Conflicts in Bankruptcy and the Sequence of Debt issues*

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Abstract

We present a model that shows how interactions between creditor groups in bankruptcy can affect the debt issuance decisions of firms. In particular, we suggest that deviations from APR should be priced and can affect the issuing decisions of junior and senior debt. Our model suggests that once firms issue debt with one level of seniority, they may have an incentive to alternate, and subsequent issues may have a different seniority level. When we introduce explicit costs of conflict in our model, we find that as these costs increase, firms will tend to stay with one class of debt. The empirical implications of our model are consistent with the tendency of firms to alternate the seniority of debt issues, and with the somewhat surprising fact that some firms issue debt at one seniority level only, and quite a few of them never issue any senior debt. Finally, we study a sample of firms in bankruptcy and again find significant relationships between corporate characteristics and the types of debts that they issue, as predicted by the model.

JEL Classification: G33

Keywords: Bankruptcy, Absolute Priority Rule, Seniority, Debt

1. Introduction

Firms issue securities in sequence. In other words, when a new debt issue hits the market, the firm usually has several other issues outstanding already. The purpose of this paper is to model this sequential issuing process, taking into account a possible conflict between classes of debt with differing priorities should bankruptcy occur. We test some of our propositions using a fixed income database as well as a sample of firms in bankruptcy.[1]

Our theory shows that conflicts during bankruptcy can make it optimal for a firm to alternate seniorities or issue senior debt only or junior debt only. When debt with different priorities is issued, we determine the optimal sequence of security issuance.

We model the bankruptcy process as a conflict, where junior creditors can extract value from the senior creditors if the Absolute Priority Rule (APR) is violated. APR violations can make junior debt cheaper to issue. Similarly, if junior debt is issued and priced first, the firm may find it optimal to subsequently issue senior debt. In equilibrium, creditors anticipate the firm's behavior and price claims taking into account the firm's best response. Ultimately, equilibrium strategies depend on the bankruptcy process and on the liquidation value of the firm, but they lead to a mechanism that explains sequential issues of alternating or similar seniority. We test some of our propositions using the Fixed Investment Securities Database from Mergent. Of the more than 10,000 issuers represented in this database, over 2000 have issued bonds only at the "senior subordinated" security level.[2] [3] This type of empirical regularity is difficult to explain otherwise, but it is consistent with our model.

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[1] There has been some analysis of how debt classes with different priorities affect the costs and outcome of bankruptcy (see for example, Gilson, John, and Lang (1990)). There has also been some work on how different classes of debt might pay for bankruptcy costs and how this will affect the bankruptcy process (see Gilson et al. (2000) and Bris et al. (2004)) or Welch (1997)). Other papers have looked at conflicts between equity holders and bondholders in bankruptcy. However, the crux of our analysis is based upon the interaction and conflict of interest between different classes of debt.

[2] If there is no senior debt, one may ask, "Subordinated to what?" However, this question is answered by the American Bar Foundation (1971) "Commentaries on Model Indentures", which gives the following language for a

In simple probit regressions, we find that firms with a single class of debt outstanding are more likely to issue debt of the same class the worse is their credit rating. This is consistent with the model, since it implies that there is a greater likelihood for one class of debt issue the higher are the expected costs of conflict. We also find that firms that have issued both senior and subordinated debt, are more likely to continue issuing debt of different seniorities. This is also consistent with our model. When conflict is already inevitable, there is an incentive to switch seniorities, that is, to issue senior after junior and vice versa. We also test the idea that a commitment to one class of debt can lower the yield on debt issues.

Our last set of tests is on a sample of bankrupt firms. Chapter 7 is costlier than chapter 11 and no APR violations occur. Our model predicts that in such cases, firms are more likely to issue one class of debt. Indeed, in a sample of 271 bankruptcy filings (81 Chapter 7 and 221 Chapter 11) we find that single seniority issues represent 42 percent of the Chapter 7 cases (34 out of 81), but less than 1 percent of the Chapter 11 cases (2 out of 221).

The rest of the paper is organized as follows. In the next section, we discuss previous work on the relation between seniority of debt and the bankruptcy process. Section 3 contains a model of debt financing and bankruptcy. Section 4 discusses the sequential issuance of debt with different seniorities and extends the model to include the bankruptcy costs that result from the conflict between different classes of creditors. Sections 5 and 6 describe empirical tests of our model using the bond database and the bankruptcy data respectively. In section 7, we summarize and conclude.

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subordination clause in a bond contract: "The Company agrees that the payment of principal and interest on all of the Debentures is hereby expressly subordinated to the prior payment in full of all Senior Debt. The term "Senior Debt" means indebtedness of the Company, whether outstanding on the date of execution of this Indenture or thereafter created unless it is provided that such indebtedness is not senior…" Thus, the bond allows for the future issuance of other bonds that are senior to it.

[3] Our database does not include bank loans. We try to take this into account in our empirical analysis.

2. Related Work

Our work is related to four strands of literature. The first strand is the literature on seniority of debt claims. The second strand is the empirical literature on APR violations, and the third is the theoretical literature on the consequences of such violations. The fourth and closest strand of literature is the body of work on incentives of different classes of creditors within the bankruptcy process itself.

In a world without bankruptcy, naturally seniority is of no consequence. However, once frictions are introduced, one can consider various effects of seniority on debt and equity valuation. Diamond (1993), relates debt seniority to maturity. His main result is that short-term debt will be senior to long-term debt. Winton (1995) shows that when a firm needs to raise funds from several investors, it is optimal to use debt with different seniority levels and an absolute priority rule. Having a senior claim allows an investor to put less effort into costly verification of firm output. If all investors are paid under the same circumstances, there will be an inefficient duplication of effort in verification.[4]

A related group of papers explains why bank debt is usually senior, even though junior creditors should have greater incentives for monitoring. Welch (1997) shows that because of their strength and organization, banks are in a better position to contest bankruptcy plans that they do not like. When they are senior creditors, this deters the junior creditors from contesting the plan. If they were junior, they would be more likely to contest proposals, thereby resulting in increased waste of the firm's resources in the form of payments to lawyers. Longhofer and Santos (2000) point out that bank seniority encourages the formation of close relationships between lenders and borrowers, especially when the borrowers are small businesses.

Our model is simpler than previous models in several ways; however, it adds a very important feature to the analysis, namely, as in Welch (1997) we allow for violations of the absolute

[4] Other authors have also studied seniority from the point of view of optimal security design. See for example, Berkovitch and Kim (1990), Hart and Moore (1995), Park (1995), Rajan and Winton (1995), Repullo and Suarez (1998), Riddiough (1995).

priority rule (APR) in bankruptcy. The conflict that is introduced between debt holders of different priorities has an effect on the proceeds from financing at different seniority levels.

APR violations have been discussed in the literature for a long time. Warner (1977), discusses railroad bankruptcies and finds some evidence that the market correctly adjusts the prices of debt claims to compensate for the possibility of future violations. Eberhart and Sweeney (1992) and Pulvino and Pidot (1997) reach similar conclusions. Several empirical studies document the frequency of APR violations. Eberhart, Moore, and Roenfeldt (1990) find that violations occur in 75% of bankruptcies in their sample. They also find that stock prices before the settlement reflect the expected violations, and that these violations are inversely related to the unexpected component of the length of chapter 11 proceedings. Widespread APR violations are also reported by Franks and Torous (1989). More recently, and using a larger sample than those used in the previous studies, Carapeto (2005) concludes that 67% of the bankruptcy settlements violate absolute priority, between creditor classes as well as between debt and equity. In Bharath et al. (2007) the incidence of APR violations is reported to be lower after 1990. (This is related to an increase in debtor-in-possession (DIP) financing and key employee retention plans (KERP)). However, APR violations are still there. Several papers, including Bris et al. (2006) report APR violations among debt classes as well.

The reported existence of APR violations has motivated a significant theoretical literature, which considers the impact of these violations on the behavior of management and investors. Some models show that APR violations are beneficial (Eberhart and Senbet [1993], Berkovitch, Israel, and Zender [1997, 1998]), discouraging, for example, both excess risk taking and underinvestment by the management of a distressed firm. Other work finds detrimental effects ex ante, before the onset of financial distress (Longhofer [1997], Bebchuk [2002]). Longhofer and Carlson (1995) find that APR violations are good for small firms but are not beneficial for larger firms. Most models consider two classes of claimants: either debt holders and equity holders or secured debt holders and unsecured debt holders. The former situation is modeled in most of the previously mentioned papers as well as in Bebchuk (2002). The latter is analyzed by Bebchuk and Fried (1996, 2001), who discuss the difficulty of valuing the collateral of a secured debt contract, as required for any bankruptcy settlement, and propose a new market-based mechanism for doing so. In our paper, we also consider two classes of claimants, but here they are both holders of unsecured debt, with different levels of seniority[5].

The closest set of papers to our work explicitly analyzes the impact of debt classes with different priorities on the costs and outcome of bankruptcy. For example, Gilson, John, and Lang (1990) study the incentives for private restructuring of debt without formal bankruptcy. Such restructurings are more likely when banks hold more of the debt, since bank debt usually has senior status. There has also been some work on how different classes of debt might pay for bankruptcy costs and how this will affect the bankruptcy process. Gilson, Hotchkiss, and Ruback (2000) study the relation between the market value of a firm emerging from bankruptcy and the valuation implied by management's forecast of future cash flows contained in the reorganization plan. They show that senior (junior) debt holders have an incentive to undervalue (overvalue) the firm to obtain the maximum value under reorganization. Bris et al. (2006) discusses recovery rates and expenses of various debt classes in Chapter 7 and Chapter 11.

Theory papers along these lines include Cornelli and Felli (1997) who consider the efficiency of bankruptcy procedures and the effect of APR violations on the incentives to monitor in bankruptcy, and Bris, Schwartz, and Welch (2005) who model the allocation of professional costs in the bankruptcy process. Cornelli and Felli (1997) show that APR violations may affect monitoring by creditors. Their model is a simple binomial model similar to ours, but in Cornelli and Felli (1997, the outcome of the project may depend on monitoring. Different parameter values may induce monitoring by one class of creditors or no class at all. In Bris et al. (2005) Courts cannot distinguish between professional expenditures that increase value and those that result only in a redistribution of the assets of a bankrupt company. Therefore, subsidies for professional costs should be designed to encourage only value-enhancing activities. Our paper uses elements from previous work as well as some new analysis to suggest how the sequence of debt issuance is affected by priorities in bankruptcy. Our empirical analysis is based upon the theoretical ideas and determines the factors that most influence the choice of seniority in bond issuance.

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[5] Cornelli and Felli (1997) discussed below have a similar framework.

3. The Model

We present a very simple binomial model of a project that may succeed or fail[6]. Our focus is on the allocation of claims in bankruptcy and the consequences of these outcomes for ex-ante seniority structure. Further, this model considers incentives in bankruptcy and it is not a model of optimal capital structure.

3.1. The Firm

We assume a firm endowed with an investment project at $t = 0$ that costs I. The investment is perfectly scalable and divisible, so the firm can decide to buy only a fraction x of the project, in which case the payoff will be proportional to x. We assume risk neutrality and a risk free rate of zero. The project may succeed or fail. If it succeeds, with probability $1\text{-}p$, it yields revenues of $(1+h)I$. Otherwise, the project pays qI, the "liquidation" (post bankruptcy) value of the firm, where $q<1$. The parameter q summarizes the value of liquidation vs. continuation less the administrative costs of bankruptcy. We specifically exclude from these bankruptcy costs any costs resulting from the conflict between claimants with different seniorities. The latter costs will be modeled separately. The bankruptcy costs included in q depend on: (1) the effectiveness of the court, which will determine, for instance, the length of the case; and (2) project characteristics such as the deployability of the assets. We assume that h is such that the expected net present value of the project is positive, otherwise the project is not worth pursuing in the first place: The NPV is given by:

$$NPV = (1-p)(1+h)I + p(qI) - I = [(1-p)(1+h) + pq - 1]I \tag{1}$$

For this expression to be positive, we need to make the following assumption:

Assumption 1: The project's NPV is positive, that is $h > p\dfrac{1-q}{1-p}$

[6] The probability of project failure is not necessarily the probability of not being able to pay the debt issued (see Haugen and Senbet 1978 for a seminal contribution in that regard). This type of a simple st-upl is used often in bankruptcy modeling, see Cornelli and Felli (1997)

We will assume that debt has some advantages, so as to make the discussion of bankruptcy meaningful. Therefore, the project will be financed by debt if possible, with a residual amount financed by equity. This is consistent with several versions of a pecking order theory, and can be justified by tax effects. However, admittedly, we are not looking for a complete security design framework (see Bris, Schwartz, and Welch [2005] for similar assumptions). Naturally, even if the project is financed entirely by debt, equity is the residual claimant and has value as long as the project has a positive NPV.

3.2. Full Debt- Financing with a single class of debt- the base case

We use the following notation:

V_d = time 0 (market) value of the debt, i.e. the proceeds from debt financing

D = face value of debt, i.e. the amount that must be repaid at time 2

V_e^* = expected value of equity with debt financing

If debt is fairly priced, and enough debt is issued to finance the entire initial investment, I, then, in case the firm defaults, the single creditor will liquidate the firm and realize the entire liquidation value, qI. The time 0 value of the firm's debt will then be:

$$V_d = (1-p)D + pqI$$

Since the entire initial investment is financed by debt, then $V_d = I$, and the face value of debt issued must be $D = I\frac{1-pq}{1-p}$.[7] We further assume throughout the paper that if the entire project

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[7] We are assuming throughout that the risk-free interest rate is zero. Thus, if there is no possibility of bankruptcy ($p = 0$), then debt is riskless and the face value of the debt (the amount to be repaid) is the same as the amount borrowed ($D = I$). Note that we can write the term $\frac{1-pq}{1-p}$ as $1+r$, where r is the corporate cost of debt.

is financed by debt then the face value of debt will not exceed the cash flows in the high state, $(1+h)\ I$[8]. We can now calculate the value of equity:

$$V_e^* = (1-p)I\left[(1+h) - \frac{1-pq}{1-p}\right] + p(0) = I\left[(1-p)(1+h) + pq - 1\right] = V_e = NPV$$

In other words, the value of equity is the NPV of the project. This is our base case. Strictly speaking, if everybody is risk neutral, we do not need to finance the entire investment by debt, and any division between debt and equity will be feasible. In what follows, we consider equilibrium strategies, in other words, strategies that will be sequentially rational.

3.3. Bankruptcy

We now consider the more interesting cases where the entrepreneur can issue different classes of debt. Formally, the entrepreneur will finance a percentage α of the project with *senior* debt, and the remaining $1-\alpha$ with *junior* debt. The difference between senior and junior debt is in the priority treatment upon bankruptcy. Following papers such as Welch (1997) or Bris et al. (2005), we assume that courts uphold the Absolute Priority Rule (APR) with probability $1-\theta$, $0 \leq \theta \leq 1$. The cost and benefit of professional effort are both zero. Let S and J be the face values of the senior and junior claims. Welch (1997) and Bris et al. (2005) assume that if APR is violated, the equal (proportional) priority rule (EPR or PPR) will be used. We will follow this assumption here, although most of our conclusions will follow regardless of the specific form of APR violation. In the case of EPR, if S and J are the face values of the senior and junior debts, and $V = qI$ is the value available to be distributed, then the senior and junior creditors receive $\frac{S}{S+J}V$ and $\frac{J}{S+J}V$ respectively. Let $X(q)$ be the payoff to the junior creditors. Thus:

Equivalently, the default risk spread is $r - r_f = r = \frac{p(1-q)}{1-p}$. Thus, our Assumption 1 says that the return on a successful project is greater than the cost of debt.

[8] In theory, since everything is priced, any face value can be used. However, there is not much point in issuing debt that is in default no matter what.

$$X_{APR}(q) = \max(qI - S, 0) = \begin{cases} 0 & q < \frac{S}{I} \\ qI - S & \frac{S}{I} < q < \frac{S+J}{I} \end{cases}$$

$$X_{EPR}(q) = \frac{J}{S+J} qI \tag{2}$$

$$X_\theta = \theta X_{EPR} + (1-\theta) X_{APR} = \theta \frac{J}{S+J} qI + (1-\theta)\max(qI - S, 0)$$

These payoffs are shown in Figure 1. Note that, obviously, junior creditors are always better off under EPR, since $X_{APR}(q) < X_{EPR}(q)$. Therefore, $X_\theta > X_{APR}(q)$ as well.

[Insert Figure 1 here]

We denote by $G(q,\theta)$ the difference between the actual allocation to junior creditors and the allocation under APR. The interpretation of $G(q,\theta)$ is two-fold. It represents the expected benefits to the junior creditors of inducing the court to violate APR. Additionally, $G(q,\theta)$ represents the court's expected degree of leniency with respect to junior creditors. If the first interpretation is accepted, then our implicit assumption is that $G(q,\theta)$ is already net of influence costs.[9] In the second case, our model assumes that $G(q,\theta)$ is court-specific, as some courts tend to violate APR more often than others.[10] In both cases, $G(q,\theta)$ is a transfer from senior to junior bondholders, which is the critical issue for this paper. Therefore, from (2) we have:

$$G(q,\theta) = X_\theta(q) - X_{APR}(q) = \theta\left[\frac{J}{S+J} qI - \max(qI - S, 0)\right] \equiv \theta G(q) \tag{3}$$

When junior creditors are out of the money under APR ($S > qI$), then $G(q,\theta)$ is increasing in q. Intuitively, as q increases, liquidation becomes more efficient and the junior creditors are better off under EPR. However, when the junior creditors are in the money ($S < qI$), then $G(q,\theta)$ is decreasing in q. The reason is that as liquidation is more efficient, a one-dollar increase in the

[9] This terminology is taken from Welch (1997). In Section 5 we relax this assumption, by adding explicit costs to the model.

[10] See Bris, Welch, and Zhu (2006) and Chang and Schoar (2006).

liquidation proceeds translates into a one-dollar increase in the junior creditors' recovery under APR, but only a fraction of it under EPR, because they have already received a partial payment. Figure 1 shows that the junior creditors have the highest incentive to fight against APR when $S = qI$.[11] For the remainder of the paper, we refer to $G(q)$ simply as G.

Equation (4) below defines the face value of senior debt, S, for each choice of α. With probability 1-p, the firm is solvent and senior debt is fully paid. With probability p, the firm defaults and the senior creditors receive the minimum of the liquidation proceeds and the amount they are owed. However, with probability θ the court will allocate G to the junior debt and thus the expected senior payoff will be reduced by that amount.

$$V_S = (1-p)S + p[\min(qI,S) - \theta G] = \alpha I \tag{4}$$

We can solve (4) for S in two cases:

$$S = \begin{cases} \alpha I + p\theta G & S < qI \\ \dfrac{\alpha I - pqI + p\theta G}{1-p} & S > qI \end{cases} \tag{5}$$

Similarly, the time-0 and face values of the junior debt, V_J and J, are related as follows:

$$V_J = (1-p)J + p[\max(qI - S, 0) + \theta G] = (1-\alpha)I \tag{6}$$

As for the senior debt, we can solve (6) for J in two cases:

$$J = \begin{cases} \dfrac{(1-\alpha)I - pqI + pS - p\theta G}{1-p} = \dfrac{1-pq}{1-p} I - \alpha I - p\theta G & S < qI \\ \dfrac{(1-\alpha)I - p\theta G}{1-p} & S > qI \end{cases} \tag{7}$$

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[11] More generally, G takes its maximum value whenever the recovery value qI is between S and J, regardless of which of the two is larger. The graph looks somewhat different when J is larger.

where the second equality in the first case is obtained by substituting S from the first case in (5). Equations (5) and (7) define S and J as functions of the model parameters p, q, θ, and α.

When there are two simultaneous issues, the sum of the face values is the same as the face value of a single debt class used to finance the entire project as calculated in the previous section:

Proposition 1: Regardless of seniority, if the project is fully financed by two debt issues for amounts αI and $(1-\alpha)I$ with face values of D_1 and D_2, then $D_1 + D_2 = \frac{1-pq}{1-p} I$.

Proof: Assuming that bankruptcy is possible means that $qI < D_1 + D_2$. Then we have: $V_{12} = (1-p)(D_1 + D_2) + p\min(qI, D_1 + D_2) = I \quad \Rightarrow \quad D_1 + D_2 = \frac{1-pq}{1-p} I$. ■

Corollary 1: If the firm issues junior and senior debt simultaneously, then V_e is independent of α.

Corollary 1 reaffirms the common sense (M-M) conclusion that (with no frictions modeled) the firm is indifferent with respect to the mix of junior and senior debt when they are issued simultaneously. This is because pricing occurs at the same time, and no incentives arise.

This paper focuses on the case when the choice is sequential, and the entrepreneur will strategically decide, after the first security has been priced by the market, whether issuing the second class of debt is optimal or not. Such behavior will be priced as well. To our knowledge, this issue of sequential choice has not been addressed in the literature. Technically, one can view this as a game between the firm and investors. Each choice, either simultaneous or sequential, is a Nash equilibrium, since everything is priced correctly. We focus on sequential issuance, and as such, on sub-game perfect, or sequentially rational choices[12].

[12] The implicit friction in our framework is that firms are not allowed to finance the entire project ex-ante. One can invoke financial constraints or other information issues.

4. Sequential Issuance of Debt Securities

The purpose of our theoretical discussion is to model a firm that has some debt outstanding while it makes a financing choice. Therefore, in this section, which contains our main results, we assume that the firm initially finances part of the project using either senior or junior debt. In the next period, it has an option to finance the remaining part of the project given the initial issue decision. We will consider the incentives embedded in the two possible choices- senior debt first and junior debt first. In principle, our main intuition is that APR violations lead to a possibility of alternating debt issues, and that the main tradeoff in subsequent issues of debt is between the value of APR violations, when the other type of debt is issued, and splitting the proceeds in liquidation according to APR if only one type of debt is issued. Costs of conflict can of course make a stronger case for a single class issues. We will first show how a single issue with no follow-up is priced, and then proceed to price a sequence of issues.

4.1. One issue only

In this section we price a single issue of debt, followed by no further issuance (the rest of the project is financed by equity which is never replaced by debt).

In the extreme case, if $\alpha = 1$ (one class of debt only and *no option of further debt financing*), the distinction between junior and senior debt is not very important. Senior debt holders will calculate their promised payment S from:

$$V_S = (1 - p)S + p\min(qI, S) = \alpha I = I \tag{8}$$

Because $I = V_S < S$, we must have $S > qI$ and:

$$S = \frac{1 - pq}{1 - p} I \tag{9}$$

as in the no-bankruptcy case in section 3.2.

Now suppose the firm issues α I of debt and $(1 - \alpha)I$ of equity, with $\alpha < 1$. Then:

$$V_S = (1-p)S + p\min(qI, S) = \alpha I \tag{10}$$

It is possible that $S < qI$, in which case the senior debt will always be paid off, so $S = \alpha I$. If, S > qI, then solving (10) for S gives:

$$S = \frac{\alpha - pq}{1-p} I \tag{11}$$

In either case, the change in the value of equity resulting from the project is:

$$V_e^S = (1-p)\big[(1+h)I - S\big] + p\max(qI - S, 0) - (1-\alpha)I \tag{12}$$

In the first case, $S < qI$, substituting $S = \alpha I$ into (12) gives:

$$\begin{aligned} V_e^S &= (1-p)I\big[1+h-\alpha\big] + p(qI - \alpha I) - (1-\alpha)I \\ &= I\big[(1-p)(1+h) - (1-p)\alpha + pq - p\alpha - 1 + \alpha\big] \\ &= I\big[(1-p)(1+h) + pq - 1\big] = NPV \end{aligned}$$

In the second case, $S > qI$, substituting (11) into (12), we get:

$$\begin{aligned} V_e^S &= (1-p)I\left[1+h-\frac{\alpha - pq}{1-p}\right] + p(0) - (1-\alpha)I \\ &= I\big[(1-p)(1+h) - (\alpha - pq) - (1-\alpha)\big] \\ &= I\big[(1-p)(1+h) + pq - 1\big] = NPV \end{aligned}$$

In either case, the equity value is increased by the NPV of the project.

We now consider the more interesting cases where the entrepreneur initially issues an amount, αI, of debt, but she is allowed to issue (1-α)*l* more debt in period 1. The choices of the initial issue are either senior or junior debt. In other words, the strategy space includes four sequential choices: *S-S S-J*, *J-S* and *J-J*. We will show that all four can be sequentially rational, depending on the values of the model parameters.

4. 2 Senior Debt First

First, we note again that if the initial issue is senior for αI, and no additional issues were anticipated the face value would be given by equation (9) or (11). We now consider all possible cases, and our propositions show the optimal sequence, given rational expectations on the part of all players. First, consider the case where senior debt is followed by another issue of senior debt[13].

Lemma 1: If the original senior lender anticipates a second senior issue, the face values of the two issues will be given by:

$$S_1 = \alpha \frac{1-pq}{1-p} I \qquad S_2 = (1-\alpha)\frac{1-pq}{1-p} I \tag{13}$$

Proof: Suppose that a second senior issue for $(1-\alpha)I$ is anticipated. In bankruptcy, the proceeds will be distributed to the two seniors in proportion to the amount owed, i.e. the face values. Since we assume that $S_1 + S_2 > qI$, we have the following:

$$\begin{aligned} \alpha I &= (1-p)S_1 + pqI\frac{S_1}{S_1+S_2} \\ (1-\alpha)I &= (1-p)S_2 + pqI\frac{S_2}{S_1+S_2} \end{aligned} \tag{14}$$

Adding these gives

$$I = (1-p)(S_1+S_2) + pqI \quad \Rightarrow \quad S_1 + S_2 = \frac{1-pq}{1-p} I \tag{15}$$

[13] Covenants may prevent the firm from issuing debt with equal or higher seniority status after $t = 0$. However, in our world, this is very possible and will be priced. In real life, this may or may not be the case. Senior debt holders cannot prevent the firm from issuing junior debt, and they cannot prevent APR violations in court. Therefore, senior debt holders must anticipate the optimal strategy for the firm in that regard when they price the bonds they buy.

Substituting (15) into the first equation of (14) gives

$$\alpha I = (1-p)S_1 + pqIS_1 \Big/ \frac{1-pq}{1-p} I \quad \Rightarrow \quad \alpha \frac{1-pq}{1-p} I = (1-pq)S_1 + pqS_1 \tag{16}$$

which gives us the first equation of (13). Substituting this value for S_1 into the last equation of (15) gives the second equation of (13). ■

However, the firm may choose to issue junior after senior. In that case, the junior will benefit from APR violations at the expense of senior debt holders. The original issuers will rationally anticipate that equity holders will choose to issue the cheapest debt they can issue (lowest face value). Therefore, they will require that their debt is priced assuming that the firm will follow this optimal strategy. This is formalized below:

Lemma 2: The original senior lender for αI will demand a face value of

$$\begin{aligned} S_1 &= \max(S_1 \mid S_2 \,,\ \mathrm{S}_1 \mid J_2) = \\ &\begin{cases} \max\left(\alpha \dfrac{1-pq}{1-p} \mathrm{I} \,,\ \alpha I + p\theta G \right) & S_1 \le qI \\ \max\left(\alpha \dfrac{1-pq}{1-p} \mathrm{I} \,,\ \dfrac{(\alpha - pq)I + p\theta G}{1-p} \right) & S_1 > qI \end{cases} \end{aligned} \tag{17}$$

where the notation on the first line means the value of S_1 anticipating S_2 and S_1 anticipating J_2.

Proof: If a following junior issue is anticipated, the face value of the senior debt will be given by equation (5) and the face value of the junior debt will be given by equation (7). The original senior issuer, not knowing whether the firm will follow with a senior or junior issue, will demand the larger of the face values S_1 in (13) and S in (5). Equation (17) follows. ■

We will now compute the conditions for issuing junior debt after senior debt (given the pricing in lemma 2). In other cases, the firm will follow senior with more senior.

Proposition 2: The firm will issue junior debt after senior debt in the following cases:

(i) $S_1 \le qI$, $\alpha\frac{1-pq}{1-p}\mathrm{I} > \alpha I + p\theta G$, and $\alpha\frac{1-pq}{1-p}I - \theta G < \alpha q I$

(ii) $S_1 \le qI$, $\alpha\frac{1-pq}{1-p}\mathrm{I} \le \alpha I + p\theta G$, and $\alpha\frac{1-pq}{1-p}I < \alpha I + p\theta G$

(iii) $S_1 > qI$, $qI - \theta G > \alpha I$, and $(1-\alpha)qI < \theta G$

(iv) $S_1 > qI$, $q\mathrm{I} - \theta\mathrm{G} \le \alpha q\mathrm{I}$

Case (iii) is impossible, but the others can all occur.

Proof: In the situation of Lemma 2, the firm will decide about the second issue based on the face value of the second issue which is given by S_2 in equation (13) or J in equation (7), picking whichever is smaller. Conditions (i)-(iv) follow immediately from picking these minima. ∎

Corollary 2: Issuing senior debt followed by junior debt is a sequentially rational equilibrium strategy given any of the conditions (i)-(iv) of Proposition 2.

In the cases that do not satisfy any of the conditions (i)-(iv), S,S will be the equilibrium strategy.

The intuition is simple: Once senior debt has been issued and priced, junior debt may be issued more cheaply, since part of the value accruing to junior debt holders is taken away from senior debt holders as deviations from absolute priority. In these cases, in equilibrium, it also must be that when senior debt is issued, investors anticipate the issuance of junior debt later and price it at a discount (requiring higher face value). In other words, lacking a pre-commitment device, once the firm issues senior debt, part of the price for junior debt has already been paid. We have also shown that this strategy can be sequentially rational, that is, once senior debt has been issued and priced, junior debt will be the optimal choice (it can be issued at a discount).

While parameters vary, it is quite clear from the proposition first, that APR violations are necessary conditions for a switching strategy and also that the size of the violations affects S,J as an optimal strategy.

However, if the firm is able to commit externally to a S,S strategy, the initial senior issuers will know that there will be no following junior issue and they will be able to accept the lower yield that would result when no APR violations are possible ($\theta = 0$ or $G = 0$.) We can thus formulate an interesting and somewhat counterintuitive implication of the model, which we later test:

Corollary 3: Firms that can credibly commit to issuing senior debt only, can issue such debt at a lower yield than firms that issue two classes of securities.

The intuition is as discussed previously. If the firm shows a credible commitment not to issue junior debt, then senior debt becomes cheaper. But if no commitment is possible, then senior creditors will factor the cost of junior debt into the price of their claim, thereby resulting in a higher yield.

4.3. Junior Debt First

Suppose now that the firm raises an amount $(1-\alpha)I$ of junior debt at $t = 0$. Issuing junior debt in the absence of senior debt is similar to issuing unsecured debt when the firm has fixed assets that can be used as collateral for future secured debt issues. The equilibrium condition to price junior debt in this case is the same as equation (10) with S and α replaced by J and 1-α. Therefore:

$$V_J = (1-p)J + p\min(qI, J) = (1-\alpha)I \tag{18}$$

Similar to the senior case, if $J < qI$, then the junior debt will always be paid off, so

$$J = (1 - \alpha)I \tag{19}$$

If $J > qI$, then

$$J = \frac{(1-\alpha) - pq}{1-p} I \tag{20}$$

In either case, the change in equity resulting from the project is

$$V_e^J = (1-p)I\left[(1+h) - J\right] + p\max(qI - J, 0) - \alpha I = NPV \tag{21}$$

using the same calculation as for the senior-only case.

We next determine the optimal sequential strategy with junior debt first.

Lemma 3. If the original junior lender anticipates a second junior issue, the face values of the two issues will be given by:

$$J_1 = (1-\alpha)\frac{1-pq}{1-p} I \qquad J_2 = \alpha\frac{1-pq}{1-p} I \tag{22}$$

Proof: Same as for Lemma 1, substituting J for S and $(1 - \alpha)$ for α. ■

However, the firms may choose to issue senior after junior in the second period. In that case, junior, rationally anticipating a senior issue, will be priced accordingly, namely, with a lower face value. We now consider first the face value demanded in both cases, and then we suggest the optimal sequence.

Lemma 4: The original junior lender for $(1-\alpha)I$ will demand a face value of

$$J_1 = \max(J_1 \mid J_2 \,,\, \mathrm{J}_1 \mid S_2) = \tag{23}$$

$$\begin{array}{ll} \max\left((1-\alpha)\dfrac{1-pq}{1-p}\mathrm{I} \,,\ \dfrac{1\text{-}pq}{1\text{-}p} I - \alpha I - p\theta G \right) & S_2 \le qI \\ \max\left((1-\alpha)\dfrac{1-pq}{1-p}\mathrm{I} \,,\ \dfrac{(1-\alpha)I - p\theta G}{1-p} \right) & S_2 > qI \end{array}$$

Proof: If the original issue is junior and a following senior issue is anticipated, the face value of the junior debt will be given by equation (7) and the face value of the senior debt will be given by equation (5). The original junior issuer, not knowing whether the firm will follow with a junior or senior issue, will demand the larger of the face values J_1 in (22) and J in (7). Equation (23) follows. ■

The next proposition identifies the equilibrium in a sequence that starts with junior debt.

Proposition 3: The firm will issue senior debt after junior debt in the following cases:

(i),(ii) $S_2 \le qI$ and $\alpha I + p\theta G \le \alpha \dfrac{1-pq}{1-p} I$

(iii) $S_2 > qI$ and $\theta G \le (1-\alpha)qI$

(iv) $S_1 > qI$, $(1-\alpha)\dfrac{1-pq}{1-p} I \le \dfrac{(1-\alpha)I - p\theta G}{1-p}$, and $\mathrm{p}\,\theta\mathrm{G} \le 0$

Case (iv) is impossible, but the others can all occur, provided that the expected transfer from seniors to juniors in bankruptcy is sufficiently small

Proof: In the situation of Lemma 4, the firm will decide about the second issue based on the face value of the second issue which is given by J_2 in equation (22) or J in equation (5), picking whichever is smaller. Conditions (i)-(iv) follow immediately from picking these minima. ■

4.4 Examples:

We can now illustrate some aspects of the model with a numerical example.

Suppose that a project costs I = 100, the recovery rate is q = .4 (recovery amount = 40), the failure rate is p = .5, and the initial financing proportion is 1 - α = .5. As in the model, we assume risk neutrality and that the risk free rate of return is 0. Consider senior debt first. The initial senior lenders are giving the firm 50, so they will set the face value to get an expected payback of 50.

- Case 1: If seniors anticipate no further borrowing, they will demand a face value of 60 because .5(60) + .5(40) = 50.

- Case 3: Seniors anticipate junior lending and qG = 30 (expected transfer from APR violations). Then the face value will be 90 since .5(90) + .5(10) = 50.

- Case 4: If seniors anticipate more senior lending, they will have to split the proceeds in bankruptcy equally with the second set of senior lenders, since a = 1 - a = .5. Therefore, they expect to get 20 in bankruptcy and the new face value will be 80 (.5(80) + .5(20) = 50.)

- Ergo, in anticipation of APR violations, seniors demand 90.

- Period 2

- Case A: If the second issue is senior, the new senior lenders will charge x, where x satisfies the equation

- $.5x + .5[x/(x+90)](40) = 50$. This is a quadratic equation with the solution $x = 81.05$.

- Case B: If the second issue is junior, the new junior lenders know that in bankruptcy with APR violations as in case 2, they will receive 30. Therefore, they will charge 70 to get an expected payoff of .5(70) + .5(30) = 50.

- Ergo, SJ is sequentially rational- once senior is issued and priced, issuing junior is cheaper.

We now consider the case of junior debt first.

Case 1: If they anticipate no further borrowing, they will demand a face value of 60 because .5(60) + .5(40) = 50.

Case 2: Juniors anticipate senior lending and $\theta = 0$ (no APR violations). Seniors receive the entire 40 in bankruptcy and the original juniors will get nothing, so juniors will charge a face value of 100 to get .5(100) + .5(0) = 50.

Case 3: Juniors anticipate senior lending and $\theta G = 10$ (expected transfer from APR violations). Then the face value will be 90 since .5(90) + .5(10) = 50.

Case 4: If juniors anticipate more junior lending, they will have to split the proceeds in bankruptcy equally with the second junior lenders, since $\alpha = 1 - \alpha = .5$. Therefore, they expect to get 20 in bankruptcy and the new face value will be 80 (.5(80) + .5(20) = 50.)

If we eliminate case 2 from consideration, if one is to raise half the initial amount in junior debt, the original juniors will demand a face value of 90 to cover their worst case scenario.

Now, having issued the first junior at 90, the firm reaches period 1 and can choose between junior and senior.

Case A: If the second issue is junior, the new junior lenders will charge x, where x satisfies the equation $.5x + .5[x/(x+90)](40) = 50$. This is a quadratic equation with the solution $x = 81.05$.

Case B: If the second issue is senior, the new senior lenders know that in bankruptcy with APR violations as in case 3, they will receive 40 - 10 = 30. Therefore, they will charge 70 to get an expected payoff of .5(70) + .5(30) = 50.

Thus, for the second issue, it is cheaper for the firm to issue senior. In other words, JS is a rational sequence in this example. JJ is not.

On the other hand, suppose that $\theta G = 30$. Then in case 3 above, the original juniors would charge 70 instead of 90. Now case 4 is most expensive, so the original juniors will demand a face value of 80. When the firm has to decide about the second issue, the two cases to be considered are:

Case C: If the second issue is junior, the new junior lenders will charge x, where x satisfies the equation $.5x + .5[x/(x+80)](40) = 50$. This is a quadratic equation with the solution $x = 80$.

Case D: If the second issue is senior, the new senior lenders know that in bankruptcy with APR violations as above in the new case 3, they will receive 40 - 30 = 10. Therefore, they will charge 90 to get an expected payoff of .5(90) + .5(10) = 50.

Thus, for the second issue, it is cheaper for the firm to issue junior and JJ is sequentially rational.

In other words, depending on parameter values, either JS or SJ may be sequentially rational.

Similar examples can be constructed to show that SJ and SS can be sequentially rational

As we can see, the outcome depends on the initial amount borrowed, on the outcome of the project and on APR violations. The example only provided one set of possible outcomes.

4.5. Explicit Costs of Conflict

The discussion so far has only focused on the incentives inherent in recoveries. In the previous sections we have seen that the presence of APR violations may make it optimal for firms to alternate maturities. Following Welch (1997), we note that upon default, disagreements between junior and senior creditors over the liquidation value of the firm give rise to costs of litigation. These costs may change the incentives delineated in the earlier section. The analysis below quantifies these tradeoffs.

In our very simple model there are only either one or two classes of debt. When there is one class of debt, there are no conflicts. When there are both senior and junior issues, we assume costs of conflict that are proportional to the amount of junior debt issued[14], $(1 - \alpha)I$. This implies that these costs are decreasing in the amount of senior debt. This formulation is intuitive because it is junior debt holders who are trying to undermine the absolute priority rule.

Assumption 2: The cost of a conflict between junior and senior creditors is $C = c(1 - \alpha)\mathrm{I}$, where $0 < c < 1$[15].

Under this assumption, our alternating seniority results may change.

Proposition 4: For firms that have issued senior debt followed by junior debt, financing with senior debt alone is preferred to financing the project with both junior and senior debt, if costs of conflict are sufficiently high. Otherwise, both types of securities may be issued in equilibrium.

Proof: Given an initial senior issue, we incorporate the costs of conflict into equation (6):

$$V_J = (1-p)J + p[\max(qI - S, 0) + \theta G - c(1-\alpha)I] = (1-\alpha)I \tag{24}$$

Solving for J, we have:

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[14] Our analysis is relatively robust to the choice of the cost-of-conflict function.

[15] A fixed cost component, as is assumed in many models, will not change the conclusion.

$$J = \frac{(1-\alpha)I - p[\max(qI - S_1, 0) - \theta G]}{1-p} + \frac{1-\alpha}{1-p} Ic \qquad (25)$$

From (25), we see that J increases linearly in c, so that for any value of S_2, we will have $J > S_2$ for sufficiently large values of c, in which case the following issue will optimally be senior. ■

Here the APR violation effect works in an opposite direction to the costs of conflict effect. The negative sign of the θG term means that the higher the expected APR violations, the higher must be the costs of conflict to make the senior after senior issue optimal. Similarly, if we increase the liquidation value, higher costs of conflict will be required to make senior only optimal[16].

It follows from Proposition 4 that when "*class warfare*" is costly for the firm, it will sometimes commit to issue only senior debt, and such a commitment is credible because if the firm were to issue junior debt afterwards, it would incur an additional cost $c(1-\alpha)I$ in bankruptcy. Unlike the no-cost case in Section 4.1, in the case of costly litigation junior claims will also result in a dead-weight loss. However, the costs of conflict must be sufficiently large to overcome the incentives discussed earlier.

The case of firms that issue junior debt first is similar, as shown in the next proposition.

Proposition 5: For firms that have issued junior debt followed by senior debt, financing with junior debt alone is preferred to financing the project with both junior and senior if conflict costs are sufficiently high. Otherwise, both securities may be issued in equilibrium.

Proof: If we have an initial junior issue for $(1-\alpha)I$, with face value J, then for c sufficiently large, we will have:

$$J + \theta G < c(1-\alpha)I \qquad (26)$$

[16] Clearly, there is nothing to prove if the firm chose to issue only junior debtor only senior debt even when no costs of conflict are considered. These firms will keep issuing one class of debt only.

which means that the purchasers of a new senior issue would have to pay some of the conflict costs. The equation analogous to (24) in this case is:

$$V_S = (1-p)S + p[\min(qI,S) - \theta G + \min(J + \theta G - c(1-\alpha)I,0)] = \alpha I \tag{27}$$

As before, we solve for S in two cases. If $S < qI$, then

$$S_2 = \alpha I - pJ + p(1-\alpha)Ic \tag{28}$$

while if $qI \leq S$, then:

$$S_2 = \frac{\alpha I - pqI - pJ}{1-p} + \frac{p(1-\alpha)I}{1-p}c \tag{29}$$

In both (28) and (29), S_2 increases linearly in c, so if c is sufficiently large, we will have $S_2 > J$ and it will be optimal for the second issue to be junior as well as the first. ■

As in the previous case, if the expected APR violations (θG) are larger, then from (26) we see that the costs of conflict, c, will have to be larger. This is of course intuitive: if junior can be issued cheaply, due to large APR violations, then it may pay to issue senior after junior. As we have seen in proposition 4, the transfers from junior to senior are the driving force behind the alternating strategy, and the higher they are, the more likely it is that they will overwhelm the costs of conflict. Similarly, the more junior debt we have issued, the less likely it is that junior only will be optimal – again for the same reason. This requires that (a) the probability that the courts violate APR is high, and (b) that junior creditors succeed at diverting funds from the seniors.[17]

4.4 Empirical Predictions

In this section, we suggest some predictions of our model that will be tested empirically.

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[17] Note that the reverse is true for senior only issuance: low probability of APR violations and small amounts diverted from seniors to juniors are required.

The model suggests, first and foremost, that some firms may choose to issue junior debt only some may issue senior debt only, or they may go for a combination thereof (Propositions 1-5). As we will see, this prediction of our model is supported directly by the data, without much analysis. We will refer to this as Prediction A. Obviously, we would like to show that the tradeoffs that result in these choices are to some extent the ones modeled in this paper. We do some of this below.

Based on Propositions 2 and 3, the model also suggests that if the projected costs of conflict are small, senior (junior) debt issues may optimally be followed by junior (senior) debt issues. This is Prediction B.

A related prediction, based upon Proposition 2 and Corollaries 2 and 3, is that if you can commit to senior debt only, then you can issue senior debt at lower yields, everything else equal. This is Prediction C.

Propositions 4 and 5 suggest that as costs of conflict increase, even firms who tend to alternate, will tend issue one debt class, for example, firms with junior debt tend to issue more junior debt. We call this Prediction D.

Since chapter 7 features few if any APR violations (which are the driving force of our alternating strategy), one can expect that firms which expect to end up in chapter 7 will have no incentive to alternate seniority levels. This is Prediction E. We note that the model only includes costs of conflict in bankruptcy. Additional bankruptcy costs, which occur with or without conflict, will make it even more difficult for a junior-only firm to reorganize.

We test these predictions below.

5. Empirical Tests of the Model Using Bond Data

Our empirical analysis consists of two complementary sets of tests. In the first and more comprehensive set of tests, we consider bond issuance activity by firms. In a subsequent empirical analysis, we provide results based on the full capital structure of firms filing for bankruptcy[18].

5.1. Data and descriptive statistics

We use data from the Fixed Investment Securities Database (FISD) of Mergent, Inc. The database has complete at-issue information on 162,593 bonds issued by 10,177 companies. Issue dates range from 1894 (a 100-year bond) to June, 2004. The earliest maturity date is January 1, 1990. About 90% of the bonds have issue dates in 1986 or later. (For 5% of the bonds, the issue date is not available.) FISD provides issue ratings from four agencies (Duff and Phelps, Fitch, Moody's, and Standard and Poor's). Since our study involves company level analysis, we use S&P issuer ratings provided by Compustat rather than the issue ratings.

For each issue listed in FISD, a security (seniority) level is provided. Table 1 shows the number of firms that have issued at least one bond at each seniority level as well as the number of firms which issue only at that level.[19] The majority of the firms issue bonds at only one security level. This is consistent with our Predictions A and D[20]. Table 1 also suggests that very few firms issue bonds at the three lowest levels. Therefore, we will use senior issues and senior subordinated bonds to test our predictions, where senior subordinated will correspond to junior in our theory section.

[Insert Table 1 here]

There are 7,501 firms issuing bonds at only these two levels, of which 967 issue at both levels. Note that almost two thirds of the firms issuing senior subordinated bonds issue bonds only at

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[18] It would be better if we could test our predictions on the entire history of issuance of all firms and we could include all components of firm capital structure, including bank debt. Such information is not available, however, we have a rather long history of issuance, and we do include in our analysis variables based upon the entire capital structure of the firms in question.

[19] One might think that firms that issue only junior debt have bank loans or other private debt and so are not allowed to issue senior public debt. However, as pointed out by Billett, King, and Mauer (2007), there is very little overlap between the private and public debt markets: companies that issue public debt do not, as a rule, have much private debt.

[20] Our ideas also extend the conclusions of Brick and Fisher (1987) that within a one period framework, provisions of the tax code make a single class of debt a value-maximizing strategy.

that level. Most of these firms have between one and ten issues, with a maximum of 28. Clearly, issuance of junior debt only is not unusual in practice.

[Insert Table 2 here]

For each bond issued by the companies in our groups from 1985-2004, we list the date of issue and the issuer (six-character) CUSIP. These items are used to obtain the company financial data from the Compustat annual database, as of the end of the fiscal year that contained the issue date. If the financial data corresponding to an issue is not available in Compustat or if some of the data items we need have missing values, we drop those issues from the sample. The composition of our final data set is presented in Table 2. Table 3 shows financial statistics for the companies in our three categories.[21] These ratios are calculated from data items obtained from Compustat. Since the data cover a twenty-year period, the market capitalization, which is the only numeric data item that is not a ratio, has been adjusted for inflation (to a base of 1982-84 dollars) using the Consumer Price Index obtained from the Bureau of Labor Statistics.

Our theory focuses on the sequence of debt issues, based on several firm and market parameters. Therefore, we will put forward probit regressions and relate the findings to our theory. We will also test a more subtle implication based upon prediction C.

However, it may still be instructive to look at table 3. Table 3 shows that senior only companies are more profitable, pay more dividends, have lower leverage, and have higher credit ratings than firms that issue junior debt only. Companies that issue both types of debt are in between the other two groups on most measures and generally closer to the senior companies. This table is not a test of the theory - we use it mainly to provide control variables. However, we can suggest that it is broadly consistent with the thrust of our propositions. Our propositions suggest that different parameters, and in particular, parameters related to costs of conflict, and deviations from absolute priority, determine whether the firm issues one class of debt or two. Indeed we see that firms that issue multiple classes of debt are different than firms which issue one class, and that firms which issue junior debt only are different from firms which issue senior only.

[21] For all the numerical data, averages are used. Since credit ratings are ordered, but not numeric, the values shown are medians and no comparison ratios are given.

Junior only companies are smaller, closer to bankruptcy (less profitable and lower credit rating) and thus can expect liquidation (more likely for smaller firms) where there are no deviations from APR. Costs of conflict loom large as well when bankruptcy is near. Thus for these companies, deviations from APR will not occur and one class of debt makes more sense. The only measure on which these companies are higher than others is capital expenditures over assets which may mean that there are more tangible assets which may lead to more conflicts.

Other companies find it optimal to issue two classes of debt as we suggest. The case for large companies which issue only senior debt is a bit more difficult. However, we note that companies with greater growth prospects (higher Q) tend to issue senior and junior debt. We will test this more explicitly below.

[Insert Table 3 here]

We should also note that our findings are consistent with findings by Rauh and Sufi (2008) which tie priority structure to firm credit quality.

5.2. Determinants of Debt Seniority

For each company, we look at the issues in chronological order. The amount and seniority of the previous issue are our variables of interest, but we also consider several control variables. Specifically, we look at:

- -Number of senior bond issues outstanding
- -Number of senior subordinated bond issues outstanding
- -Total number of bond issues outstanding.
- -Face value of senior bond issues outstanding
- -Face value of senior subordinated bond issues outstanding
- -Total face value of bond issues outstanding
- -Time since last issue
- -Amount of last issue
- -Seniority level of last issue (1 for senior, 0 for senior subordinated)
- -Maturity, offering yield, and treasury spread of the new issue

Company financial ratios.

The dependent variable is an indicator that equals one when the new issue is senior, and zero otherwise. Positive coefficients mean that issuing a junior bond is more likely.

Table 4 contains the probit results for all debt offerings. The four major columns of the table contain results from a run of all issues, issues when only junior issues were outstanding, issues when only senior issues were outstanding, and issues when both senior and junior issues were outstanding respectively.

[Insert Table 4 here]

Our main hypotheses can be tested using the previous issue variable. We find that when there are outstanding issues of both types, the seniority of the immediately previous issue is significantly negative. This implies that companies issuing at both seniority levels tend to alternate levels, consistent with Prediction B. We should note that this finding is not obvious. It could be that firms persist in one seniority level and then alternate. If most firms continued issuing at one seniority level, the previous level would not be significant. However, we find that it is. A possible interpretation is that, since firms that issue at both levels, by definition, have lower <u>marginal</u> costs of conflict and higher benefits from APR violations(they already have several classes of debt outstanding, so issuing at either the junior or the senior level will not dramatically change the landscape). Therefore, such firms tend to act as in propositions 2 and 3. When firms have only one level of debt outstanding, they tend to act as in propositions 4 and 5, that is, they stick to that level, since the marginal costs of conflict will increase dramatically if we add a new class of debt. Our model is self contained, in other words, it suggests that every debt issue creates incentives for the next period. However, the parameters in question may change depending on debt which may not be covered in the data base, such as bank debt or trade credit. To account for this, we collect the total amount of other debt outstanding, and we include a variable that considers the percentage of other junior debt in the firm's total capital structure.

We find that having a large amount of junior debt significantly increases the probability of issuing junior debt if all previous issues in the data base are senior or if there are junior and senior issues outstanding. Again, having junior debt in addition to senior issues, implies that additional junior debt may not result in higher costs of conflict, at the margin and that APR violations are already counted. Thus, alternating issues are more likely.

The credit rating variable has a positive sign for firms that have issued junior debt. In other words, as the credit quality worsens, junior firms and firms that alternate are more likely to issue junior debt, as we have seen in the means comparisons. Small firms that issue junior debt are more likely to liquidate and thus do not see the benefit of alternating, but will bear costs of conflict should they alternate. Firms that have senior debt are not affected by this variable. This is consistent with prediction D and propositions 4 and 5.

Table 5 expands this analysis, by including several dummy variables to describe outstanding bonds at the time of issue. The results are similar, with a few additional findings. We find again that firms tend to alternate, that is, they will issue senior debt if previous debt issues are junior. In fact, if all previous issues are senior, we see a positive coefficient (that is to say, junior debt is more likely) although this coefficient is not significant. However, as we interact the all senior debt variable with the credit rating, we find that the action tends to be for risky firms. If all previous issues were senior and the firm has a low credit rating, then it tends to continue and issue senior debt. This again broadly fits our model- as bankruptcy looms larger, the expected costs of conflict from an additional class of debt increase, and may outweigh the pricing advantage we have discussed for alternating seniority levels.

[Insert Table 5 here]

5.3. Benefit of One Seniority Level

The last test we offer using this data set, considers Prediction C; namely, if a firm could commit to issuing only senior debt, it would not have to pay the premium to compensate the purchasers of senior debt for later issues of junior debt. The most obvious way to make this commitment is to include a covenant in the debt contract that prohibits later issues of junior debt. In the entire FISD, there are 1,052 issues that have such a covenant against subordinated or junior debt.

However, 938 of these issues are themselves at the senior subordinated level and only 84 are at the senior level. Clearly, firms do not often use covenants as a way to commit to issuing senior debt only.[22]

The other way that a firm can commit to using only senior debt is by its behavior. If over a period of many years it issues only senior debt, investors may become convinced that it will continue to do so. If our model is correct, then if investors are convinced that a firm is committed to issuing senior debt only, it should be able to issue senior debt at a lower yield than similar companies that are known to issue junior debt as well. In order to test this idea, we have identified 8,991 pairs of senior issues, one from a company that issues only senior debt and another from a company that issues senior as well as junior debt. We matched the issues on the following criteria. Both are senior issues offered on the same date, both have the same credit rating, and the maturities are within 200 days of each other.

[Insert Table 6 here]

Table 6 shows that the bonds from the companies that issue at both levels pay on average 75 basis points more in yield. Since these bonds are at all possible credit ratings and maturities, we also calculate the ratios of the yields. The average ratio over all issues is 1.27. When we look at the average ratios for single credit ratings, we find that they are almost all larger than 1, except in a few of the lower-rated categories where the number of data points is very small and the differences are not significant. Perhaps the behavioral commitment not to issue junior debt is less credible for firms with low credit ratings. Also, there the expected costs of conflict loom large, and thus investors assume that all companies will be reluctant to issue more classes of debt. However, the preponderance of evidence seems to confirm the model's Prediction C, namely, that senior-only companies should pay lower spreads.

The model also predicts that junior-only firms should pay a higher yield on their junior bonds than firms issuing at both levels would pay on their comparable junior bonds. We don't have a enough data for testing this hypothesis. The same matching process that we use for the senior

[22] Covenants against additional issues of senior debt are even less common. There are 254 of them in the FISD, of which 186 are again on senior subordinated issues.

bonds produces only 103 pairs of junior bonds. For these pairs, the junior-only firms pay on average an additional 20 basis points on their junior bonds, but this result is not statistically significant.

6. Evidence from Bankruptcy Data

In this section, we explore a sub-sample of firms that have filed for either Chapter 11 or Chapter 7 to see if bankruptcy proceedings follow the ideas advanced in our model. Filing firms have to report detailed financial information, and in particular, they have to report the composition of their debt securities outstanding. This enables us to consider some implications of the model given the entire seniority structure of firms, rather than just issuing information. One can reasonably assume that this sample includes firms for which the tradeoffs illustrated in the model are at play. Since these firms have gone bankrupt, we can reasonably assume that ex-ante they had faced a high probability of such an event. In particular, according to prediction E, we expect much more one class firms in chapter 7 which features few APR violations

6.1. Data

We use the sample of bankrupt firms in Bris, Welch and Zhu (2006) and Baird, Bris and Zhu (2007). The sample consists of the corporate Chapter 11 bankruptcies in the District of Arizona and the Southern District of New York between 1995 and 2001. The sample excludes dismissals or transfers to other courts, as well as "pre-packs". Therefore it consists only of "pure" Chapter 7 and 11 cases. For each case, we have information on the duration of the case, the fees paid by the firm and the creditors, and the creditors' recovery rates. Additionally, we have data on firm characteristics such as the number of senior and junior creditors, the size of their claim, whether they include banks, the size of the company, and the amount of equity owned by the managers. There are 82 Chapter 7 cases, and 221 Chapter 11 cases for which we know how many senior and junior creditors there are.

6.2. Junior and Senior Debt Issuance

Table 7 shows the distribution of cases depending on the presence or absence of senior and junior creditors

There are very few cases with senior debt only in bankruptcy, and they are both chapter 11 cases and chapter 7 cases (6 in total). The small number of such cases does not allow us to draw any inferences from this subset. Both chapter 11 and chapter 7 cases feature firms that have several classes of debt. However, in Chapter 7 there are 31 cases with junior debt but no senior debt, whereas chapter 11 does not have any junior only firms. One of the important institutional differences between the two chapters is that in chapter 7 APR violations are rare. Our theory suggests that it is APR violations that drive firms into alternating issues. Assuming rational expectations, then, firms that expect to end up in chapter 7 will have no reason to alternate, and costs of conflict will drive them to a one class structure. Therefore, a much higher percentage of one class firms in chapter 7 is consistent with our model. Again, we cannot draw inferences from the very small number of senior only firms, but we can suggest that the reason that the one class is junior is because junior only firms tend to be smaller.

Although the data is from a different time period, the results presented in Table 7 are consistent with those of Kaplan and Stein (1993) and Cotter and Peck (2001) who follow companies that went through leveraged buyouts in the 1980's. Kaplan and Stein show that companies in the later deals used more junior debt and became more likely to default. Cotter and Peck (2001) find that the relationship between debt seniority and default likelihood depends on the identity of the LBO buyers. Buyout specialists used more junior debt and yet were less likely to default, while the reverse is true for buyers who were outside investors.

7. Conclusion

Very few studies consider the sequence of debt issues by firms. We show that interactions between creditor groups in bankruptcy can affect the optimal series of issues. In particular, we suggest that deviations from APR should be priced and can affect the issuing decisions of junior and senior debt. Once firms issue debt with one level of seniority, they have an incentive to alternate, so that subsequent issues will have a different seniority level. When we introduce explicit costs of conflict, we find that as these costs increase, the advantage of alternating seniorities diminishes and firms tend to stay within one class of debt. Our model is supported by the fact that firms tend to alternate seniority levels, and that companies that issue only senior debt pay lower spreads than companies that issue at both levels The empirical implications of our model are also consistent with the somewhat surprising fact that many firms issue debt at one seniority level only, and quite a few of them never issue any senior debt. Finally, we study a sample of firms in bankruptcy and again find significant relationships between corporate characteristics and the types of debts that they issue, as predicted by the model. We view this work as a first step towards a more comprehensive analysis, which will subsume bankruptcy considerations into the pricing and optimal issuance of debt securities.

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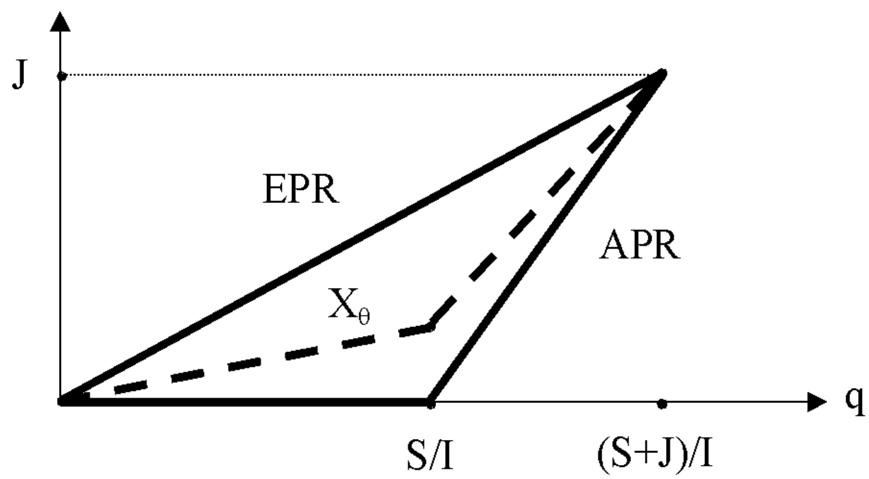

Figure 1: Payoff to Junior Creditors under Different Priority Schemes

Given the total investment required for the project, I, and the face values of junior and senior debt, J and S, this figure shows the expected payoff to junior creditors as a function of the recovery rate q for different priority rules. Under the Absolute Priority Rule (APR), senior debt holders are paid in full before junior debt holders receive any payment. Under the Equal Priority Rule (EPR), payments in all states are proportional to the amounts owed to each class of debt holders. X_θ represents the expected payoff when EPR is used with probability θ and APR with probability $1-\theta$.

Table 1. Security Levels of Bond Issues in FISD

For each of the seven seniority levels included, the first column shows the number of firms in the FISD that issue at least one bond at that level and the second column shows the number of firms that issue bonds only at that level.

Security Level	Number of Firms Issuing at this level	Number of firms issuing at this level only
Junior Subordinated	88	14
Junior	4	1
Subordinated	21	3
Senior Subordinated	3,508	2,232
Senior	5,853	4,304
Senior Secured	1,014	559
No level reported	1,429	1,134
Any Level	9,972	
More than one Level	1,725	
Total number of firms	10,177	
Number of firms with no issues	205	

Table 2: Size of data set.

This table shows the number of issues in the reduced data set that includes those companies that issue bonds only at the senior or senior subordinated levels. These companies are further divided into those that issue senior only, those that issue senior subordinated only, and those that issue at both levels. Financial data for the companies is available on an annual basis. Therefore, to avoid duplication in the calculation of financial summary statistics, we reduce the data further to one issue per company per year.

Security Level	Number of Companies	Number of Issues (One per Year)	Number of Issues (Total)
Senior	797	1,097	29,793
Senior Subordinated	533	616	4,105
Both	361	624	17,727

Table 3. Average Financial Measures of Companies by Types of Bonds Issued.

This table shows the averages over firm-years of financial measures for the three categories of companies in our data set. The Senior column describes those companies that issue senior bonds only. The Seniorsub column describes those companies that issue senior subordinated bonds only. The Both column describes those companies that issue senior and senior subordinated bonds only. All averages are calculated using one value for each company in each year in which the company issued any bonds. Since credit ratings are ordered, but not numeric, the values shown are medians and no difference tests are reported. Size is measured as the market capitalization adjusted for inflation to base 1982-84 dollars using the CPI. All values are calculated from annual Compustat data. *. **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

	Firms that issue…			Difference Senior Only - Subordinated Only	Difference Senior Only - Both Classes	Difference Junior Only - Both Classes
	Senior Debt Only	Subordinated Debt Only	Both	t-stat	t-stat	t-stat
Credit Rating	BBB+	BB-	BBB-			
Payout	54.41%	10.27%	6.24%	2.02 **	1.89 *	0.28
PE Ratio	13.170	24.115	15.692	-1.05	-0.3	0.86
Price to Book Ratio	2.828	2.347	4.335	0.89	-1.01	-1.29
Size	5228.8	557.0	3089.2	11.57 ***	3.77 ***	-6.24 ***
ROA	2.22%	-0.59%	2.48%	3.25 ***	-0.58	-3.64 ***
ROE	4.07%	0.05%	2.29%	0.41	0.3	-0.22
Total Debt to Total Assets	29.25%	42.62%	34.05%	-13.34 ***	-4.72 ***	7.11 ***
Operating Income to Assets	12.12%	10.67%	11.64%	2.89 ***	1.18	-1.95 *
Capital Expenditures to Assets	7.21%	8.76%	6.33%	-3.19 ***	2.46 **	4.79 ***
Interest Coverage Ratio	3.428	-0.049	2.304	4.500 ***	1.480	-5.130 ***

Table 4: Probit Regression for seniority of issues of bonds for all companies when there are outstanding issues.

This table reports the results of a probit regression, where the dependent variable is the probability of issuing a senior subordinated (junior) bond when there are other bonds outstanding. All financial variables are from the end of the fiscal year before which the bond was issued. Credit_Rating is the Standard and Poor's long-term issuer credit rating converted to a numeric scale from 2 (AAA) to 27 (D). Size is measured as the market capitalization adjusted by the CPI to base 1982-84 dollars. R-squared is the pseudo-R-squared of McFadden (1974).
*,**, and *** indicate significance at the 10, 5, and 1% levels.

	Conditional on Existing Prior Issues		Conditional on Existing Prior Issues, all Junior		Conditional on Existing Prior Issues, all Senior		Conditional on Existing Prior Issues, both Junior and Senior	
Variable	Coefficient Estimate	St. Error	Coefficient Estimate	St. Error	Coefficient Estimate	St. Error	Coefficient Estimate	St. Error
Intercept	21.207	[20.434]	-27.630	34.2149	73.899	[35.464]	8.530	[44.114]
Capital Expenditures to Assets	-0.118	[0.575]	1.405	1.073	-0.642	[1.146]	-0.998	[1.478]
Credit Rating	0.079 ***	[0.020]	0.136 ***	0.0384	0.025	[0.037]	0.069 *	[0.042]
Total Debt to Total Assets	0.262	[0.233]	0.451	0.4096	0.262	[0.466]	0.585	[0.519]
Ratio of Subordinated Debt to Total Debt	0.854 ***	[0.159]	0.349	0.2422	1.292 **	[0.458]	0.589 *	[0.321]
Interest Coverage Ratio	-0.001	[0.004]	0.000	0.0045	-0.020	[0.025]	0.038	[0.029]
Operating Income to Assets	0.094	[0.724]	0.945	1.2664	0.316	[1.354]	-6.867 ***	[2.052]
PE Ratio	0.000	[0.000]	0.000	0.0004	-0.001	[0.001]	0.002	[0.002]
Payout Ratio	0.016	[0.017]	0.077 **	0.039	0.007	[0.026]	-0.040	[0.120]
ROA	0.699	[0.858]	0.122	1.456	1.059	[1.830]	3.148	[2.465]
Log (Size)	-0.116 ***	[0.045]	0.035	0.081	-0.204	[0.080]	-0.239 **	[0.105]
Log (Face Value Most Recent Issue)	0.013	[0.052]	-0.145	0.1314	0.029	[0.070]	0.368 **	[0.164]
Amount of Senior Debt Oustanding	0.000	[0.000]			0.000	[0.000]	0.000	[0.000]
Seniority of the previous issue (1 = junior	-1.466 ***	[0.113]					-1.178 ***	[0.195]
Number of Senior Issues Outstanding	-0.025 **	[0.012]			-0.004	[0.010]	-0.055	[0.047]
Time since Previous Issue	0.000	[0.000]	0.000 ***	0.0001	0.000	[0.000]	0.000 **	[0.000]
Calendar Year of New Issue	-0.011	[0.010]	0.014	0.0172	-0.038	[0.018]	-0.005	[0.050]
Number of Observations	2218		418		1315		485	
R-squared	0.517		0.159		0.178		0.401	

Table 5: Probit Regression for seniority of issues of bonds, when there are already outstanding issues.

This table reports the results of a probit regression, where the dependent variable is the probability of issuing a senior subordinated bond when there are other bonds outstanding. All financial variables are from the end of the fiscal year before which the bond was issued. Credit Rating is the Standard and Poor's long-term issuer credit rating converted to a numeric scale from 2 (AAA) to 27 (D). Size is measured as the market capitalization adjusted by the CPI to base 1982-84 dollars. All outstanding senior and all outstanding junior are dummy variables defining the state of previous issues when the current issue occurs. In other words, all junior means that all previous issues are junior. If they are both zero, then there are both senior and junior bonds outstanding at the time of the new issue. R-squared is the pseudo-R-squared of McFadden (1974).
*,**, and *** indicate significance at the 10, 5, and 1% levels.

Variable	Coefficient Estimate		Standard Error	Significance Level
Intercept	21.1104		[20.698]	0.3078
Capital Expenditures to Assets	-0.0127		[0.595]	0.9829
Credit Rating	0.1011	***	[0.031]	0.001
Total Debt to Total Assets	0.0306		[0.467]	0.9477
Ratio of Subordinated Debt to Total Debt	0.7303	***	[0.170]	<.0001
Interest Coverage Ratio	-0.0002		[0.004]	0.971
Operating Income to Assets	-0.157		[0.768]	0.838
PE Ratio	-0.0003		[0.000]	0.3768
Payout Ratio	0.0179		[0.018]	0.3274
ROA	0.8326		[0.905]	0.3576
Log (Size)	-0.1386	***	[0.046]	0.0024
Log (Face Value Most Recent Issue)	0.0469		[0.054]	0.3858
Amount of Senior Debt Oustanding	0		[0.000]	0.4657
Seniority of the previous issue (1 = junior)	-1.1456	***	[0.167]	<.0001
Time since Previous Issue	0		[0.000]	0.2712
Calendar Year of New Issue	-0.011		[0.010]	0.2918
All outstanding senior = 1	0.5246		[0.389]	0.1775
All outstanding junior = 1	0.054		[0.501]	0.9142
All outstanding senior = 1 x credit rating	-0.0652	*	[0.037]	0.0757
All outstanding junior = 1 x credit rating	0.005		[0.040]	0.901
All outstanding senior = 1 x debt/assets	0.3502		[0.605]	0.5628
All outstanding junior = 1 x debt/assets	0.2854		[0.584]	0.6247
All outstanding senior = 1 x number outstanding	-0.0129		[0.011]	0.2455
All outstanding junior = 1 x number outstanding	0.0747		[0.049]	0.1281
Number of Observations	2218			
R-squared	0.5228			

Table 6: Comparison of offering yields on senior debt issued by companies that issue senior debt only and companies that issue both senior and senior subordinated debt.

This table reports the relation between offering yields of 8991 pairs of senior bonds. In each pair, one of the bonds is issued by a company that issues only senior bonds, and the other is issued by a company that issues both senior bonds and senior subordinated bonds. The two bonds in each pair have the same offering date, the same credit rating, and maturity dates within 200 days of each other. For each pair, we calculate the ratio of the yield on the second bond (two-level company) to the yield on the first bond (senior-only company) and the difference of the two yields. For the entire set, and for each credit rating, we calculate the average of the ratios and the average of the differences, reported in the third and fourth columns above. We also perform a t-test for equality of the yields and the t statistics are shown in the last column.
*,**, and *** indicate significance at the 10, 5, and 1% levels.

Rating	N	Mean Yield Ratio	Mean Yield Difference (bps)	t-stat
All	8,990	1.270	75.83	46.16 ***
AAA	1,225	1.701	114.80	15.43 ***
AA+	83	1.083	21.31	1.21
AA	145	1.086	19.65	1.53
AA-	570	1.076	28.51	0.94 **
A+	2,664	1.208	74.60	40.48 ***
A	2,668	1.314	102.74	39.33 ***
A-	492	1.177	71.95	11.38 ***
BBB+	458	1.065	26.69	4.74 ***
BBB	365	1.094	29.82	3.42 ***
BBB-	162	1.024	-10.66	-0.87
BB+	35	1.006	-19.19	-0.64
BB	16	0.887	-140.16	-1.37
BB-	27	0.963	-51.04	-1.41
B+	19	0.913	-94.55	-1.80 *
B	32	0.966	-104.61	-2.08 **
B-	20	1.408	29.90	0.46
CCC+	1	1.085	61.50	
D	8	1.008	-78.10	-0.55

Table 7. Distribution of Junior and Senior Claims

The Table reports the number of cases with and without junior/senior debt. The sample includes all corporate bankruptcies, with sufficient data, filed under Chapter 7 and Chapter 11 between 1995 and 2001 in the Federal Bankruptcy Courts of Arizona and Southern District of New York. Data is obtained online and hand-coded from the Public Access to Court Electronic Records (PACER). We exclude from the original sample: pre-packs, dismissals, transfer to other courts or chapters (except for Chapter 11 to Chapter 7 conversions), and cases of subsidiaries of the same company after the initial filing by the parent.

Panel A. Chapter 7 Liquidations

		Junior Debt		
		No	Yes	**Total**
Senior Debt	No		31	**31**
	Yes	4	46	**50**
	Total	4	77	81

Panel B. Chapter 11 Reorganizations

		Junior Debt		
		No	Yes	**Total**
Senior Debt	No		0	**0**
	Yes	2	219	**221**
	Total	2	219	221