Creditor-on-Creditor Violence and Secured Debt Dynamics

Preliminary, comments welcome

Samuel Antill* Zhaoli Jiang† Neng Wang‡

May 8, 2024

Abstract: Anticipating a borrower's default, secured lenders have recently used aggressive legal tactics to extract value from other secured lenders. We model the implications of this new "creditor-on-creditor violence" trend. In our novel continuous-time capital structure model, secured debt enjoys higher priority in default. However, secured lenders take harmful actions to ensure their full recovery: they inefficiently push to prematurely sell assets and strip competing lenders of their priority. We show this creates a tradeoff between secured and unsecured debt that matches recent empirical evidence. While the creditor-conflict trend endogenously leads to higher secured credit spreads, it nonetheless increases investment and ex-ante firm value — creditor conflict enables ex-post debt reductions in states of the world with high expected default costs.

Keywords: Continuous-time capital structure models, Liability management, Secured debt, Bankruptcy, Creditor-on-creditor violence, Dropdowns, Uptiers

*Harvard Business School, santill@hbs.edu
†The Hong Kong Polytechnic University, zhaoli.jiang@polyu.edu.hk
‡Columbia University, NBER, and ABFER, nw2128@columbia.edu

1 Introduction

Serta Simmons, a leading mattress producer, was struggling financially in 2020. Serta had substantial debt from a leveraged buyout. Its sales were falling due to the pandemic and the growth of online retail.[1] In June 2020, Serta's problems led to a creative debt restructuring. A majority coalition of Serta's secured lenders consented to amend their credit agreement. The amendment allowed Serta to issue new secured debt with a super-priority lien on Serta's assets. The majority coalition exchanged each dollar of their existing secured debt for 74 cents of new "super" secured debt.[2] Crucially, existing secured lenders outside the coalition were not given the exchange opportunity. These excluded lenders, who previously held 30% ($600 million) of first-lien secured debt, suddenly had their highest priority debt subordinated to more than $1 billion in new debt.[3] This restructuring eliminated $400 million in debt for Serta through the exchange rate paid by coalition lenders. Nonetheless, Serta ultimately filed for bankruptcy shortly after the restructuring.[4]

Practitioners have divided views on these transactions, which have become increasingly common in the last decade (Buccola and Nini, 2022). Firms like Serta euphemistically call these restructurings "liability-management transactions." They argue these restructurings are a beneficial way to lower debt, increase liquidity, and prevent bankruptcies or liquidations. Lenders and other practitioners call this "creditor-on-creditor violence." They point out that most of these barely-legal transactions are quickly followed by bankruptcies. These

[1] See https://www.penews.com/articles/apollo-sues-serta-simmons-and-owner-advent-over-debt-dispute-20200612 and https://www.wsj.com/articles/advent-backed-serta-takes-on-debt-to-issue-a-670-million-dividend-1475878821.

[2] See https://bedtimesmagazine.com/2020/06/news-release-serta-simmons-bedding-enters-into-agreement-with-majority-of-lenders-on-deleveraging-and-liquidity-enhancing-transaction/ for details.

[3] See https://casetext.com/case/n-star-debt-holdings-lp-v-serta-simmons-bedding-llc.

[4] See https://dm.epiq11.com/case/sertasimmons/info.

critics believe this trend is harmful, eroding trust in the corporate borrowing system. To resolve the conflicting views, we build the first theory of how these transactions impact both ex-post and ex-ante firm behavior. We show that both critics and proponents of creditor-on-creditor violence are partially right. The trend increases the cost of secured debt due to the anticipation of future lender mistreatment. This endogenously limits secured debt use. However, secured debt also creates incentives for lenders to push for premature asset sales. By endogenously lowering firms' ex-ante secured-debt use, this creditor-aggression trend thus preserves firms. Moreover, we show that these restructurings are valuable because they introduce state-contingent leverage reductions: secured lenders only accept restructuring offers in states of the world where expected default costs are high. We thus show that the possibility of a future aggressive restructuring increases ex-ante firm value.

In our continuous-time capital structure model, an optimizing firm endogenously chooses its investment, equity issuance, dividend policy, leverage ratio, secured-debt ratio, and default timing. The firm's capital, the first state variable, evolves stochastically according to a jump-diffusion process. The drift of the firm's capital depends on its endogenous investment policy. The firm adjusts its outstanding short-term debt, the second state variable, to trade off the tax benefits of debt with the expected deadweight losses caused by default. As the firm rolls over its debt, it decides what fraction of its new debt to issue as secured debt. Secured debt must be fully collateralized by the value of the firm's assets in default.

After a negative capital shock, equity holders can endogenously choose to default. Equity holders default when the cost of the equity injection necessary to repay debt exceeds the continuation value of their future cash flows. In default, secured lenders have first priority on the recovery value of the firm. Crucially, unsecured lenders only get paid after both secured lenders and *priority unsecured claims*, such as employees' unpaid wage claims and unpaid taxes. This creates an incentive for the firm to issue secured debt. The choice of secured debt does not simply reallocate a pie of fixed size between secured and unsecured lenders. Instead, secured debt allows the firm to increase the overall value available to financial lenders in default. Issuing secured debt essentially transfers value from existing priority claim holders, such as employees, to financial lenders. Secured debt thus lowers the firm's total cost of credit because secured-debt usage allows financial lenders as a whole to recover more in default.

While secured debt lowers the firm's cost of credit, it also has a cost: secured lenders have an incentive to push for premature asset sales, even if doing so lowers firm value, because it ensures they get full recovery. Without an early sale, it is possible a severe capital shock could leave secured lenders impaired. In our model, there is a probability that secured lenders force an asset sale. This captures the ability of secured lenders to use covenants or the threat of foreclosure to manipulate debtors, as we describe in Section 2.3. Importantly, these early asset sales destroy value for other claim holders.

The firm thus trades off the possibility of an inefficient forced asset sale with the lower cost of credit when deciding how much secured debt to issue. Given this tradeoff, firms optimally use both secured and unsecured debt. We show this implies that limiting secured debt lowers firm value, since it forces a deviation from the optimal secured-debt ratio. The lower firm value per unit of capital leads the firm to endogenously invest less: the marginal cost of investment is the same but the marginal value of an additional unit of capital is lower since it cannot be used to collateralize secured debt. While limiting secured debt lowers firm value and investment, it also lowers the probability of default through fewer forced asset sales.

We introduce creditor-on-creditor violence into this realistic model of corporate policies.

We assume that after a negative capital shock, with some exogenous probability, the firm has an opportunity for an aggressive restructuring. If the restructuring offer is accepted by lenders, a coalition of lenders exchange their secured debt for super-secured debt with a lower face value, leaving excluded lenders with a subordinated claim. We thus capture all the details of transactions like Serta's deal. We show that as the probability of an aggressive restructuring opportunity increases, the endogenous cost of secured debt rises and the firm endogenously lowers its secured-debt ratio ex-ante. However, the state-contingent nature of these restructurings nonetheless creates value. Specifically, because of equity-issuance costs, the firm's leverage can drift far above target leverage before the firm finds it optimal to reduce leverage with a costly equity issuance. We show that secured lenders optimally accept restructuring offers if and only if leverage has drifted sufficiently far above the target — secured lenders only accept a haircut if the expected default costs, and thus the benefits of super-secured debt, are sufficiently high. This implies that restructurings provide an opportunity to reduce leverage precisely in states of the world where leverage is inefficiently high. Equity holders' moral hazard is limited by the fact that secured lenders will not accept an offer in low-leverage states, where the tax shields are valuable. As a result, we show that ex-ante firm value increases in the probability of an ex-post restructuring.

Finally, we validate this central prediction of our model by showing our other model predictions about leverage and secured debt are realistic. The debt policies in our model match the following empirical facts: (i) firms choose a leverage ratio of 37% and a secured-debt ratio of 33.7% in our model, which precisely match the sample averages in Benmelech, Kumar, and Rajan (Forthcoming); (ii) the difference in credit spreads between a firm's simultaneously issued secured and unsecured debt is 285 basis points, quite close to the estimate of 222 basis points from Benmelech, Kumar, and Rajan (2022); (iii) "distressed" firms with higher-than-target leverage use more secured debt, consistent with Benmelech, Kumar, and Rajan (Forthcoming). Since the choice of secured debt in our model matches this empirical evidence, it is reasonable to think our model accurately captures the effect of the rise in creditor-on-creditor violence. Importantly, there is no well-identified evidence on how the creditor-aggression trend affects ex-ante firm behavior, which necessitates a theoretical approach like ours. Our model also implies that the ability to issue secured debt *can* be quite valuable — at our assumed parameters, the legal enforcement of secured-lender rights improves ex-ante firm value by 3.6%. Of course, it is likely that our parameterization only captures particular types of firms.

Related literature: We make two contributions to the literature. First, we build the first theory of creditor-on-creditor violence. Our main finding, that this novel trend prevents defaults and increases ex-ante firm value and investment, is thus new to the literature. We build on a long theory literature modeling distressed restructurings, including Donaldson, Morrison, Piacentino, and Yu (2020); Gertner and Scharfstein (1991); Fan and Sundaresan (2000); Lambrecht (2001); Sundaresan and Wang (2007); Glode and Opp (2023); Zhong (2021). These models generate many important insights about distressed debt restructurings. Our model differs from these earlier papers by including (i) an ex-ante choice of investment and secured versus unsecured debt; (ii) the tendency for secured lenders to push for asset sales; and (iii) an ex-post restructuring in which only a subset of the most secured lenders exchange their claims, while junior claims are unaffected. As we show, the interactions between these model features are critical for understanding the ex-ante implications of these recent aggressive creditor tactics.

Our second contribution is to show that a novel tradeoff between secured and unsecured debt can produce realistic secured debt choices. Specifically, our model is the first to include a tradeoff in which secured debt can extract value from priority unsecured claims but also leads to premature asset sales. By studying the implications of this novel tradeoff, our model complements the existing theory literature in which different tradeoffs drive the choice between secured and unsecured debt (Morellec, 2001; Hartman-Glaser, Mayer, and Milbradt, 2023; Rampini and Viswanathan, 2013; Hackbarth and Mauer, 2012; Hackbarth, Hennessy, and Leland, 2007; Rampini and Viswanathan, 2020; Hu, Varas, and Ying, 2021; Bolton and Scharfstein, 1996; Bris and Welch, 2005; Donaldson, Gromb, and Piacentino, 2020, 2019).

Methodologically, we build on earlier continuous-time models of short-term debt such as Bolton, Chen, and Wang (2011); Bolton, Wang, and Yang (2021); Abel (2018). We also build on the literature modeling how institutional features of the treatment of debt in default influence ex-ante firm decisions (Broadie, Chernov, and Sundaresan, 2007; Antill and Grenadier, 2019; François and Morellec, 2004). None of these papers study the recent trend of creditor-on-creditor violence.

Finally, we contribute to the recent literature studying creditor-on-creditor violence, including Ivashina and Vallee (2020) and Buccola and Nini (2022), by providing the first theory of how this practice impacts firms ex-ante.

2 Institutional details

2.1 Secured debt

Unlike unsecured debt, secured debt is explicitly backed by collateral. Article 9 of the Uniform Commercial Code (UCC) outlines the legal treatment of secured debts outside of bankruptcy.[5] A secured debt contract gives the lender a "security interest" in a specified asset

[5]See https://www.law.cornell.edu/ucc/9.

of the debtor, which is a voluntary lien on the asset. The lender registers this security interest in a public database ("perfecting the security interest") so that other potential lenders are aware which of the debtor's assets already have liens on them.[6] Once registered, the secured lender has the right to seize the specified collateral if the debtor defaults on the loan. Unlike unsecured lenders, the secured lender can take collateral from a defaulting debtor without asking for court permission as long as they do not "breach the peace" by doing so.[7] When physically seizing collateral is impractical, a foreclosure is a straightforward way to transfer ownership of the asset to the secured lender. Importantly, these secured-lender rights only apply if the assets are held by the borrowing company.

A given piece of collateral can have multiple liens on it. A lender can file a security interest in a piece of collateral even after an existing lender has filed a security interest. However, the second lender gets a "second lien" and only receives value in a foreclosure after the first lien-holder is paid back in full.[8]

If a debtor files for bankruptcy, the automatic stay prevents secured lenders from seizing collateral. In exchange, the bankruptcy code gives secured lenders special treatment. Essentially, a bankruptcy plan can only be confirmed if secured lenders receive full recovery or secured lenders receive the value of their collateral.[9] Specifically, 11 U.S.C. §1129(a)8 requires all classes of claims to approve a bankruptcy plan. If this condition is not met, a plan

[6] See https://www.nolo.com/legal-encyclopedia/how-attach-perfect-security-interest-under-the-ucc.html.

[7] See https://www.nolo.com/legal-encyclopedia/what-secured-debt.html.

[8] See https://www.forbes.com/advisor/business-loans/what-is-a-ucc-filing.

[9] If a creditor holds a secured claim with a face value that exceeds the value of the loan collateral, the bankruptcy court gives the creditor a secured claim with a face value equal to collateral value and an unsecured "deficiency" claim equal to the difference between the original face value and the collateral value. See https://content.next.westlaw.com/practical-law/document/I68760bc7169611e598db8b09b4f043e0/Deficiency-Claim?viewType=FullText&transitionType=Default&contextData=(sc.Default)#:~:text=In%20bankruptcy%2C%20a%20general%20unsecured,is%20not%20secured%20by%20collateral.

can only be confirmed under the conditions of 11 U.S.C. §1129(b). Section 1129(b)2 requires that secured lenders (i) get to retain their liens on secured assets (or the sale proceeds from selling those assets in bankruptcy) and (ii) receive deferred cash payments with a present value equal to the claim or asset value.[10] In other words, a firm cannot exit bankruptcy unless secured lenders exit bankruptcy in the same position that they entered the bankruptcy (or better).

2.2 Priority unsecured claims

As part of its operations, a firm always owes money to employees. This includes, for example, wages or contributions to employee retirement plans that have not yet been paid. Likewise, firms always owe some taxes to the government that have not yet been paid. If a firm files for bankruptcy, these wage and tax obligations are priority unsecured claims.[11] These priority unsecured claims must be paid before unsecured lenders. Formally, 11 U.S.C. §507 specifies a certain amount of employee wages, employee benefit contributions, and tax claims that receive priority over general unsecured claims. If unsecured lenders are paid before these priority unsecured claims receive full recovery, the bankruptcy plan cannot be confirmed.[12]

While priority unsecured claims must be paid before unsecured claims, secured claims enjoy the highest priority: as described above, the firm cannot exit bankruptcy unless secured lenders effectively receive full recovery. In our model, this creates a motive to issue secured debt; the firm can obtain cheaper credit by issuing secured debt because secured creditors are paid before the priority unsecured claims that result from the firm's operations.

[10] See https://www.law.cornell.edu/uscode/text/11/1129.
[11] See https://www.law.cornell.edu/uscode/text/11/507.
[12] See https://www.law.cornell.edu/uscode/text/11/1129.

2.3 Secured lender control

The high priority of secured lenders creates an incentive to push for fast liquidations or foreclosures, even if the firm's going concern value is higher than the sale proceeds. This incentive arises when the sale value of a secured lender's collateral is high enough to give the secured lender full recovery but an uncertain continuation could lead to a future default with lower recovery. Antill (2022) and Ayotte and Morrison (2009) show empirical evidence of inefficient liquidations that benefit secured lenders.

In practice, secured lenders have some ability to push for an asset sale outside of default. For example, secured lenders can use a technical covenant violation to force the appointment of a new sympathetic CEO, promising the CEO generous compensation in return for a fast asset sale. Using a discontinuity design to identify the causal effect of a covenant violation, Nini, Smith, and Sufi (2012) show that "the marginal likelihood of observing a forced CEO turnover is 60% higher during the quarter of a covenant violation." Becher, Griffin, and Nini (2022) show that creditors control acquisition activity prior to defaults. Gilson and Vetsuypens (1994) show that "creditors are able to influence corporate policies by... replacing senior management, and influencing the terms of senior executives' compensation" prior to default.

2.4 Liability management and creditor-on-creditor violence

When large firms issue secured debt, they typically have a credit agreement that specifies both the terms of the debt and the circumstances under which the terms can be amended. In a recent trend, lenders have begun exploiting loopholes in these credit agreements to protect themselves when firms become distressed. Transactions like the one used by Serta's lenders are called "uptiering transactions." In these instances, a coalition of secured lenders and the borrower collude to exploit the amendment terms in a credit agreement. Specifically, as described above, credit agreements typically include negative covenants preventing lenders from issuing new liens on assets that would “prime” the existing first liens of secured creditors. However, these documents typically allow for a change of these pledges, or a release of liens entirely, if a majority of lenders agree to amend the terms. In uptiering transactions, a majority coalition of secured lenders agree to such an amendment in exchange for the ability to receive the new secured debt with the highest priming lien. The excluded lenders are stuck with essentially a second lien on the assets.

Another type of liability-management transaction is called the “dropdown.” This was made famous by J. Crew in 2016. In a dropdown, secured lenders have a first lien on a company’s assets. The firm exploits loopholes in the credit agreement to transfer these assets to an “unrestricted subsidiary” such that the secured lenders’ liens no longer apply. The firm then issues new secured debt backed by the now unencumbered collateral, often to existing lenders. In many instances, prior secured lenders challenge the legality of these transactions, so firms like J. Crew offer a consolation payment to a majority coalition of prior lenders to settle disputes. In this sense, the end outcome of a dropdown is similar to that of an uptiering: the firm issues new secured debt that is senior to previously secured debt and only a fraction of prior secured lenders benefit.

Buccola and Nini (2022) provide a detailed description of how these liability-management transactions work. Buccola (2023) includes a list of the many liability-management transactions that have occurred since 2015.

3 Model

We model the partial-equilibrium optimization of a firm in continuous time. A firm chooses its debt level ex-ante, then makes decisions ex-post to maximize equity value. This section presents our model assumptions.

3.1 Capital and investment

Let K_t denote the firm's capital at time t. Let I_t denote the firm's endogenous investment choice at time t. Capital evolves according to the following SDE:

$$dK_t = K_{t-}\Big(\psi\left(\frac{I_{t-}}{K_{t-}}\right) - \delta\Big)dt + \sigma K_{t-}d\mathcal{B}_t - (1-Z)K_{t-}d\mathcal{J}_t, \tag{1}$$

where the parameter $\delta \geq 0$ captures depreciation.

In this equation, we use $K_{t-} = \lim_{s\uparrow t} K_s$ to denote left limits. The process $\mathcal{B}_t$ is a standard Brownian motion and the exogenous parameter $\sigma > 0$ captures volatility. We assume that capital shocks arrive with an exogenous constant rate λ and the Poisson process $\mathcal{J}_t$ counts these shocks. At each shock, a fraction $1 - Z$ of the firm's capital is destroyed, where $Z \in [0, 1]$ is an i.i.d draw from the following CDF:

$$F(Z) = Z^{\beta}. \tag{2}$$

The exogenous parameter $\beta > 0$ determines the distribution of capital shocks. Finally, the function $\psi(\,\cdot\,)$ captures the efficacy of investment and is given by:

$$\psi(i) \equiv i - \frac{\xi}{2}i^2, \tag{3}$$

where the parameter ξ captures capital adjustment costs.

3.2 Priority claims and free cash flow

As motivated in Section 2.1, we assume in each instant the firm owes ρK_t in priority unsecured claims (e.g., wages) for an exogenous parameter ρ. This is a simplifying assumption to capture the creation of new claims as the firm pays out previously unpaid wages and taxes. We assume these claims scale with the size of the firm to preserve homogeneity for tractability.

We use the "AK-technology" specification for firm production, which is frequently used in the macroeconomics literature. Under this assumption, the firm's unlevered free cash flow Y_t is given by the following equation:

$$Y_t = AK_t - \tau(AK_t - \delta K_t) - I_t = \theta K_t - I_t, \tag{4}$$

where the parameter $A > 0$ captures the firm's capital productivity, $\tau \in (0, 1)$ is an exogenous parameter capturing the firm's tax rate, and the parameter $\theta \equiv A(1 - \tau) + \tau\delta$ captures the firm's productivity and tax burden.

3.3 Financing

At time zero, the firm issues X_0 in debt. The firm can costlessly issue new debt at any time before default. It can also pay a cost to issue equity, which allows the firm to reduce its outstanding debt. For tractability, we assume that all debt is short term and matures immediately. The firm's debt level X_t thus evolves stochastically over time as it (i) issues new short-term debt to cover maturing debt or fund investments, (ii) pays down debt using its free cashflow or equity-issuance proceeds.

In each instant, the firm rolls over some or all of its debt by issuing new short term debt. The firm chooses a fraction $s_t \in [0, 1]$ of the newly issued debt to issue as secured debt. The remaining fraction $1 - s_t$ is unsecured.

3.3.1 Credit spreads

The firm's cost of credit depends endogenously on its actions. Let η_t^S denote the endogenous credit spread on secured debt and let η_t^U denote the endogenous credit spread on unsecured debt. Let $Def_{t,t+dt}$ denote an indicator equal to one if the firm endogenously defaults over the interval of time $[t, t + dt]$ for some small $dt > 0$. Let $\mathcal{R}_{t+dt}^{Sec}$ denote the value, at time $t + dt$, of the total recovery value received by secured-debt holders in the event of default. We describe this recovery in detail in Section 3.5. Then the secured credit spread η_t^S is defined by the condition that secured lenders must receive an expected return equal to the exogenous risk free rate r:

$$s_t X_t(1 + rdt) = \mathbb{P}\left(Def_{t,t+dt} = 0 \right) s_t X_t(1 + (r + \eta_t^S)dt) + \mathbb{E}\left[\mathcal{R}_{t+dt}^{Sec} Def_{t,t+dt}\right]. \quad (5)$$

Secured lenders could invest the total secured debt $s_t X_t$ at the exogenous risk free rate r and receive $s_t X_t(1 + rdt)$ at time $t + dt$. We assume that lenders demand a credit spread η_t^S such that they get the same expected return on the firm's secured debt. This expected return is given by the right side of equation (5). If the firm does not default over the interval $[t, t+dt]$, then lenders get a return equal to sum of the risk free rate r and the credit spread η_t^S. If the firm defaults over the interval $[t + dt]$, then secured lenders get the recovery described in Section 3.5. Formally, we define η_t^S by taking the limit of equation (5) as $dt \to 0$ (see

Appendix A).

Unsecured credit spreads are defined by an analogous break-even condition, where the analogous unsecured recovery $\mathcal{R}^{Unsec}_{t+dt}$ is defined in Section 3.5:

$$(1-s_t)X_t(1+rdt) = \mathbb{P}\left(\, Def_{t,t+dt} = 0 \, \right)(1-s_t)X_t(1+(r+\eta^U_t)dt) \\ + \mathbb{E}\left[\mathcal{R}^{Unsec}_{t+dt} Def_{t,t+dt}\right]. \tag{6}$$

3.3.2 Debt coupon payments and the interest tax shield

The firm's debt coupon payment is $C_t dt$ per unit of time, where:

$$C_t \equiv \left(\, r + \eta^S_t s_t + \eta^U_t (1-s_t) \, \right) X_t. \tag{7}$$

We assume that the firm receives an interest tax shield $\tau C_t dt$ per unit time where $\tau > 0$ is an exogenous parameter capturing the firm's tax rate.[13] This creates an incentive to issue debt. As discussed in Section 3.5, deadweight losses in default create an incentive to avoid excessive debt.

3.3.3 Payouts, equity issuance, and debt dynamics

At any time, equity holders can issue debt and pay themselves the proceeds. That is, equity holders can pay out ϵ to themselves by increasing the debt level from X_t to $X_t + \epsilon$. Let U_t denote the cumulative amount paid out to equity holders by time t.

Likewise, equity holders can inject ϵ in equity at any time to reduce the debt level

[13] Note that in the definition of free cash flow Y_t, the parameter $\theta = A(1-\tau) + \tau\delta$ includes the role of taxes in determining unlevered free cash flow.

from X_t to $X_t - \epsilon$, and incur a total equity issuance cost of $h_0 K_t + h_1 \epsilon$. Let N_t denote the cumulative amount of equity injections by time t. Let H_t denote the corresponding undiscounted cumulative costs of external equity financing incurred by time t.

Given our assumptions, in the absence of debt restructurings, the firm's level of debt X_t evolves according to the following stochastic differential equation (SDE):

$$dX_t = -\big[\underbrace{Y_t}_{\text{Free cash flow}} - \underbrace{(1-\tau)C_t}_{\text{Coupon and tax shield}}\big]dt + \underbrace{dU_t}_{\text{Payout}} - \underbrace{dN_t}_{\text{Equity Issue}}. \tag{8}$$

We explain how the potential for debt restructurings changes leverage dynamics in Section 3.4.4.

For technical reasons, we assume equity holders must keep leverage below an exogenous limit.[14] This represents a covenant imposed by lenders. Importantly, in our calibration, we set this limit such that it never binds on the equilibrium path — equity holders endogenously default before reaching the exogenous leverage limit. This ensures the exogenous limit does not drive our results.

3.4 Secured lender incentives

One of our key contributions is our modeling of secured debt. We include many realistic features of secured debt in our model. The treatment of secured debt in default influences secured lender incentives, which in turn determines default timing and secured lender recovery. Because of this circularity, we build up to our formal characterization of secured lender recovery in steps.

[14]Formally, we assume that $X_t \leq qK_t$ for a given large number $q > 0$. This technical condition is a standard way to rule out Ponzi schemes in which the firm constantly issues debt under the self-fulfilling prophecy that it will issue more debt to repay old debt (Auclert and Rognlie, 2016).

3.4.1 Firm value in default

We assume the total firm value in default is πK_t, where $\pi > 0$ is an exogenous parameter. This can be thought of as the recovery value from selling the firm in a liquidation or going-concern sale.[15] The value πK_t is split by all of the firm's claimholders.

3.4.2 Secured debt limit

We assume that secured debt must be fully collateralized. Specifically, the value of a firm's secured debt issued at time t must be less than the total value claimholders would receive if the firm were to default at time t:

$$s_{t-}X_{t-} \leq \pi K_{t-}. \tag{9}$$

This relatively innocuous constraint, which does not bind in our calibration, simply imposes that there is no partially collateralized debt. While the firm can issue both secured and unsecured debt, each debt is either fully secured or fully unsecured. See Section 2.1 for motivation.

Importantly, equation (9) does not imply that secured debt is risk free. If a capital shock occurs at time t, then $\pi K_t = Z\pi K_{t-}$ can be insufficient to cover the secured debt $s_{t-}X_{t-}$ issued a moment earlier.

3.4.3 Secured versus unsecured conflict

We assume that secured lenders enjoy the highest priority in default. Combined with equation (9), this gives secured lenders an incentive to force an early default. If secured lenders

[15] Deadweight losses arise in default regardless of whether the default is resolved through liquidation (Antill, 2024), reorganization (Antill and Hunter, 2023), or going-concern sale (Antill, 2022).

can force a default before a capital shock arrives, they get first priority on the firm value πK_t. By equation (9), this implies full recovery. In contrast, if default occurs after a capital shock, there is a chance that the capital shock leave secured lenders impaired.

We model this incentive as follows. We assume that secured lenders will sometimes push to sell the firm before equity holders would optimally choose to default. Formally, we assume that over the increment of time $[t, t + dt]$, secured lenders take the firm and sell it with probability

$$\phi\Big(\frac{s_{t-}X_{t-}}{K_{t-}}\Big)^{\nu} dt, \tag{10}$$

where $\phi, \nu > 0$ are exogenous parameters. If this occurs, then the firm shuts down. Secured lenders get full recovery and the remaining claimholders split the firm as described in Section 3.5.

3.4.4 Liability management or creditor-on-creditor violence

To our knowledge, our dynamic capital structure model is the first to capture the recent trend of "liability management," also called "creditor-on-creditor violence." We model this as follows. Whenever a capital jump shock occurs, before lenders learn the extent Z of the capital shock, with probability $\alpha \in [0, 1]$ there is the potential for a liability-management transaction. In this transaction, the firm offers a coalition of secured lenders holding a fraction $\zeta \in [1/2, 1]$ of secured claims the opportunity to exchange their secured claims worth $\zeta s_{t-}X_{t-}$ for new super secured claims worth $\varepsilon\zeta s_{t-}X_{t-}$. The exchange rate $\varepsilon \in [0, 1]$, which we assume is exogenous for tractability, allows the firm to lower its debt slightly. The coalition accepts if its expected payoff is higher with the exchange than without the exchange.

We now provide intuition for how secured lenders decide whether to accept a restructuring offer. Suppose that X_{t-} is very high and a shock occurs. Because X_{t-} is high, the shock could plausibly lead to a default in which secured lenders are impaired ($\pi Z K_{t-} < s_{t-} X_{t-}$). In this scenario, the secured-lender coalition might prefer to exchange their debt $\zeta s_{t-} X_{t-}$ for $\epsilon \zeta s_{t-} X_{t-}$ in super senior debt. The motive for doing this is that the new debt will be less likely to impaired in a default, leading to higher expected recovery:

$$\mathbb{E}[\min(\pi Z K \, , \, \varepsilon \zeta s_{t-} X_{t-}) \, |\text{Shock}] > \zeta \mathbb{E}[\min(\pi Z K \, , \, s_{t-} X_{t-}) \, |\text{Shock}]. \tag{11}$$

Now, suppose that X_{t-} is low. Then it is very unlikely that a shock will lead to a default at all, let alone one in which secured lenders are impaired. In this case, secured lenders will not accept the offer. After all, if no default occurs, the coalition would simply give up a fraction $1 - \varepsilon$ of its debt to protect against a scenario that doesn't happen. This intuition matches our formal result: we show that secured lenders optimally accept a restructuring offer if and only if book leverage X_{t-}/K_{t-} exceeds an endogenous threshold. We characterize this formally in the Appendix.

Importantly, it is possible that secured lenders agree to a restructuring then learn the shock is mild enough to avoid a default. When this happens, the firm has simply reduced its outstanding debt. Indeed, this is precisely why firms do these restructurings in practice (Section 2.4). We will show that this possibility creates value ex-ante by expanding the contract space to allow a state-contingent reduction in debt precisely when expected default deadweight losses are large. Formally, we can write the debt dynamics with restructurings as

$$dX_t = -\big[\underbrace{Y_t}_{\text{Free cash flow}} - \underbrace{(1-\tau)C_t}_{\text{Coupon and tax shield}}\big]dt + \underbrace{dU_t}_{\text{Payout}} - \underbrace{dN_t}_{\text{Equity Issue}} - \underbrace{\mathbf{1}_t^R \zeta(1-\epsilon)s_{t-}X_{t-}d\mathcal{J}_t}_{\text{Liability management}}, \quad (12)$$

where $\mathbf{1}_t^R$ is an indicator equal to one if a restructuring is offered and accepted after the jump shock at time t.

3.5 Recovery by absolute priority rule in default

We can now formalize the treatment of claims in default. We assume that total firm value in default is πK_t. We assume that all claimholders split this value according to the absolute priority rule: each claim must get full recovery before any junior claim receives any recovery. However, the amount of secured claims depends on whether liability management has occurred (Section 3.4.4).

3.5.1 Recovery with no liability management

If there is no liability-management transaction, then the firm defaults with secured claims worth $s_{t-}X_{t-}$ and unsecured claims worth $(1-s_{t-})X_{t-}$. Secured claims receive first priority on the recovery value: letting T_* denote the time of default,

$$\mathcal{R}_{T_*}^{Sec} \equiv \min\left(s_{T_*}X_{T_*} \ , \ \pi K_{T_*} \right). \quad (13)$$

After secured lenders, priority unsecured lenders get second priority. These claims have face value ρK_{T_*} regardless of whether liability management occurs (Section 3.2). If there is enough value left over, then unsecured lenders have third priority:

$$\mathcal{R}^{Unsec}_{T_*} \equiv \min\left((1 - s_{T_*})X_{T_*} \ , \ \left[\pi K_{T_*} - s_{T_*}X_{T_*} - \rho K_{T_*}\right]^+ \right), \tag{14}$$

where $x^+ \equiv \max(0, x)$ gives the positive total unsecured recovery or zero.

Note that by assumption, if secured lenders force a default, then no liability management occurs because the probability of a simultaneous capital shock is zero.

3.5.2 Recovery with liability management

If a liability-management transaction occurs, then the firm has secured claims worth $(1 - \zeta + \varepsilon\zeta)s_{T_*}X_{T_*}$ and unsecured claims worth $(1 - s_{T_*})X_{T_*}$. The total recovery for pre-default secured lenders is then

$$\mathcal{R}^{Sec}_{T_*} \equiv \min\left((1 - \zeta + \varepsilon\zeta)s_{T_*}X_{T_*} \ , \ \pi K_{T_*} \right), \tag{15}$$

where the participating coalition gets fully repaid before the nonparticipating secured lenders receive anything.

Unsecured lenders have the same recovery as in the no-liability-management case, but they benefit from the reduced amount of secured debt:

$$\mathcal{R}^{Unsec}_{T_*} \equiv \min\left((1 - s_{T_*})X_{T_*} \ , \ \left[\pi K_{T_*} - (1 - \zeta + \varepsilon\zeta)s_{T_*}X_{T_*} - \rho K_{T_*}\right]^+ \right). \tag{16}$$

This is the same as the no-liability-management case, but accounting for the reduced amount $(1 - \zeta + \varepsilon\zeta)s_{T_*}X_{T_*}$ of secured debt.

3.6 Default timing

Default can occur two ways. First, secured creditors can force a default (Section 3.4.3). Let J_t^{sec} denote a jump process with jump arrival rate $\phi\left(s_t X_t / K_t\right)^{\nu}$ and define

$$T_S \equiv \inf\{t : J_t^{sec} = 1\} \tag{17}$$

to equal the time of the first jump of the process J_t^{sec}. Then default occurs at time T_S if it has not yet occurred.

Second, a default can occur when equity holders choose to stop paying their debt. We let T_D denote the endogenous time at which equity holders choose to stop paying debt. Default then occurs at time $T_* = T_D \wedge T_S$. The default indicator is then

$$Def_{t,t+dt} \equiv \mathbf{1}\left(t \leq T_* \leq t + dt\right). \tag{18}$$

3.7 Equity objective

After initially issuing debt X_0 at time zero, equity holders choose a payout process U_t, issuance process N_t, investment process I_t, secured debt process s_t, and default time T_D to maximize expected equity payouts. We assume that equity holders have a discount rate γ that is potentially higher than the risk free rate. This assumption captures equity holder impatience. Equity holders thus solve the following stochastic optimization problem:

$$P(K_t, X_t) \equiv \sup_{U,N,I,s,T_D} \mathbb{E}_t \Bigg[\int_t^{T_D \wedge T_S} e^{-\gamma(u-t)} \Big(dU_u - dN_u - dH_u \Big) + e^{-\gamma(T_D \wedge T_S - t)} \big((\pi - \rho) K_{T_D \wedge T_S} - X_{T_D \wedge T_S} \big)^+ \Bigg]. \tag{19}$$

The integral corresponds to net equity payouts prior to default. The final term corresponds to the possibility that equity holders earn positive recovery in default. Equity holders maximize this objective subject to: the evolution of capital (1); the credit spreads implied by (6) and (5), given the firm's strategy; the evolution of debt (12); the forced-default stopping time (17) implied by the firm's strategy; and the exogenous limit (9). Equity holders thus account for the impact of their choices on credit spreads and credit spreads are defined based on the choices of equity holders as described in the previous sections.

Given this definition of $P(\cdot,\cdot)$, at time zero, equity holders choose X_0 to maximize $P(K_0, X_0) + X_0$, the sum of equity value and debt proceeds:

$$\sup_{X_0 : P(K_0, X_0) > 0} P(K_0, X_0) + X_0. \tag{20}$$

.

Equity holders choose X_0 subject to $P(K_0, X_0) > 0$; otherwise, equity holders would default immediately and lenders would not lend. This condition introduces an endogenous maximum level of time-zero leverage. Likewise, the incentive of equity holders in the above maximization to default after issuing debt introduces an endogenous maximum leverage ratio ex-post.