data

This figure shows plots the relationship between bankruptcy efficiency and composite bond market development, as reported by the World Bank (2006), and captures various aspects of bond market development, including liquidity and size, averaged for the 2001-2005 period. Three letter codes denote countries. The correlation is 0.61 and the R-squared is 0.37.

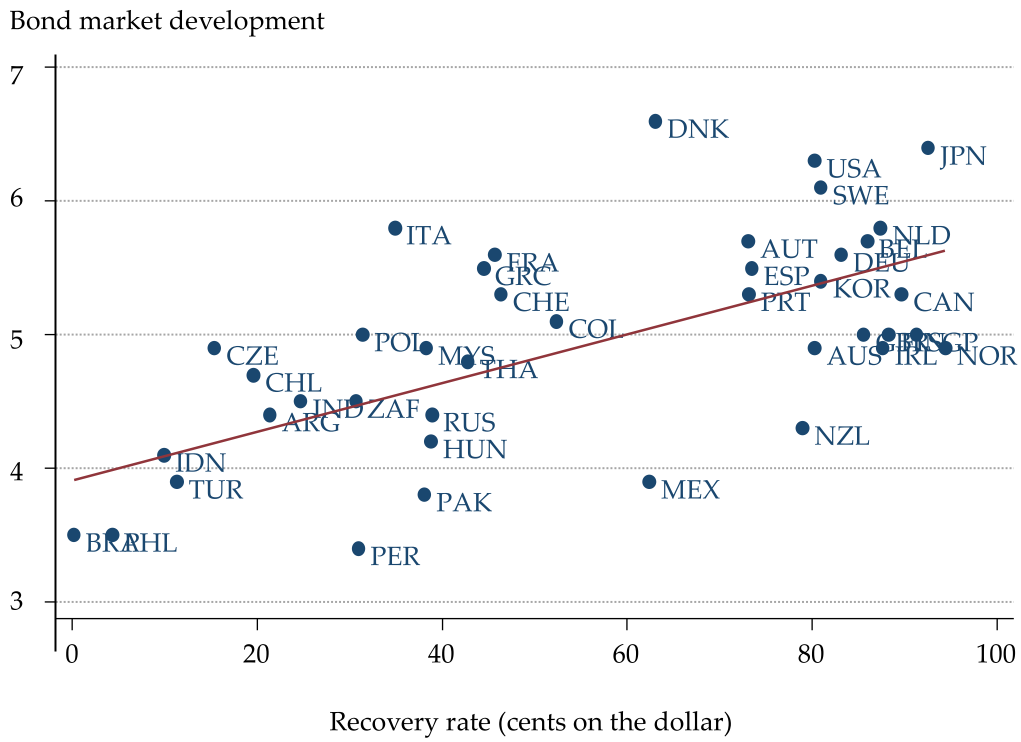


Table 1. Selected summary statistics: firm level data

Summary statistics are reported in Panel A for variables that vary by firm and year. Rating is the corporate credit rating. For S&P, the scale is AAA=28, AA+=26, AA=25, AA-=24, A+=23 and so on down to CCC-=9. CC=7, C=4 and D=1 (in default). When there are two ratings, the average was used. Estimated credit ratings are based on a regression. Explanatory variables in the ratings estimation are described in the text. Investment grade is equal to one if the estimate rating is 18 or higher. In Panel B, cross-country summaries of variables from the World Bank's cost of doing business survey, covering 169 countries, are reported. Each country-year is one observation for the purpose of calculating summary statistics here. Only 44 countries are represented in our firm sample, and we also report summary statistics across this subsample.

Panel (A) Firm variables

	Mean	Std. dev.	Min	25th perc.	Median	75th perc.	Max
Bond share in debt	0.197	0.324	0	0	0	0.291	1
Bond share in debt, IG firms	0.325	0.360	0	0	0.175	0.649	1
Bond share in debt, HY firms	0.167	0.307	0	0	0	0.178	1
Bond share in debt, ex-US	0.136	0.263	0	0	0	0.137	1
Rating, actual	18.0	3.7	1	15	18	21	28
Rating, estimated	12.9	4.6	1	10.0	13.4	16.1	28
Investment grade	0.167	0.373	0	0	0	0	1

Panel (B) Country variables

	Mean	Std. dev.	Min	25th perc.	Median	75th perc.	Max
Bankruptcy recovery	36.1	22.6	0.0	20.8	31.6	44.4	92.5
Bankruptcy time (years), 2010	2.90	1.41	0.4	1.9	2.8	4	8
Bankruptcy recovery, sample countries	56.5	26.7	4.4	34.1	64.2	80.2	92.5
Bankruptcy time, sample countries	2.12	1.43	0.4	1.1	1.8	3	6.5

Table 2. Bankruptcy reform examples

This table presents brief summaries of four selected reform examples. Each of these corresponds to a change in bankruptcy efficiency.

Country	Reform summary
Brazil	A new bankruptcy law aiming to allow viable firms to reorganize and survive was passed in 2004. Key features were a stronger role for creditors, limitations to the size of labor claims in bankruptcy, and reduced priority for tax claims. Going concern sales free and clear of tax and labor liens and liabilities were introduced by the new law. Bankruptcy times fell by half over subsequent years. See Ponticelli (2013).
Italy	Prompted by the Parmalat scandal and a couple of other large firm failures, a number of reforms were implemented to Italian bankruptcy and insolvency rules between 2004 and 2007. Notably, creditors were allowed to reach a deal with creditors outside of bankruptcy; the minimum requirements for a reorganization (instead of a liquidation) were reduced; the creditor's committee gained more influence in proceedings; it removed limits to operations while in bankruptcy. The Italian reforms dramatically reduced backlogs and reduced the frequency of liquidation. See Beye and Nasr (2008).
Poland	Poland recently undertook a number of procedural and operational reforms to facilitate the resolution of insolvency. Features include: changed documentation requirements for bankruptcy filings; increased qualifications for administrators; limiting pay for administrators. Improved electronic systems to processes cases and assign them to judges as well as to improve the operations of courts were introduced over the 2004-2007 period, reducing case backlogs. The civil procedure was amended in 2012, eliminating separate procedural steps in commercial cases. Poland has also reformed insolvency law, notably introducing a reorganization procedure. Secured creditors have also received stronger rights. See Doing Business (2013).
Peru	Peru undertook a range of reforms to improve credit availability to the private sector during the early 2000-s. For example, security interests were vastly simplified and out-of-court resolution facilitated. The implementation of the reforms was problematic. Also, amending and adjusting a reorganization plan became more difficult. These issues resulted in a reduction of bankruptcy efficiency around 2007. See Marechal and Shahi-Saless (2008).

Table 3. Coexistence of bank loans and bond debt

The table reports the frequency of firm-years having or not having bonds outstanding having bank loans above 1%, 10% or 20% of assets. The difference in the propensity to have bank debt above the threshold between bond and no bond observations is reported below each box. * represents significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

Among firm-years with….	…the fraction with bank debt ≥ 1% assets is:		…the fraction with bank debt ≥ 10% assets is:		…the fraction with bank debt ≥ 20 % assets is:
No bond debt (131,944)	49.4%	<10%	35.9%	<20%	25.5%
Bond debt (62,370)	72.6%	>10%	49.5%	>20%	31.5%
Difference:	**23.1%*** **		**13.7%*** **		**5.9%*** **

Table 4. Bankruptcy efficiency and corporate debt mix

The table shows regressions of bond use. The dependent variable is bonds as a share of debt. Variable definitions are described in the data section. Safe firms refers to firms whose estimated numerical rating is above 13.86 (this is set to divide the firm-year sample in half). Creditor rights is a legal variable, credit rating (AAA = 28) includes inferred ratings; ROA is operating income over assets; dividend indicator is positive for dividend payers; market capitalization and book assets are measured in US $ and logged; Book-to-market; volatility is annualized , based on daily returns. Volume refers to turnover of shares on stock exchange. Dependent variables are lagged. Heteroskedasticity–robust standard errors, clustered by country, are reported below coefficients. * represents significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var.	Bond share					
Firm sample	All	Safe	Risky	All	Safe, ex US	Risky, ex US
Dep. var. mean	0.212	0.248	0.178	0.212	0.173	0.119
Bankruptcy	**0.246****	**0.210***	**0.233*****	**0.580*****	**0.004**	**0.151*****
recovery	0.009	0.120	0.064	0.126	0.082	0.055
Recovery * Rating				**-0.025*****		
				0.009		
Creditor rights	**-0.055****	**-0.043****	**-0.043****	**-0.055****	**-0.057***	**-0.045*****
	0.022	0.016	0.016	0.022	0.030	0.019
Credit Rating	**-0.038****	**-0.029*****	**-0.029*****	**-0.016**	**-0.024**	**-0.029*****
	0.015	0.008	0.008	0.016	0.024	0.008
ROA	**0.023**	**0.163**	**0.001**	**0.042**	**0.076**	**-0.023**
	0.122	0.197	0.056	0.113	0.192	0.048
Dividend indicator	**0.052***	**0.050**	**0.027***	**0.046**	**0.055**	**0.022***
	0.033	0.050	0.012	0.034	0.056	0.012
Cash/Assets	**0.163*****	**0.242*****	**0.138*****	**0.150*****	**0.180****	**0.122*****
	0.031	0.079	0.016	0.032	0.084	0.017
Market capitaliz.	**0.049*****	**0.069*****	**0.017****	**0.053*****	**0.047*****	**0.018*****
	0.015	0.022	0.007	0.015	0.021	0.006
Book-to-market	**-0.001**	**0.030**	**-0.021*****	**-0.001**	**0.021**	**-0.022*****
	0.012	0.020	0.004	0.001	0.018	0.005
Volatility	**0.001**	**-0.000**	**0.001**	**0.003**	**0.003**	**0.002***
	0.001	0.001	0.001	0.002	0.005	0.001
Book assets	**0.034*****	**0.046*****	**0.021*****	**0.034*****	**0.062*****	**0.018*****
	0.007	0.014	0.007	0.007	0.012	0.004
Volume	**0.189*****	**0.223****	**0.160*****	**0.196*****	**0.176***	**0.159*****
	0.057	0.096	0.030	0.059	0.092	0.023
Industry, year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
N	123,838	61,922	61,924	123,838	50,269	44,905
R-squared	0.193	0.279	0.156	0.180	0.173	0.100
Clusters	40	40	40	40	37	38

Table 5. Bankruptcy efficiency and corporate debt mix: robustness

The table shows regressions of bond use. In columns (1) to (4), the dependent variable is the bond share of debt, in (5) and (6) an indicator for first bond issue. Bankruptcy delay is time to resolution in years. Inefficient liquidation is an indicator of the worst bankruptcy outcome from Djankov et al (2008). See variable descriptions in Table 4. Dependent variables are lagged. Heteroskedasticity–robust standard errors, clustered by country, are reported below coefficients. * represents significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var.	Bond share				First bond issue	
Firm sample	Safe	Risky	Safe	Risky	Safe, no bonds.	Risky, no bonds
Dep. var. mean	0.247	0.160	0.247	0.160	0.026	0.044
Bankruptcy recovery					**-0.006**	**0.035****
					0.010	0.016
Bankruptcy delays	**-0.002**	**-0.029*****				
	0.015	0.009				
Inefficient liquidation			**-0.054**	**-0.069*****		
			0.041	(0.026)		
Creditor rights	**-0.057***	**-0.045*****	**-0.051***	**-0.037***	**0.101**	**0.141**
	0.030	0.019	0.025	(0.019)	0.176	0.354
Credit Rating	**-0.024**	**-0.029*****	**-0.026**	**-0.021****	**-0.092**	**-0.179**
	0.024	0.008	0.024	(0.009)	0.234	0.161
ROA	**0.076**	**-0.023**	**0.072**	**-0.074**	**-1.957**	**-5.499*****
	0.192	0.048	0.187	0.056	2.536	1.823
Dividend indicator	**0.055**	**0.022***	**0.026**	**0.008**	**0.094**	**-0.002**
	0.056	0.012	0.049	0.012	0.496	0.437
Cash/Assets	**0.180****	**0.122*****	**0.217*****	**0.131*****	**0.650**	**-0.179**
	0.084	0.017	0.075	0.014	0.935	0.526
Market capitaliz.	**0.047*****	**0.018*****	**0.057*****	**0.007**	**-0.396****	**-0.645**
	0.021	0.006	0.020	0.007	0.156	0.530
Book-to-market	**0.021**	**-0.022*****	**0.021**	**-0.030*****	**-0.448***	**-0.675**
	0.018	0.005	0.020	0.006	0.251	0.530
Volatility	**0.003**	**0.002***	**0.000**	**0.000**	**0.014*****	**0.010*****
	0.005	0.001	0.001	0.000	0.005	0.002
Book assets	**0.062*****	**0.018*****	**0.043*****	**0.017*****	**0.190**	**0.306**
	0.012	0.004	0.013	0.004	0.267	0.347
Volume	**0.176***	**0.159*****	**0.173***	**0.114*****	**0.569**	**1.904****
	0.092	0.023	0.091	0.020	0.761	0.775
Industry, year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
N	46,717	46,404	61,913	61,924	50,347	49,867
R-squared	0.294	0.149	0.273	0.147	0.012	0.029
Clusters	33	37	38	39	35	39

Table 6. Bankruptcy efficiency – using bankruptcy reforms as natural experiments

The table shows country-year level regressions of bond debt shares on average recovery rates and country and year fixed effects. Heteroskedasticity–robust standard errors, allowing first order autocorrelation, are reported below coefficients. * represents significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	(1)	(2)	(3)	(4)
Dependent variable	Bond share, equal weighted	Bond share, value weighted	90th percentile of bond share	First bond issue
Dep. var. mean	0.130	0.337	0.462	0.023
Bankruptcy recovery	**0.060***	**0.227*****	**0.286*****	**0.030*****
	0.032	0.065	0.107	0.007
Country F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
N	349	349	349	349
Autocorrelation	0.639	0.568	0.537	0.421
R-squared	0.071	0.187	0.102	0.062