Debt Renegotiations Outside Distress

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ABSTRACT

This paper develops a model to explore the implications of non-distressed debt renegotiation on debt prices and corporate policies. The model incorporates the empirical observation that creditors can influence firms also outside corporate distress through debt covenant renegotiation and not only in distress. We find that considering both distressed and non-distressed creditor interventions is key to investigating how creditor governance affects firms. The model explains cross-sectional patterns of control premiums and credit spreads that traditional debt renegotiation models do not capture. We also derive novel implications for the impact of firm characteristics associated with renegotiation on debt prices and corporate policies.

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1. Introduction

The traditional view on debt financing is that creditors only occasionally intervene in corporate policies to protect their debt claims when a firm approaches distress. Recent empirical studies highlight an alternative creditor governance view. This view emphasizes that creditors not only influence corporate policies in distress but also frequently outside distress through debt renegotiations (e.g., Denis and Wang, 2014; Roberts, 2015). Whereas the theoretical debt renegotiation literature provides profound insights into how specific renegotiation events can affect firms (e.g., Fan and Sundaresan, 2000; Davydenko and Strebulaev, 2007), it abstracts away from a creditor governance view that comprises both distressed and non-distressed creditor interventions. This neglect is surprising because empirical studies emphasize that creditor governance is key to explaining the investment, financing, and governance policies as well as the debt prices of real firms (Nini, Smith and Sufi, 2012; Vig, 2013; Favara et al., 2017; Feldhütter, Hotchkiss and Karakas, 2016, Ferreira, Ferreira and Mariano, 2018).

This paper develops a model to analyze the influence of non-distressed debt renegotiation on firms. To this end, we extend existing debt renegotiation frameworks with distressed creditor interventions to a creditor governance model, in which creditors can also influence firms outside distress through debt covenant renegotiation. Incorporating non-distressed renegotiation is key to bringing debt renegotiation models closer to the real data. Specifically, our creditor governance model explains cross-sectional patterns of credit spreads and control premiums that existing debt renegotiation models do not capture. We also derive novel testable implications for the impact of firm characteristics associated with renegotiation on debt prices and corporate policies. Finally, we find that our model considerably improves the existing debt renegotiation models’ ability to reflect the patterns with which creditors intervene in firms.

The model builds on a continuous-time corporate finance framework of a levered firm with assets in place and an investment opportunity as in Hackbarth and Mauer (2012). Agency costs of debt arise from the financing and timing of the investment because equity holders shift wealth from debt to equity upon these decisions. Following Fan and Sundaresan (2000), we consider distressed reorganization as a debt-equity swap, which is a standard approach to model creditors’ influence on firms in distress. Distressed reorganization avoids bankruptcy costs, but entails a loss of the tax shield of debt.
To incorporate that debt holders can also influence firms outside distress, we allow firms to include a covenant that restricts investment in the initial debt contract. Such a covenant is ubiquitous in private debt (Denis and Wang, 2014). Equity holders can renegotiate the covenant with creditors to waive the policy restriction, which is consistent with the empirical observation that many renegotiations occur in non-distressed states because of borrowers’ desire to relax the covenant restriction to increase investment or alter financial policy (Nini et al., 2009; Roberts and Sufi, 2009b; Denis and Wang, 2014; Roberts, 2015). We model covenant renegotiation as Nash bargaining. Successful renegotiation entails investment, issuance of a debt-equity mix to finance the investment, and compensation to initial debt holders. Our main theoretical result is that renegotiation solves the agency friction associated with the financing of the investment. Thus, renegotiation allows creditors to influence corporate policies outside distress by disciplining firms in their ex-post financing decision. Initially, firms decide whether to include the covenant by trading off its benefit against its cost. The benefit of inclusion is that it avoids the agency friction of investment financing. The cost is underinvestment, which typically occurs because the creditor compensation for waiving the covenant shifts wealth to initial debt holders. Our model provides a tractable representation of creditors’ ability to influence firms in and outside distress. It presents a first step toward analyzing and quantifying the implications of creditor governance for firm policies and debt prices.

Intuitively, creditor governance should have first order implications for debt prices because creditors’ primary motive for intervention is to influence the value of their claims. Thus, we first investigate the consequences of creditor governance for debt prices. We start by comparing model-implied to empirical credit spreads. To assess the contribution of our model, we also perform this comparison for the standard debt renegotiation frameworks in the spirit of Fan and Sundaresan (2000), Davydenko and Strebulaev (2007), and Favara et al. (2017). As these standard frameworks abstract away from the firm’s ability to issue additional debt, they underestimate credit risk. Specifically, they predict median credit spreads of 31-45 basis points (bps), which are considerably below the empirical counterpart of 109 bps. Simply adding the ability to issue new debt leads to a median credit spread of 287 bps and thus severely overestimates the empirical spread because the firm has an incentive to overlever at investment. In contrast, our creditor governance model implies a credit spread level of 119 bps, which is close to its empirical counterpart. The key mechanism of our model leading to this result stems from two counteracting forces. On the one hand, the model incorporates a firm’s possibility to issue new debt,
which implies higher credit spreads than in the standard frameworks. On the other hand, creditor governance allows creditors to intervene in corporate policies and thereby avoid the overleverage friction, which reduces credit spreads to a plausible level. Furthermore, we show that only the creditor governance model reflects the reported empirical relationship between debt renegotiation parameters and credit spreads. In this regard, our model also explains how debt renegotiation parameters affect the empirical relationship between growth options and credit spreads. Specifically, we show that because the financing of the investment is an important driver of credit risk, the renegotiation of this financing with creditors affects the impact of growth options on credit risk. In addition, the model predicts that control premiums increase before defaults and covenant violations, which is consistent with the empirical evidence in Feldhütter et al. (2016). To the best of our knowledge, our study is the first to explain these patterns in a model. Overall, we find that incorporating creditor governance is key to improving the ability of the existing renegotiation models to explain observed debt pricing patterns.

Next, we analyze the implications of creditor governance for corporate policies. With only distressed reorganization, higher bargaining power of equity holders delays investment.\(^1\) In contrast, our creditor governance model implies that bargaining power accelerates investment. Specifically, higher bargaining power increases the fraction of the renegotiation surplus that equity holders capture at investment, which induces them to invest earlier. This effect dominates the impact of bargaining power on investment timing from the distressed reorganization channel. The example shows that to investigate how parameters associated with debt renegotiation affect corporate policies, it is crucial to consider a creditor governance framework that goes beyond capturing distressed renegotiation. Furthermore, the creditor approach yields novel cross-sectional predictions on the impact of firms’ covenant violation cost on investment timing and the covenant structure.

Finally, we find that also considering non-distressed renegotiation considerably improves our model’s ability to reflect the empirical patterns with which creditors intervene in corporate policies. We consider samples of model-implied firms, which reflect the cross-section of real firms in terms of market-to-book and leverage ratios. For these samples,\(^1\)

\(^1\)Specifically, equity holders must share the value of the investment opportunity with debt holders at distressed reorganization but capture the entire value if they invest before the reorganization. Hence, potential distressed reorganization before investment stimulates equity holders to accelerate investment. With stronger bargaining power, equity holders receive a higher share of the investment value at distressed reorganization, which reduces this acceleration. Thus, higher bargaining power of equity holders delays investment.
we measure implied debt renegotiation patterns and compare them to their empirical counterparts. For example, the probability that a contract is renegotiated is approximately 62% in the empirical samples. Our model predicts 55.2%, whereas the existing debt renegotiation frameworks imply approximately 4.5%. By exploring additional creditor intervention patterns, we find that our model provides a realistic creditor governance framework, which is well-aligned with the timing of creditor interventions in real firms.

In practice, many different covenants can trigger debt renegotiations outside distress. We, therefore, additionally model a financing covenant instead of an investment covenant. The main results are robust to this variation. We also discuss alternative mechanisms in addition to creditor governance to mitigate the agency friction of the financing and timing of investment. For example, we compare our approach to the debt priority approach of Hackbarth and Mauer (2012) and to the possibility of calling debt discussed in Fischer et al. (1989). Our results highlight that the creditor governance approach entails larger firm values than these alternative approaches for a wide range of parameters.

We contribute to three strands of the literature. First, we link the theoretical to the empirical literature on debt renegotiation. The existing theoretical literature provides profound insights into either distressed reorganization or non-distressed renegotiation.\(^2\) It, however, abstracts away from a creditor governance view as these studies neglect the empirical literature highlighting that creditors intervene both in and outside distress, most renegotiations are unrelated to default, and renegotiations occur very frequently (Roberts and Sufi, 2009b; Denis and Wang, 2014; Roberts, 2015). We show that capturing a comprehensive creditor governance channel, which reflects these intervention patterns, is an important step toward improving the ability of debt renegotiation models to reflect real firms’ corporate policy and debt pricing patterns.

Second, studies on the impact of creditor characteristics on debt prices shows that financial health, concurrent services, skin in the game, previous large losses, syndicate composition, information advantages, and the identity of the lender affect loan prices (Hubbard et al., 2002; Drucker and Puri, 2005; Santos and Winton, 2008; Hale and Santos,\(^2\)

The main idea behind the distressed reorganization models in Giammarino (1989), Anderson and Sundaresan (1996), Mella-Barral and Perraudin (1997), Mella-Barral (1999), Fan and Sundaresan (2000), and Sundaresan and Wang (2007) is that equity holders can reduce contractual debt obligations due to costly bankruptcy threats when firm performance deteriorates. Models of non-distressed renegotiation are typically restricted to static frameworks (Bergman and Callen, 1991; Berlin and Mester, 1992; Gorton and Kahn, 2000; Dessein, 2005; Garleanu and Zwiebel, 2009). The motive for renegotiation in these studies is an investment distortion that harms debt holders.
We contribute to these studies by developing a model to explain how debt counterparty characteristics that are important in renegotiations influence debt prices and corporate policies.

Finally, we speak to the research on the impact of debt financing frictions on investment (Mello and Parsons, 1992; Whited, 1992; Hennessy, 2004; Hugonnier et al., 2015; Favara et al., 2017). By incorporating in a model the insight from the empirical literature that non-distressed renegotiation is an important channel for this impact (Chava and Roberts, 2008; Denis and Wang, 2014), we derive novel cross-sectional predictions of how creditor governance affects firms by reducing financing frictions. In this regard, we contribute to the literature on covenant structures (Kwan and Carleton, 2010; Bradley and Roberts, 2015) and the effect of creditor rights on corporate policies (Vig, 2013; Favara et al., 2017; Ferreira et al., 2018; Gamba et al., 2019).

2. The Base Model

The novel feature of our model is that we incorporate the ability to renegotiate debt both outside distress and in distress. We now describe the firm’s assets in place, investment opportunity, covenant renegotiation, and distressed reorganization.

2.1 Assumptions

Our model is in the spirit of Mello and Parsons (1992) with the extension for investment of Hackbarth and Mauer (2012). Assets are continuously traded in complete and arbitrage-free markets. Investors may lend and borrow at the risk-free rate $r$. Corporate taxes are paid at a constant rate $\tau$ on operating cash flows and full offsets of corporate losses are allowed. Firms choose corporate policies to maximize equity value.

The firm’s assets in place and investment opportunity. A firm has assets in place and an investment opportunity. At each time $t$, assets generate a cash flow $X_t$. $X_t$ is the exogenous state variable. Following Grossman and Hart (1986), $X_t$ is observable but not verifiable by courts. Hence, an ex-ante contract specifying corporate policies contingent on cash flows is not feasible because courts cannot enforce it. This assumption is standard
in the debt overhang literature (e.g., Favara et al., 2017). The firm’s cash flow $X_t$ follows a geometric Brownian motion under the risk-neutral probability measure $\mathbb{Q}$

$$dX_t = \mu X_t dt + \sigma X_t dW_t, \quad X_0 > 0,$$

in which $\mu$ is the drift, $\sigma$ the volatility, and $W_t$ a Brownian motion under $\mathbb{Q}$.

To generate cross-sectional variation in operating activities and funding needs, we incorporate an investment opportunity, which is modeled as an American call option on the firm’s cash flow analogous to Hackbarth and Mauer (2012). Specifically, an investment cost $I$ must be paid to scale all future cash flows by some factor $s > 1$. After investment, the firm consists of only invested assets. The investment decision is irreversible.

Initially, the firm is financed by issuing equity and private debt of infinite maturity. Private debt is the most important source of external financing in OECD countries (Gorton and Winton, 2003). Whereas renegotiations also occur with public bonds in practice, they are more costly, have a higher exposure to free-rider problems, and are more difficult to coordinate than the renegotiations of private debt (Rajan, 1992; Krishnaswami et al., 1999). Initial debt is issued at the par value $P_0$. After this issuance, the firm pays a total coupon $c_0^A$ to initial debt holders (A). The firm pays corporate taxes at a constant rate $\tau$. If the promised debt service exceeds the cash flow, equity holders can decide to inject funds to finance the coupon or default on their debt obligations (Leland, 1998). Default leads to immediate liquidation, unless equity holders and debt holders renegotiate. Debt holders enjoy absolute priority of their claims. In default, debt holders obtain the unlevered value of assets in place times the recovery rate $\alpha$, and the investment opportunity is lost (Hackbarth and Mauer, 2012).

Covenant renegotiation and the financing of investment. Following Sundaresan and Wang (2007) and Hackbarth and Mauer (2012), we assume that new debt can only be issued to finance the investment so that a firm chooses the investment and new financing policies simultaneously. Whereas this assumption is a simplification to keep the model tractable, it is consistent with empirical evidence showing that debt restructuring occurs commonly upon lumpy investment (Dudley, 2012). We allow the firm to include a covenant in the initial debt contract that prevents the firm from investing (investment covenant).3 Covenants that restrict investment are ubiquitous in real debt contracts and more standardized than financing covenants (Paglia, 2002; Dichev and Skinner, 2002; 3As the investment is not divisible, any investment covenant restricts the entire investment.
Chava and Roberts, 2008; Nini et al., 2009; Denis and Wang, 2014). A covenant specifying future investment contingent on $X_t$ is not feasible as $X_t$ is not verifiable by courts.

Equity holders can renegotiate this covenant with debt holders when they exercise the firm’s investment opportunity. The investment cost can be financed through a mix of additional equity and new private debt. The values of new debt and new equity sum up to the investment costs $I$. We denote equity holders’ bargaining power by $\eta$. Hence, debt holders’ bargaining power is $1 - \eta$. As in Garleanu and Zwiebel (2009), the renegotiation friction is a fixed cost $k_u$. Equity holders pay this cost just before non-distressed renegotiation. The cost can be interpreted as an administrative cost, due to, e.g., legal expenses or the opportunity cost of time.\(^4\) Both the decision to invest and the financing of the investment cost are determined in non-distressed renegotiation. Specifically, the investment and financing decisions are given as the Nash solution to a renegotiation game between equity holders and debt holders. In this game, equity holders select the better of two outside options: First, they can choose to comply with the covenant. In this case, debt holders enforce the prevailing investment covenant and prevent equity holders from investing. The absence of the corresponding investment cost implies that no new financing is raised. Thus, the firm continues as a firm with only assets in place and initial debt. Second, equity holders can choose to violate the covenant. Specifically, they can undertake the investment (and finance the investment cost) despite the covenant restriction. In case of such a covenant violation, initial debt holders obtain immediate repayment of their claim (e.g. Nini et al., 2009). We assume that the repayment corresponds to the par value of debt. Violating a covenant without the consent of creditors usually entails substantial costs to firms owing to reputation losses, restructuring costs, collateral requirements, monitoring and reporting frequencies, rating changes, or CEO turnover (e.g., Beneish and Press, 1993; Chava and Roberts, 2008; Nini et al., 2009). We capture this notion by assuming that firms suffer a covenant violation cost $k_v$ in case of violation. For a large range of realistic parameter values, equity holders optimally choose to violate the covenant in the outside option.

The surplus associated with the Nash bargaining game depends on equity holders’ choice of the outside option. In case of covenant violation, the surplus consists of the firm value given successful covenant renegotiation minus the firm value given covenant violation. Subsection 3.2 shows that because equity holders choose first-best financing

\(^4\)In case $k_u$ is sufficiently high, equity holders may optimally violate the covenant instead of engaging in costly renegotiation.
both in renegotiation and violation, the surplus consists of the covenant violation cost \( k_v \). In case equity holders comply with the covenant, the surplus corresponds to the firm value given the firm invests with the negotiated new financing minus the firm value given the firm does not invest and does not issue new debt.

Renegotiation implies that firms compensate initial debt holders for waiving the covenant and agreeing to the new debt financing. Debt holders receive the compensation through an additional coupon \( c_1^A \), resulting in a total coupon to initial debt holders of \( c_{01}^A = c_0^A + c_1^A \geq c_0^A \). In this setup, the Nash solution corresponds to a set of coupons \( \{ c_1^A, c_1^B \} \), in which \( c_1^B \) denotes the coupon to new debt.

We model one possible non-distressed renegotiation. This simplification allows us to investigate the impact of creditor governance on firms without complicating the analysis with subsequent non-distressed renegotiation rounds. Our simple representation of non-distressed renegotiation is consistent with the following empirical facts: (i) debt renegotiations are prevalently a consequence of borrowers’ desire to go beyond the restrictive initial debt contract to increase investment or to alter the financial policy (Roberts and Sufi, 2009b; Denis and Wang, 2014; Roberts, 2015); (ii) debt renegotiations do not only serve to resolve distress but also constitute a governance channel through which creditors intervene in firm policies subject to conflicts of interest (Chava and Roberts, 2008; Denis and Wang, 2014; Bradley and Roberts, 2015); (iii) debt holders can often negotiate a change in contract terms (such as higher coupons) that improves the value of their claim (Rajan, 1992; Kahan and Rock, 2009; Feldhütter et al., 2016); (iv) covenants and interest rates are the most frequently adapted debt contract terms at renegotiations (Roberts and Sufi, 2009b; Roberts, 2015). In practice, non-distressed renegotiations occur for multiple reasons, which cannot be simultaneously captured in a tractable model. Our simple representation of these events serves us to explore the implications of creditors’ ability to influence firms both in and outside distress.

Reorganization: Debt renegotiation in corporate distress. We model distressed reorganization as a debt-equity swap following Fan and Sundaresan (2000). We also consider a reorganization cost similar to Garleanu and Zwiebel (2009). This cost is a fraction \( k_s \) of the unlevered asset value at reorganization. Equity holders must pay this cost just before reorganization. Similar to the non-distressed renegotiation cost, the reorganization cost captures administrative cost such as legal expenses or the opportunity cost of time.
When cash flows deteriorate, equity holders offer debt holders to swap their original debt against equity ("debt-equity swap"). We assume that the investment opportunity and the associated restructuring option are preserved in distressed reorganization. A disagreement triggers immediate default. The firm’s claim holders have an incentive to reorganize to avoid default costs on assets and the loss of the investment opportunity. The equity fraction offered to debt holders in exchange for their debt, denoted by \(1 - \theta\), corresponds to the Nash solution. A distressed debt-equity swap implies that the firm becomes an all-equity firm, which results in a loss of tax shield. Thus, whereas corporate taxes encourage debt financing by shielding part of a firm’s cash flow from taxation, distressed reorganization limits the incentive to issue debt.

Analogous to non-distressed renegotiation, equity holders optimally decide whether to engage in distressed reorganization or whether to immediately default. Specifically, if distressed reorganization is sufficiently costly (i.e., \(k_s\) sufficiently large), equity holders decide to default immediately rather than to engage in costly distressed reorganization.

In the following, we focus on the case in which the magnitudes of the renegotiation cost and distressed reorganization cost do not prevent renegotiation or reorganization. Figure 1 presents the time line of the model. Covenant renegotiation takes place at investment if there is no previous reorganization ("covenant renegotiation"). Reorganization can occur before or after investment. If equity holders first reorganize after firm initiation ("initial reorganization"), they may still invest later ("investment after initial reorganization"). Equity holders can again decide to reorganize this new debt ("reorganization after investment following reorganization") in case of distress. If reorganization occurs after covenant renegotiation ("reorganization after covenant renegotiation"), initial debt holders, new debt holders, and equity holders bargain over the surplus. \(\eta_o\) and \(\eta_n\) are the bargaining power of initial and new debt holders, respectively, with \(\eta_o + \eta_n + \eta = 1\). We consider the asymmetric Nash solution to the multilateral bargaining game.\(^5\)

\(^5\)Britz et al. (2010) provide non-cooperative support for this asymmetric Nash bargaining solution. Specifically, they consider a non-cooperative multilateral bargaining game in which the proposing player in each round is determined by a Markov process. The authors show that stationary subgame perfect equilibrium payoffs converge to the weighted Nash bargaining solution with the stationary distribution of the Markov process as the weight vector.
Value functions and parameters after firm initiation but before covenant renegotiation or initial reorganization carry a subscript 0. After covenant renegotiation or initial reorganization, we use a subscript 1. To distinguish between these two cases, the additional subscript $l$ ($l$ for low) labels value functions after initial reorganization, while the subscript $h$ ($h$ for high) labels value functions after covenant renegotiation. Value functions and parameters after reorganization following investment and after investment following reorganization carry a subscript 2. A subscript 3 indicates that a firm has reorganized twice (reorganization after investment following initial reorganization).

3. Model Solution

The model is solved by backward induction. First, Section 3.1 presents an overview of corporate policies and value functions after initial renegotiation. Subsequently, Section 3.2 solves the bargaining game of covenant renegotiation and presents our main theoretical result. Finally, we solve for the value functions of corporate securities and corporate policies before covenant renegotiation or distressed reorganization (Section 3.3).

3.1 Value Functions and Firm Policies after Initial Renegotiation

Initial reorganization and the value functions thereafter. The value functions after investment following reorganization correspond to the case analyzed in Fan and Sundaresan (2000) augmented with distressed reorganization cost. The Appendix provides details.

In the period after initial reorganization but before subsequent investment, the firm is all-equity financed with the option to invest and relever simultaneously. In this case, the value of equity, $e_{II}(X)$, corresponds to the firm value. The investment threshold is denoted by $U_{1}$. We present both $e_{II}(X)$ and $U_{1}$ in closed-form in the Appendix.

Next, we consider initial reorganization. Denote the initial reorganization boundary by $S_{0}$ and the unlevered value of assets in place by $v(X) = \frac{1}{\tau - \mu} X$. The outside option is that equity holders default on their debt obligation and debt holders receive the unlevered value of assets in place net of default costs. The fraction of the unlevered asset value...
offered to debt holders for their claim at initial reorganization, $1 - \theta_0$, is determined as the Nash solution to the initial reorganization game

$$\theta_0 = \arg \max_{\tilde{\theta}_0} \left\{ \tilde{\theta}_0 e_{1l} (S_0) - 0 \right\}^\eta \left\{ (1 - \tilde{\theta}_0) e_{1l} (S_0) - \alpha v (S_0) \right\}^{1-\eta}. \quad (2)$$

The sharing rule in this game corresponds to $\theta_0 = \eta \left( 1 - \alpha \frac{v (S_0)}{e_{1l} (S_0)} \right)$.

**Value functions after covenant renegotiation.** $S_1$ is the reorganization boundary after covenant renegotiation. Multilateral bargaining entails a fraction $\theta_1 = \eta (1 - \alpha)$ of total surplus to equity holders, thereby generalizing the outcome of bilateral bargaining calculated in Fan and Sundaresan (2000). The full solution to the multilateral bargaining game is presented in the Appendix. Let $d_{1h} \left( \cdot ; c_0^A \right)$, $d_{1h} \left( \cdot ; c_1^B \right)$, and $e_{1h} \left( \cdot ; c_0^A + c_1^B \right)$ denote the value of initial debt, new debt, and equity, respectively, after covenant renegotiation. Because of the coexistence of two creditors at this stage, we write the dependence on the coupon explicitly. We provide the solutions to these value functions and the closed-form expression for equity holders’ choice of the reorganization boundary $S_1$ in the Appendix.

### 3.2 Covenant Renegotiation

The threshold triggering covenant renegotiation is denoted by $U_0$. We define the sharing rule as $\{ c_0^A, c_1^B \}$, i.e., the total coupon to initial debt holders and the coupon of new debt. Equity and debt holders’ outside option in non-distressed renegotiation given the initial coupon $c_0$, are denoted by $e^{oo} \left( U_0; c_0^A \right)$ and $d^{oo} \left( U_0; c_0^A \right)$, respectively. In the outside option, equity holders optimally choose between complying with and violating the covenant. In case of compliance, equity holders cannot invest and thus cannot raise new financing. In case of violation, we assume that equity holders incur the violation costs $k_v$, pay back the par value of initial debt $P_0$, invest, and implement the optimal capital structure. Thus:

$$e^{oo} \left( U_0; c_0^A \right) = \max \left\{ e^{1h} \left( U_0; c_0^A \right), e^{1h} \left( sU_0; c^f \right) + d^{1h} \left( sU_0; c^f \right) - I - k_v - P_0 \right\}. \quad (3)$$

The first term in the curly brackets is equity holders’ value in case they respect the covenant. The second expression is their value in case of covenant violation. We denote equity holders’ optimal action in the outside option as $a_{oo} \in \{ comply, vio \}$.

Debt holders’ outside option depends on equity holders choice of action in the outside option $a_{oo}$. In case equity holders comply with the covenant, debt holders’ value corre-
sponds to the value of their claim without investment and new financing. In case equity holders violate the covenant, debt holders’ value equals the par value of debt. Thus:

$$d^{oo} (U_0; c_0^A) = \begin{cases} d^{th} (U_0; c_0^A) & \text{if } a_{oo} = \text{comply} \\ P_0 & \text{if } a_{oo} = \text{vio} \end{cases}$$  \tag{4}

The expression in the curly brackets on the right-hand side in the first line of Eq. (5) is the surplus to equity holders in covenant renegotiation. This surplus is the value of equity at renegotiation less equity holders’ outside option. The expression in the curly brackets in the second line of Eq. (5) shows the surplus to initial debt holders in this renegotiation. This surplus is the difference between the value of initial debt at renegotiation and debt holders’ outside option. Proposition 1 presents our main general result.

**Proposition 1.** In case equity holders renegotiate the covenant, the Nash solution to Eq. (5) entails firm-value maximizing financing of the investment opportunity.

First-best leverage at covenant renegotiation follows from Pareto efficiency of the Nash solution. The proof of Proposition 1 in the Appendix also illustrates that equity holders and debt holders receive a fraction of total surplus corresponding to their respective bargaining power, as is standard in Nash bargaining frameworks.

Proposition 1 is robust to various model assumptions. In particular, the proposition remains valid with different debt priority structures determining the outside options in the reorganization game after covenant renegotiation. Further, different means of compensation, such as a one-time compensation payment to initial debt holders, leave the first-best leverage result unaffected. Overall, our theoretical result shows that non-distressed renegotiation solves the agency conflict regarding the leverage decision at investment.
3.3 Value Functions and Corporate Policies before Renegotiation

Value functions. We present the value functions before covenant renegotiation or initial reorganization for equity and corporate debt, denoted by \( e_0(X) \) and \( d_0(X) \), respectively.

**Proposition 2.** (i) The value of equity in the continuation region \( S_0 \leq X \leq U_0 \) is given by

\[
e_0(X) = A_{e0}^0 + A_{e1}^0 X + A_{e2}^0 X^{\beta_1} + A_{e3}^0 X^{\beta_2},
\]

in which

\[
\beta_{1,2} = \frac{1}{2} - \frac{\mu}{\sigma^2} \pm \sqrt{\left( \frac{1}{2} - \frac{\mu}{\sigma^2} \right)^2 + \frac{2r}{\sigma^2}},
\]

\[
A_{e0}^0 = -\frac{(1-\tau)}{r} c_A^0, \quad \text{and} \quad A_{e1}^0 = \frac{1-\tau}{r-\mu}. \quad A_2^e, A_3^e \text{ solve a linear system stated in the Appendix, Eqs. (61)–(62).}
\]

(ii) The value of corporate debt in the continuation region \( S_0 \leq X \leq U_0 \) is given by

\[
d_0(X) = A_{d0}^0 + A_{d1}^0 X^{\beta_1} + A_{d2}^0 X^{\beta_2},
\]

in which \( \beta_{1,2} \) are defined in Eq. (7) and \( A_{d0}^0 = \frac{c_A^0}{r} \). \( A_2^d, A_3^d \) jointly solve a linear system stated in the Appendix, Eqs. (61) and (64). The value functions are independent of the model assumptions to which Proposition 1 is robust (see discussion in Section 3.2).

Reorganization threshold, renegotiation boundary, and capital structure. For a given initial coupon \( c_0^A \) and a given principal \( P_0 \), equity holders solve

\[
\{S_0, U_0\} = \arg\max_{S_0, U_0} e_0(X).
\]

The boundary conditions for equity are

\[
e_0(S_0) = \eta e_{1i}(S_0) - (\eta \alpha + k_s) \frac{1-\tau}{r-\mu} S_0
\]

\[
e_0(U_0) = \eta F_{1h} s U_0 + (1-\eta) e^{oo}(U_0; c_0^A) - \eta d^{oo}(U_0; c_0^A) - \eta I - k_u,
\]

in which \( e^{oo}(U_0; c_0^A) \) and \( d^{oo}(U_0; c_0^A) \) are defined in Eqs. (3) and (4), respectively. The first boundary condition Eq. (10) reflects that equity holders bear the renegotiation cost.
ks, but obtain a fraction \( \eta \) of the surplus of distressed renegotiation. This surplus is defined by unlevered equity value less default costs.

For a given and fixed action of equity holders in the outside option, we can write the smooth-pasting conditions. Specifically, given that equity holders select violation in the outside option \( (a_{oo} = \text{vio}) \), the smooth-pasting conditions are

\[
\frac{\partial}{\partial X} e_0(X) \big|_{X = S_0} = \eta \frac{\partial}{\partial X} e_{1h}(X) \big|_{X = S_0} - (\eta \alpha + k_s) \frac{1 - \tau}{r - \mu} \tag{12}
\]

\[
\frac{\partial}{\partial X} e_0(X) \big|_{X = U_0} = F_{1h} s. \tag{13}
\]

In contrast, given that equity holders select compliance in the outside option \( (a_{oo} = \text{comply}) \), the smooth-pasting conditions are

\[
\frac{\partial}{\partial X} e_0(X) \big|_{X = S_0} = \eta \frac{\partial}{\partial X} e_{1h}(X) \big|_{X = S_0} - (\eta \alpha + k_s) \frac{1 - \tau}{r - \mu} \tag{14}
\]

\[
\frac{\partial}{\partial X} e_0(X) \big|_{X = U_0} = \eta F_{1h} s + (1 - \eta) \frac{\partial}{\partial X} e_{1h}(X; c_0^A) \big|_{X = U_0} - \eta \frac{\partial}{\partial X} d_{1h}(X; c_0^A) \big|_{X = U_0}. \tag{15}
\]

Because equity holders optimally select their action in the outside option, the objective function in Eq. (9) can have two local maxima. Specifically, each region, in which equity holders select a specific action in the outside option, may have a local maximum. A local maximum is either an interior solution and satisfies the corresponding smooth-pasting conditions stated above (Eqs. (12)–(13) or Eqs. (14)–(15)) or is a corner solution. In our main specification, the interior maximum given violation is the global optimum.

We assume that debt is issued at par. The par value is the repayment to debt holders at covenant violation. For given coupon \( c_0^A \), the par value \( P_0 \) solves:\(^6\)

\[
P_0 = d_0(X; c_0^A) \tag{16}
\]

\(^6\)Because equity holders can select two distinct actions in the outside option (namely, compliance and violation), Eq. (16) may exhibit none, one, or two solutions for \( P_0 \). We assume that equity holders can only issue coupons that have one or two solutions. In case of two solutions, we select the solution that entails the higher initial firm value. Two solutions can arise if the two different principals solving Eq. (16) imply a different optimal choice of equity holders’ action in the outside option at covenant renegotiation.
Finally, equity holders optimally choose the initial capital structure by trading off the
tax advantage of debt against distressed reorganization costs and the agency cost of debt.
To this end, they maximize the value of their objective function ex-ante:

\[ c_0^A = \arg \max_{c_0} \{ e_0 (X_0) + d_0 (X_0) \}, \tag{17} \]

subject to Eqs. (9) and (16). A closed-form solution does not exist. We use numerical
procedures and verify the optimality of the policy choices numerically.

4. Model Analysis

We now discuss the baseline parameters, benchmark models, and model mechanisms.

4.1 Baseline Parameters

We use the baseline parameter values of Hackbarth and Mauer (2012). The risk-free
interest rate is \( r = 6\% \), the risk-neutral growth rate of cash flows \( \mu = 1\% \), the cash flow
volatility \( \sigma = 25\% \), the tax advantage of debt \( \tau = 15\% \), the recovery rate \( \alpha = 75\% \), the
initial cash flow \( X_0 = 20 \), the investment cost \( I = 200 \), and the scale parameter \( s = 2 \).
Following Kuehn and Schmid (2014), the market-to-book (mtb) ratio is the firm’s market
value divided by the value of invested assets. The bargaining power of equity holders is \( \eta = 0.5 \) as in the base case of Fan and Sundaresan (2000). In distressed reorganization
after covenant renegotiation, we assume that new and initial debt holders have equal
bargaining power, i.e., \( \eta_n = \eta_o = 0.25 \). We choose a bargaining friction of zero in the
baseline setting to ensure comparability to existing renegotiation frameworks (e.g., Fan
and Sundaresan, 2000). The covenant violation cost is \( K = 100 \), which corresponds to
19.1\% of the asset value of the baseline firm just before investment. We explore the
impact of alternative choices of bargaining frictions and violation costs on our results.

4.2 Benchmark Debt Renegotiation Frameworks

To highlight the novel insights of our creditor governance model, we compare our base
model’s predictions to those of three frameworks. Specifically, we benchmark against
the frameworks of Fan and Sundaresan (2000), Davydenko and Strebulaev (2007), and an all-equity financed investment framework in the spirit of Favara et al. (2017). These frameworks represent the commonly used existing debt renegotiation models in the literature. Whereas they capture distressed reorganization, they abstract away from a creditor governance view, in which creditors can influence firms in a broader set of states.

First, we select the framework of Fan and Sundaresan (2000) to represent distressed reorganization models. We label this model the “FS”-framework. Second, we use the model of Davydenko and Strebulaev (2007) because this framework also incorporates bargaining frictions besides distressed reorganization. We label this model the “DS”-framework. Third, we represent the debt renegotiation frameworks with distressed reorganization and an all-equity financed investment in the spirit of Favara et al. (2017). Specifically, we assume that the firm faces no investment restriction but must entirely finance the investment cost by issuing equity. We label this model the “EFI”-framework (EFI stands for “Equity-Financed-Investment”). The Internet Appendix presents the benchmark models.

We also report the results from our base model if we prevent the firm from installing a covenant. Whereas this firm can issue debt to finance the investment, the missing covenant prevents non-distressed renegotiation. The derivation is in the Internet Appendix. We label this framework “Without covenant”. We cannot apply an existing benchmark framework from the literature to isolate the impact of going from a debt renegotiation to a creditor governance approach because, besides ignoring non-distressed renegotiation, these frameworks differ in additional important features from our base model. For example, the FS-, DS-, and EFI-frameworks ignore new debt financing. The without covenant model, however, only differs by ignoring non-distressed renegotiation.

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7 An additional benchmark could consider only non-distressed renegotiation without the ability for distressed reorganization. We do not incorporate such a benchmark for two reasons. First, under US regulation, it is unrealistic to assume that a real firm can renegotiate its debt outside distress but not in distress. The Trust Indenture Act of 1939 gives trustees in public bond issues only limited discretion during renegotiation outside bankruptcy and imposes strict approval policies for amendments to public bond contracts. For example, changes to public bond covenants outside bankruptcy must be approved by bondholders representing no less than two-thirds of the total principal. Such majority approval is difficult in the case of diffusely held public bonds. By contrast, Chapter 11 facilitates debt renegotiations in distress. Second, incorporating distressed reorganization is standard in the continuous time corporate finance literature (e.g., Morellec et al., 2012).

8 Mella-Barral (1999) also consider a distressed reorganization model with renegotiation frictions. We use the model of Davydenko and Strebulaev (2007) because it incorporates different distributions of bargaining power.

9 The model of Favara et al. (2017) is a discrete time model and does not consider the ex-ante optimal capital structure. Hence, our benchmark model is not directly analogous to their model, but rather reflects one of its important features of an equity-financed investment.
from our base model. Thus, comparing this model to the base model isolates the pure impact of going from a debt renegotiation framework to a creditor governance approach.

4.3 Corporate Policies and Firm Value

We now discuss how creditor governance affects firm value and corporate policies. Firms need to install the investment covenant to establish creditor governance, i.e., to allow creditors to influence firms also outside distress through non-distressed covenant renegotiation. Thus, we first discuss the friction that motivates firms to install this covenant.

Line one of Table I shows the corporate policies and values of our benchmark model that neglects the possibility to install a covenant to permit non-distressed renegotiation (without covenant). The second line is this case with investment and financing policies that maximize firm value. Comparison of these two lines shows that three policy distortions occur without the ability to renegotiate outside distress. First, this firm overlevers at investment ($lev_U$). The intuition behind this ex-post distortion is that issuing new debt transfers wealth from initial debt to equity. Thus, the possibility to exploit this wealth transfer induces equity holders to issue too much new debt. Second, the firm invests too early ($U_0$). Two opposing channels drive this ex-post overinvestment distortion. On the one hand, investment promotes the value of initial debt by increasing the firm’s cash flow without the need for the debt holders to pay the investment cost. This debt overhang channel delays investment because equity holders limit the corresponding benefit to initial debt by investing at a higher threshold. On the other hand, the possibility to exploit the wealth transfer from initial debt to equity owing to the issuance of new debt at investment induces equity holders to accelerate investment. As in Hackbarth and Mauer (2012), the second channel dominates the first channel for a wide range of relevant parameters such that the firm invests too early. Third, the firm underlevers ex-ante ($lev_0$) to mitigate the ex-post overleverage and overinvestment distortions.

The agency cost of the overleverage, overinvestment, and initial underleverage frictions is 1.13% of firm value for our baseline parameters, as shown in Column $AC$. We measure the agency cost as the difference between the firm values in the model of interest and the same model with first-best investment and financing policies (“first-best firm value”), expressed as a percentage of the corresponding first-best firm value. The nature of these agency distortions of debt is similar to that in the model without debt reorganization of Hackbarth and Mauer (2012). In particular, the agency frictions hinge on
the assumption that debt restructuring only occurs upon lumpy investment. In our case with distressed debt reorganization, the magnitude of the agency cost is larger (by approximately factor 1.9) than that in Hackbarth and Mauer (2012) because incorporating distressed reorganization induces firms to install higher initial leverage, which aggravates agency distortions. The magnitude of the agency cost in Table I is similar to that of the agency cost of debt in Parrino and Weisbach (1999) and Childs et al. (2005).

Next, we investigate the results of our creditor governance model. This model incorporates firms’ ability to install an investment covenant, which allows creditors to also intervene in firm policies outside distress besides the distressed interventions. Line three of Table I shows the corporate policies and values of this model, and line four depicts this case with investment and financing policies that maximize firm value. The firm value maximizing leverage at covenant renegotiation in line three is consistent with the corresponding general theoretical result of Proposition 1 in Section 3.2. In contrast to the leverage result, creditor governance does not eliminate the investment timing distortion. Specifically, in Table I and for a wide range of relevant parameters, underinvestment occurs because initial debt holders capture part of the surplus at covenant renegotiation, which shifts wealth to initial debt holders. Finally, the firm also slightly overlevers initially to mitigate the ex-post underinvestment distortion. The remaining agency cost of debt in the base model compared with the first-best amounts to 0.18%. Overall, the ability to renegotiate debt outside distress increases the baseline firm value by 0.74% compared to the case without a covenant in line one.

To summarize, firms face a trade-off when deciding whether to include the covenant and thereby admit creditor governance through non-distressed renegotiation. Specifically, the benefit of covenant inclusion is that it mitigates the ex-post overleverage at investment and overinvestment distortions of the benchmark model (without covenant). The cost of covenant inclusion is the underinvestment cost, which occurs because the renegotiation at investment shifts wealth to initial debt holders. Column V_NDR shows the value of

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10 Initial debt holders’ outside option at covenant renegotiation corresponds to the par value of initial debt (see Eq. (4)). Higher leverage reduces the par value per unit of initial coupon and, hence, the bargaining position of initial debt holders. Thus, overleverage allows equity holders to reduce the wealth transfer to initial debt holders at covenant renegotiation and, thus, the underinvestment distortion.
including the covenant ex-ante, where \( V_{NDR} \) stands for the “Value of Non-Distressed Renegotiation.” We interpret \( V_{NDR} \) as a firm’s incentive to include the covenant.

While optimal leverage at investment is a general result, the investment distortion and choice of initial leverage depend on parameters. In Table II, we therefore discuss the robustness of our results by exploring the influence of parameter variations on corporate policies, firm value, and the value of creditor governance. In each panel, we change one parameter. In Panel A, we reduce the bargaining power to 0.25. Panel B explores the impact of an alternative bargaining power allocation among debt holders. In Panel C, we reduce the recovery rate to \( \alpha = 0.55 \), which reflects the estimate of Glover (2016). In Panel D, we use the tax rate of 0.27 from He and Xiong (2012). Panel E shows the results for the volatility of 0.29 in Morellec et al. (2012), and Panel F depicts those for the cash flow drift of 0.02 in Grenadier and Malenko (2011). Panel G assumes a renegotiation cost of \( k_u = 2 \) for non-distressed renegotiation, which corresponds to 1% of the investment cost, and a distressed reorganization cost of \( k_s = 0.01\% \), which is 1% of the unlevered asset value in reorganization. Finally, Panel H considers a covenant violation cost of \( K = 20 \). The panels imply that our implications are robust to parameter variations and suggest a reasonable range of \( V_{NDR} \) between 0.35% and 1.89% of the firm value. In Section 5.3, we also explore parameter combinations for which firms optimally abstain from installing the covenant.

INSERT TABLE II HERE

5. Model Predictions

We now apply our model to analyze and quantify the influence of creditor governance on the value of corporate securities and firm policies.

5.1 Credit Spreads

We first discuss the implications of creditor governance for credit spreads. To this end, we compare model-implied credit spreads to empirical credit spreads. We follow the standard approach to derive model-implied credit spreads (Longstaff et al., 2005). Specifically, we solve for the credit spread by determining the spread such that the present value of
receiving this spread until a firm’s non-compliance with contractual coupon payments (fee leg) equals the present value of the loss on debt given this non-compliance (protection leg). The Internet Appendix provides details on this calculation.

Column one of Table III lists the empirical credit spread patterns reported in Davydenko and Strebulaev (2007). We benchmark the models against this study because it empirically estimates the impact of firm characteristics associated with debt renegotiation on corporate credit spreads in a large sample of real firms (empirical sample). The median firm’s credit spread in Panel A is 109 bps. Panel B shows how firm variables associated with debt renegotiation (strategic variables) from Table VI in Davydenko and Strebulaev (2007) affect spreads. Panel C summarizes how the standard variables (non-strategic variables) from Table V in Davydenko and Strebulaev (2007) affect spreads.

In Columns two to six of Table III, we summarize the implications of the different models for credit spreads. To compare the model-implied credit spreads to their empirical counterpart in Column one, we calibrate model firms to the median empirical firm in the study of Davydenko and Strebulaev (2007). The median empirical firm has a leverage of 30.3%, an mtb ratio of 1.47, and an asset volatility of 20.4%. The median risk free rate in the empirical sample is 5.94%. For each model, we calibrate the initial coupon and the investment scale parameter to match the median empirical leverage and mtb ratios in Davydenko and Strebulaev (2007). We assume that calibrated base model firms have a debt value at par. A model firm’s market leverage is the market value of debt divided by the market value of the firm. In addition, we use a volatility of 20.4% and a risk-free rate of 5.94% to reflect the corresponding parameters in the empirical sample. The remaining model parameters, for which we find no counterpart in the empirical study of Davydenko and Strebulaev (2007), are set equal to our baseline parameters. We numerically calculate the impact of firm parameters on model-implied credit spreads as the first derivative of a calibrated model firm’s credit spread with respect to the corresponding firm parameter.

\text{INSERT TABLE III HERE}\n
\footnote{Davydenko and Strebulaev (2007) extract credit spreads from corporate bond yields. In contrast to CDS spreads, bond yields could contain a control spread. The control spread of bonds, however, is quantitatively small: Feldhütter et al. (2016) show that the mean control premium, i.e., the present value of the control spreads up to a bond’s maturity, is only 29 bps. In addition, Zhang et al. (2009) investigate the impact of firm characteristics on traded CDS spreads (instead of credit spreads extracted from bond yields) and find that the results are similar to those in Davydenko and Strebulaev (2007).}
The credit spread of the median baseline firm is 119 bps, which is close to the 109 bps in the empirical sample. In addition, Panels B and C suggest that the base model calibration is consistent with the impact of all the strategic and non-strategic variables on spreads in the empirical sample of Column one. The relation between growth options and credit spreads has attracted considerable attention in the literature (e.g. Arnold et al., 2013; Kuehn and Schmid, 2014; Gamba and Saretto, 2020). Our model conforms to the positive relation between the mtb ratio (as a proxy of growth options) and credit spreads in the empirical sample. This result holds because firms with more valuable growth options are closer to exercising the investment opportunity and, thus, issuing new debt to finance the investment, which increases spreads. In addition, we contribute to the discussion by highlighting that firm characteristics associated with renegotiation have a key impact on the relation between growth options and credit spreads. The intuition behind this link is that because the financing of the investment is an important driver of credit risk, the renegotiation of the covenant with creditors affects the influence of growth options on credit risk. Specifically, our model predicts that the relation between growth options and credit risk should be stronger for higher bargaining power of equity holders or lower bargaining frictions (not tabulated).12 Thus, the model explains the corresponding empirical patterns in Table VII of Davydenko and Strebulaev (2007). Further, we derive the novel, testable predictions that the relation should be stronger for a lower recovery rate or smaller covenant violation costs (not tabulated).13 Finally, our model also generates a novel prediction regarding the impact of covenant violation costs on credit spread levels. We find that this cost has a negative impact on credit spreads (not tabulated) mainly because it delays investment and, hence, the issuance of new debt.

Columns three to five in Table III summarize the credit spreads in the calibrated benchmark models. Panel A shows that these models imply a spread between 31 and 45 bps. Thus, they severely underestimate the empirical spread of 109 bps because they ignore the firm’s ability to issue additional debt. In addition, Panel C suggests that they cannot reflect the empirically positive impact of the mtb ratio on spreads.14

\[\text{\textsuperscript{12}For a higher bargaining power (lower bargaining frictions) of equity holders, firms invest earlier, which aggravates the positive impact of closer future debt financing at investment on credit risk.}\]

\[\text{\textsuperscript{13}For a lower recovery rate, debt is riskier and, hence, the positive impact of closer future debt financing at investment on credit risk is stronger. For smaller covenant violation costs, firms invest earlier, which aggravates the positive impact of closer future debt financing at investment on credit risk.}\]

\[\text{\textsuperscript{14}In the EFI-framework, the firm issues new equity at investment to finance the investment. New equity decreases the default risk of existing debt. Thus, a higher mtb ratio reduces credit spreads in this framework because a firm with a higher mtb is closer to the equity issue. The FS- and DS-frameworks}\]
Column six of Table III summarizes the credit spread patterns for the without covenant model. The median credit spread is 287 bps. The large spread is mainly driven by the agency problem that the firm overlevers at investment as in Hackbarth and Mauer (2012). In addition, Column six in Panel B shows that the credit spread in this case fails to reflect the positive impact of the liquidation cost on credit spreads that prevails in the empirical sample. Specifically, a higher liquidation cost mitigates equity holders’ incentive to overlever at investment, which explains the negative impact of the liquidation cost on credit spreads. The main difference that drives credit spreads between Column six and the benchmark models in Columns three to five is that the firm in Column six incorporates the possibility of issuing new debt. Thus, the results illustrate that simply augmenting the benchmark frameworks with the ability to issue additional debt does not lead to model-implied credit spread patterns that reflect their empirical counterparts. Comparing Columns two and six isolates the impact of incorporating creditor governance on credit spreads because the only difference between these two models is that creditors can also influence corporate policies outside distress in Column two. This comparison suggests that considering creditor governance is the key to bringing the models closer to the empirical data. Specifically, creditor governance solves the overleverage friction at investment, leading to the lower credit spread in Column two compared to Column six. In addition, solving this friction avoids the negative impact of the liquidation cost on credit spreads, which prevails in Column six.

Overall, Table III implies that creditor governance is a crucial feature for improving the ability of debt renegotiation models to explain both the credit spread levels of real firms and how firm characteristics influence these levels.

5.2 Control Spread

The recent empirical literature suggests that creditor control generates observable premiums in debt instruments (Feldhütter et al., 2016). Specifically, creditors can influence firm decisions during debt renegotiations to improve the value of their debt claim. For example, creditors may renegotiate higher interest rates on their loan or extract rents from the firm through alternative debt contract or corporate policy changes. To measure this creditor control premium of corporate debt in our model, we calculate the difference abstract away from a firm’s opportunity to invest and, hence, do not predict the impact of the mtb ratio on credit spreads.
between the value of private debt and the value of debt without bargaining power (i.e., \( \eta = 1 \)) while fixing the corporate policies at those of the firm with private debt. Without bargaining power, debt holders only receive their outside option in any renegotiation and, thus, cannot extract surplus from the firm. We also report a control spread, which annualizes the total control premium. The calculation is in the Internet Appendix.

For the median baseline parameters in Davydenko and Streublau (2007), the annual control spread is 144 bps. Thus, the ability to extract surplus through renegotiations reduces the debt holders’ required yield by 144 bps. The magnitude of this spread depends on the parameters. For a bargaining power of \( \eta = 0.95 \), for example, the control spread is only 39 bps. Thus, our base model is consistent with the cross-sectional prediction in Feldhütter et al. (2016) that control spreads decline with equity holders’ bargaining power. The model also yields the novel testable prediction that the control spread should increase with the covenant violation cost. In terms of absolute magnitude, the control spread in our private debt model is larger than that of the public bonds in Feldhütter et al. (2016). This result is plausible because whereas private debt holders can directly renegotiate their private debt with the firm, it is difficult to renegotiate public bonds because of coordination and free-rider problems (Rajan, 1992; Krishnaswami et al., 1999).\(^{15}\)

5.3 Corporate Policies

We now discuss the novel firm policy predictions from our creditor governance model. We first analyze investment timing before we investigate covenant structures.

In Figures 2 and 3, we analyze investment timing. The solid lines correspond to the baseline firm and the dashed lines show the firm without a covenant. We use optimal initial coupons for all models. Figure 2 plots the relation of the investment boundary to the bargaining power of equity holders. It shows that higher bargaining power accelerates investment in our baseline model. Higher bargaining power increases the fraction of the renegotiation surplus that equity holders capture at investment, which induces them to

\(^{15}\)Feldhütter et al. (2016) argue that public bond prices reflect a control premium because bond holders may indirectly benefit from the private debt holders’ ability to renegotiate debt. For example, if private debt holders renegotiate a corporate strategy with lower risk, this renegotiation also benefits public bonds. The control premium of public bonds, however, is likely to be lower than that of private debt because private debt holders may also renegotiate some features that only benefit their debt. For instance, they could renegotiate an increase in their private debt interest rate, which raises the value of their claim but not that of the public bonds.
invest earlier. In contrast, the dashed line for the firm without the possibility of creditor intervention outside distress predicts that higher bargaining power delays investment.\footnote{This result holds because equity holders must share the value of the investment opportunity with debt holders at distressed reorganization but capture the value if they invest before reorganization. Thus, potential distressed reorganization before investment stimulates equity holders to accelerate investment. The dominating effect of higher bargaining power of equity holders is to reduce this acceleration because equity holders receive a higher share of the investment opportunity at distressed reorganization. Thus, stronger bargaining power delays investment.}

Figure 3 plots the relation between the investment boundary and the covenant violation cost. The solid line for our baseline model shows that up to a violation cost of about 209, higher violation costs delay investment. The intuition behind this result is that higher violation costs reduce equity holders' bargaining position at covenant renegotiation (see Eq. (3)). Hence, equity holders delay investment. If the violation cost is sufficiently high, i.e., if $K \geq 209$, the cost of this investment delay is larger than the benefit of non-distressed renegotiation. Thus, equity holders ex-ante prefer to abstain from installing the covenant to avoid this renegotiation. The solid line (base model) therefore coincides with the dashed line (without covenant model) for high violation costs. Without the covenant, the investment boundary is independent of the violation cost as reflected by the dashed constant line. Overall, our model generates the novel prediction that for firms with an investment covenant, violation costs delay investment.

Next, we analyze the implications of our model for covenant structures. To this end, we plot $V_{NDR}$, i.e., the value to firms of implementing the investment covenant, against firm parameters. Firms face a trade-off when deciding whether to include the covenant. Specifically, the benefit of covenant inclusion is that it mitigates the ex-post overleverage at investment and overinvestment distortions of the without covenant model. The cost of covenant inclusion is the ex-post underinvestment cost, which occurs because the renegotiation at investment shifts wealth to initial debt holders.

Figure 4 shows that higher covenant violation costs reduce the value of including the investment covenant for a wide range of the violation cost. The primary channel driving this result is that higher violation costs reduce equity holders' bargaining position.
(see Eq. (3)) and, hence, increase the wealth transfer to initial debt holders at covenant renegotiation. Thus, higher violation costs exacerbate underinvestment.\textsuperscript{17} If the violation cost is sufficiently high, i.e., beyond a violation cost of $K \geq 209$, the underinvestment cost of including the covenant is larger than the benefit of covenant inclusion. Thus, the firm abstains from installing the covenant, which is why $V_{NDR}$ is zero in this area.

Finally, Figure 5 suggests that the recovery rate increases the value of including the covenant. A higher recovery rate raises the optimal initial leverage, which aggravates the agency costs from overleverage at investment and overinvestment in the without covenant model. Thus, the benefit of including the investment covenant is larger. For sufficiently small values of the recovery rate, the benefit of including the covenant is smaller than the cost of having the covenant. In this region, firms optimally abstain from implementing the covenant and, hence, $V_{NDR}$ is constant at zero.

Our corporate policy predictions highlight the importance of incorporating a comprehensive creditor governance approach to investigate how firm characteristics associated with renegotiations affect firms. Considering creditor governance allows us to derive novel predictions on the impact of renegotiation parameters on corporate policies, which cannot be generated in a standard debt renegotiation model that neglects non-distressed renegotiation. Our results contribute to the empirical studies on the importance of non-distressed covenant renegotiation as a channel behind the financing-investment link (Chava and Roberts, 2008; Denis and Wang, 2014; Roberts, 2015). In addition, we show that creditor governance is a key aspect to understand covenant structures. Thus, we also contribute to the studies on debt covenant policies by showing how firm characteristics associated with renegotiation influence firms’ decision to include an investment covenant (Malitz, 1986; Nini et al., 2009; Bradley and Roberts, 2015).

\textsuperscript{17}For small levels of the violation cost, higher violation costs increase the value of including the covenant. This result is driven by a secondary channel from the repayment of debt at par value in violation. Specifically, in covenant renegotiation, the par value is smaller than the present value of the initially promised interest payments. Repayment at par in the outside option therefore induces equity holders to accelerate investment. For small violation costs, the wealth transfer to initial debt holders from the primary channel is limited. Thus, in this region, the secondary channel dominates the primary channel and equity holders overinvest. A higher violation cost counteracts this overinvestment distortion, and, hence, increases the value of including the covenant.
6. Simulation Analysis

We now present quantitative predictions from a simulation approach in the spirit of Strebulaev (2007), which matches simulated model firms to the empirical cross-sectional distribution of real firms. We use this simulation to explore the time-series implications of our model. Further, a potential caveat when comparing model predictions to empirical statistics of real firms is that the statistics of a typical model firm with average firm characteristics may deviate from the average statistics of a cross-section of real firms because the impact of firm characteristics on firm statistics is usually non-linear. Thus, average statistics of a cross-section of firms depend on both the distribution of each characteristic across firms and the correlation of the different firm characteristics with each other. Only considering an average model firm neglects these distributional features. Our simulation, which uses a cross-sectional distribution of model firms matched to real firms, also allows us to address this caveat and validate the results of Section 5..

6.1 Simulation Approach

We first generate cross-sections of model-implied firms that reflect real firms’ cross-sectional distribution of the mtb and leverage ratios. We then measure average statistics in the model-implied cross-sections and compare them with the statistics in an empirical sample of real firms. Analogous to Bhamra et al. (2010), the impossibility of observing the probability of corporate events (e.g., default or renegotiation) for individual firms dictates the need to compare cross-sectional statistics.

To obtain the empirical sample, we collect the 3,720 private credit agreements covered in Nini et al. (2009) from their home page. We use this sample of real firms as an empirical benchmark because the sample is widely referenced in debt renegotiation studies (e.g., Roberts and Sufi, 2009b; Denis and Wang, 2014). It consists of all private loans extended to non-financial public firms from 1996 to 2005 in the Loan Pricing Corporation Dealscan database, for which the original credit agreements are available in SEC filings. We merge these data with Compustat information, which leaves us with 3,688 observations. Following the literature (e.g., Roberts and Sufi, 2009b, Denis and Wang, 2014), we calculate the average mtb and market leverage ratios over the four quarters before
the initiation of each private credit agreement. After dropping firms with any missing data over these four quarters, our final empirical sample consists of 3,070 private credit agreements. Each observation in this empirical cross-section is characterized by the average mtb and leverage ratios of the corresponding firm over the previous four quarters. We winsorize the mtb and leverage ratios at the 2.5% and 97.5% percentiles.

Next, we generate a model-implied sample of firms reflecting the cross-sectional joint distribution of the mtb and leverage ratios in the empirical sample. We obtain a wide range of leverage and mtb ratios through variations in cash flow $X$ (cf. Strebulaev, 2007) and option scale parameter $s$ (cf. Arnold et al., 2013). To generate these variations, we simulate the cash flows of a large universe of initially optimally financed firms with different option scale parameters for 10 years (“pre-simulation”). To relate the risk-neutral to the physical measure in the simulations, we specify a risk premium. Following Strebulaev (2007), we choose a risk premium on assets of 6.5%, which implies a cash flow drift under the physical measure of $\mu^P = 1\% + 6.5\% = 7.5\%$.

For each firm in the empirical sample, we select the model-implied firm at the end of the pre-simulation with the shortest Euclidean distance with respect to leverage and the natural logarithm of one plus the mtb ratio. We obtain a sample of 3,070 model-implied matched firms. The Internet Appendix provides details on the simulation and matching procedures. The average distance at matching is 0.14 with an average cross-sectional standard deviation of 0.20.

Table IV shows statistics for the empirical sample of Nini et al. (2009) and our model-implied samples at matching. The mean and median market leverages as well as the median mtb ratio of the model-implied samples reflect their counterparts in the empirical sample well. The mean model-implied mtb ratio of 1.38 is below the 1.69 in the empirical sample because model firms exercise sufficiently valuable investment opportunities, which bounds their mtb ratio from above. Finally, the model-implied samples also capture the large negative correlation between mtb and leverage in the empirical sample. Overall, the model-implied samples are structurally very similar to the empirical sample.

The mtb ratio is constructed as Total Assets (item 44) minus Book Equity plus Market Equity, all scaled by Total Assets. Book Equity is Total Assets minus Total Liabilities (item 54) minus Preferred Stock (item 55) plus Deferred Taxes (item 52). Market Equity is the Equity Price (item 14) times Common Shares Outstanding (item 61). The market leverage ratio is Book Debt, divided by Total Assets minus Book Equity plus Market Equity.
To investigate the extent to which our model explains empirically observed firm statistics, we simulate each matched sample forward with a quarterly frequency. This simulation is denoted as “post-simulation.” To preserve the empirical sample properties in the simulated samples over time, we replace a reorganized or invested firm with the corresponding firm at matching. That is, each replacement uses a firm with an identical investment opportunity and cash flow as at the time of matching. In addition, we reflect the average contract maturity of 46.7 months in Denis and Wang (2014) by choosing a horizon of 16 quarters for the post-simulation. For each of the 100 pre-simulations, we consider 100 post-simulations, resulting in 10,000 simulations. We record the statistics in the post-simulation and compare these patterns with those in the empirical samples.

### 6.2 Credit Spreads

To investigate our model’s predictions for credit spreads in the simulation, we first calculate the credit spread of each model-firm in the matched samples. The median spread is 203 bps. As the matched samples of model firms are structurally similar to the cross-section of real firms in Nini et al. (2009) (see Table IV in Section 6.1), we directly compare this spread to the median spread of the empirical cross-section in Nini et al. (2009). The median spread over the risk free rate in this empirical sample is approximately 200 bps.\(^{19}\) Thus, the model-implied credit spread is very close to its empirical counterpart. The limitation of this comparison is that the empirical spread of private credit agreements may also reflect sizeable liquidity, control, and bank premiums.\(^{20}\)

\(^{19}\)The median debt interest rate spread over LIBOR in Nini et al. (2009) is 150 bps and the median TED-spread in their sample period is approximately 50 bps (see https://fred.stlouisfed.org/series/TEDRATE#0), which results in the spread of 200 bps.

\(^{20}\)Regarding liquidity and control premiums, the empirical literature lacks a quantification for private credit agreements. Feldhütter et al. (2016) estimate a mean control premium for public bonds of 29 bps. The control premium of private debt is likely to be higher because public bonds are more difficult to renegotiate than private debt (Rajan, 1992; Krishnaswami et al., 1999). Regarding bank premiums, Schwert (2020) shows that in a sample of bank loans to noninvestment-grade firms about half of the spread is attributable to factors other than credit risk and liquidity.
6.3 Control Premium

Using the simulation, we explore our model’s time-series implications for the control component reflected in debt prices. To compare the model’s implications to the empirical study of Feldhütter et al. (2016), which reports control premiums instead of control spreads, we now consider the control premium of the initial debt in our model. The control premium is the difference between the value of private debt and the value of debt without bargaining power (i.e., \( \eta = 1 \)), expressed as a percentage of the initial debt value.

Figures 6 and 7 plot the average control premiums in one typical post-simulation of Section 6.1 before distressed reorganization and non-distressed renegotiation, respectively. One simulation represents the realisation of one economy, which we compare to the average empirical control premiums in the historical economy. The figures indicate that the time series patterns of control premiums in our model are consistent with two key features of the corresponding empirical patterns in Feldhütter et al. (2016). First, Figures 6 and 7 illustrate that the average control premium increases before distressed reorganization and non-distressed renegotiation, and peaks close to these renegotiation events.\(^{21}\) Feldhütter et al. (2016) find similar patterns in their empirical sample of observed control premiums before defaults and non-default covenant violations.\(^{22}\) Second, our model-implied control premiums are larger before distressed reorganization than before non-distressed renegotiation, consistent with the corresponding empirical evidence in Feldhütter et al. (2016). The intuition behind this result is that the control premium is mainly driven by the portion of the renegotiation surplus that accrues to debt holders at renegotiation. At distressed reorganization, this surplus is the default cost plus the value of the growth option. At non-distressed renegotiation, the surplus is the violation cost. As the sum of the default cost plus the value of the growth option is larger than the violation cost for realistic parameters, the surplus that accrues to debt holders is higher at distressed reorganization than at non-distressed renegotiation. To the best of our knowledge, our model is the first to explain the two empirical patterns.

\[^{21}\] Control premium patterns of a single simulation are not necessarily monotonically increasing over time due to the high volatility of realized control premiums, consistent with the corresponding evidence in Feldhütter, Hotchkiss and Karakas (2016).

\[^{22}\] Covenant violations rarely lead to liquidation or bankruptcy but rather to debt renegotiation (Nini et al., 2012; Roberts and Sufi, 2009a). Feldhütter et al. (2016) argue that control is valuable to debt holders around such non-default events because creditors attain more influence on firms.
Table V presents the statistics over the 10,000 simulations of Section 6.1. On average, control premiums are monotonically increasing before distressed reorganization and non-distressed renegotiation, which confirms that the creditor governance channel in our model rationalizes the time-series patterns of the empirical control premium.

Overall, our analysis of control premiums in Sections 5.2 and 6.3 contributes to the discussion on the surplus that creditors extract from firms (e.g. Feldhüter et al., 2016; Schwert, 2020). We highlight creditor governance as a key channel behind this extraction, which explains time serial and cross-sectional empirical patterns of control premiums. In addition, the model generates novel predictions on the relation between firm characteristics such as covenant violation costs and the rent extraction through creditor control.

6.4 Renegotiation Timing Policies

A key empirical insight of the recent debt renegotiation literature is that creditors influence firm policies through debt renegotiations frequently and mostly outside distress (Denis and Wang, 2014; Roberts and Sufi, 2009b). To support the plausibility of our creditor governance framework, we now investigate the extent to which our model reflects the patterns with which creditors intervene in real firms.

Roberts and Sufi (2009b) and Denis and Wang (2014) report stylized facts on empirical renegotiation patterns in large, randomly selected subsamples of the sample of Nini et al. (2009). These studies provide measures of the timing of the first renegotiation after initiation, which we compare with our model’s predictions. Columns one and two of Table VI summarize the empirical benchmark statistics. On average, slightly more than 60% of contracts are renegotiated at least once. The average effective duration of an initial contract (i.e., the mean waiting time to the first renegotiation or final maturity if a contract is not renegotiated) is two years in Denis and Wang (2014) and 1.5 years in Roberts and Sufi (2009b). We also obtain the effective duration in percentage of the maturity of 58% from Table 2 in Denis and Wang (2014) and of 64% from Table

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23 Denis and Wang (2014) only incorporate covenant renegotiations. Roberts and Sufi (2009b) consider all debt renegotiations with material changes even if they do not entail a covenant modification. A comparison of the renegotiation timing patterns in Roberts and Sufi (2009b) and Denis and Wang (2014) suggests that the impact of this selection criterion is minor.
In addition, these studies show a time to the first renegotiation of renegotiated contracts of approximately 1.4 years.

Further, Table VI reports stylized timing patterns that additionally consider subsequent debt renegotiations besides the first renegotiation, namely the percentage of distressed renegotiations, duration in percent of the maturity, and renegotiation frequency statistics. Only approximately 18% of the empirically observed renegotiations are associated with corporate distress. The average time to any renegotiation or maturity divided by the initially stated maturity ("duration % of maturity") is 61%. In addition, Figure 1 of Denis and Wang (2014) suggests that approximately 37% of contracts are renegotiated only once, 22% are renegotiated twice, and close to 13% are renegotiated three times. About 53% of contracts are amended between two and five times during their lifespan. The study also shows that renegotiated contracts are, on average, renegotiated 2.7 times.

**INSERT TABLE VI HERE**

Next, Column three of Table VI presents the renegotiation timing patterns in the simulated samples of our model. To highlight the contribution to the literature, we repeat the simulation procedure for the benchmark frameworks outlined in Section 4.2. In these simulations, we reflect the average contract maturity of 46.7 months in Denis and Wang (2014) by choosing a horizon of 16 quarters for the post-simulations. Columns four to six in Table VI report the resulting renegotiation timing patterns. Column seven shows the patterns in the case with debt financing but without a covenant. Comparing the patterns of Columns three and seven allows us to highlight the marginal impact of incorporating non-distressed renegotiation on the model-implied debt renegotiation patterns.

Column three of Table VI shows that 55.2% of the firms in our base model renegotiate their contracts before maturity. This number is below its empirical counterpart, which is in line with the intuition that some renegotiations in the empirical samples are triggered by reasons beyond the motives that we capture. The renegotiation probability is between 4.2% and 4.7% for the benchmark frameworks. Thus, our model considerably improves the existing frameworks’ ability to reflect the probability with which creditors influence real firms through debt renegotiations. Further, the base model predicts an effective

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24When omitting right censored outcomes instead of classifying these outcomes as “no renegotiation” observations, the effective duration is 57% in Roberts and Sufi (2009b).

25Roberts (2015) confirms in his samples that most renegotiations are initiated by borrowers in response to changing conditions, rather than from lender interventions due to close default.
duration of 2.3 years and an effective duration in percentage of the maturity of 57.5%. These numbers are also closer to their empirical counterparts than those in the benchmark frameworks in Columns four to six. In addition, the time to first renegotiation of one year in the base model reflects the empirical statistic quite well. While the time to first renegotiation is also close to its empirical counterpart in Columns four to six, this statistic is of limited insight for the benchmark frameworks as it only considers the renegotiated contracts, which represent a minority of 4.2-4.7% of the initial contracts.

In addition, we use the simulations to predict the timing and frequency patterns that incorporate subsequent debt renegotiation rounds. This part of the analysis is subject to the replacements of model-firms at debt renegotiation in our simulation. The base model reflects that the vast majority of real firms renegotiates debt outside distress. Specifically, Column three of Table VI shows that only 8.1% of model-implied renegotiations occur in distress. By construction, all renegotiations are due to corporate distress in the benchmark frameworks. The base model also captures the empirical renegotiation frequencies well. For instance, it predicts that 25.7% of debt contracts are renegotiated once, 15.2% are renegotiated twice, 12.4% are renegotiated three times, and 48% are renegotiated between two and five times. The corresponding numbers in the empirical sample are 37%, 22%, 13%, and 53%, respectively. In contrast, the existing frameworks predict that the vast majority of contracts are only renegotiated once, which is inconsistent with the empirical patterns (see Columns four to six of Table VI). Finally, the average renegotiation frequency is 3.9 in our model compared with 2.7 in the empirical sample.

Further, Column seven of Table VI presents the results of the case in which we incorporate new debt financing but prevent the firm from installing the covenant. The main renegotiation patterns in this column are similar to those of the benchmark frameworks in Columns four to six. Thus, the improvement in the reflection of realistic creditor intervention patterns arises in our baseline model in Column three and not in Column seven. Therefore, the key feature for this improvement is not to include new debt financing but rather to incorporate non-distressed renegotiation.

In practice, many different events can trigger a debt renegotiation outside distress. Hence, our simple representation of these events through debt renegotiation at investment cannot entirely explain empirical renegotiation timing policies. Our simulation analysis,

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26 The time to first renegotiation of 1.5 years and renegotiation frequencies are relatively close to their empirical counterparts. These numbers alone, however, are of limited relevance because they are calculated only from the 6.1% of contracts that are renegotiated.
however, shows that the creditor governance model considerably improves the ability of the existing debt renegotiation frameworks to reflect the empirical timing and frequency patterns of creditor interventions. As such, the analysis emphasizes the credibility of our model for analyzing the influence of these interventions on firms.

7. Alternative Approaches to Mitigate Agency Frictions

We now discuss alternative approaches to mitigate the agency friction of debt.

**Financing covenant** Firms may also install a financing covenant instead of an investment covenant to enable non-distressed renegotiation and, hence, creditor governance. In practice, however, financing covenants are not standardized and ambiguous, i.e., they are defined in multiple different ways (Dichev and Skinner, 2002; Chava and Roberts, 2008). Thus, we follow Hennessy and Livdan (2009) for the definition of a simple representation of a financing covenant by assuming that this covenant restricts the issuance of additional debt. The Internet Appendix presents this covenant model.

In Panel A of Table VII, we again list our baseline firm with an investment covenant in line one. Line two shows the baseline firm with a financing covenant. The results are identical. This equality arises because the outside option in the renegotiation game at investment is “violating the covenant” for both firms. Hence, both firms would simply violate the covenant in case the renegotiation fails. The policies that a firm would implement after such a violation, however, correspond to the optimal policies of a firm without a covenant and, thus, do not depend on the nature of the violated covenant. Therefore, the outside options and, thus, the results are identical for the two alternative covenants.

**INSERT TABLE VII HERE**

The results for an investment and financing covenant, however, can differ if covenant violation costs are large. In this case, firms may prefer to comply with the covenant in the outside option instead of violating the covenant and facing the large covenant violation cost. The outside option then depends on the nature of the covenant’s restriction. Specifically, in contrast to the firm with an investment covenant, the firm with a financing covenant...

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covenant can invest in the outside option while still complying with the covenant. Thus, for a fixed renegotiation boundary, equity holders’ bargaining position is stronger with the financing covenant than with the investment covenant. We explore the quantitative implications of this potential difference in lines three and four of Panel A of Table VII. To assure that firms prefer to comply with the covenant in the outside option, we set $K$ prohibitively large. Comparing the firms with an investment and a financing covenant suggests that the differences in policies and firm values are relatively small.

Overall, Panel A of Table VII suggests that our results are robust to modelling an alternative covenant as a mean through which creditors can influence firms outside distress. Thus, adding non-distressed renegotiation drives our results and not the specific covenant through which creditors can exert influence outside distress.

**Debt priority** In a framework without debt renegotiation, Hackbarth and Mauer (2012) investigate how firms can select the debt priority structure to mitigate the agency cost of debt that arises from the financing and timing of the investment. We replicate this approach in Panel B of Table VII. Specifically, lines one to three show the debt priority structures observed in practice, namely equal priority (pari passu) debt, senior initial debt, and senior additional debt (Schwartz, 1989; Hackbarth and Mauer, 2012). For completeness, we also calculate the so-called normative priority structure in line four that represents the hypothetical case, in which a priority rule allocates a fraction of the liquidation proceeds to initial debt.\(^{27}\) The results show that all priority structures imply a firm value that is considerable below that of our creditor governance approach in line one of Panel A. The dominance of our approach arises because creditor governance allows firms to mitigate both distress costs and the agency cost of debt, whereas the debt priority approach only addresses the agency cost of debt.

Next, we consider the possibility that firms may install both, renegotiable debt and an optimal debt priority. To this end, we derive the debt priority approach in a framework with distressed reorganization.\(^{28}\) Hence, this firm selects a debt priority structure instead of a renegotiable covenant to mitigate the agency friction. Details on this model

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\(^{27}\)The main caveat of a debt priority approach in practice is enforceability. Bankruptcy courts in the US, for example, recognize priority arrangements only in a limited sense (Warner, 1977). In addition, the contracting parties have incentives to contest formal priority structures leading to lobbying and litigation waste (Welch, 1997). Carapeto (2006), for example concludes that 67% of the bankruptcy settlements violate the absolute priority between priority classes. Thus, even the priority of clearly defined senior or junior debt is difficult to enforce, leaving normative priority rules infeasible in practice.

\(^{28}\)A large literature examines how debt securities with different priorities influence the costs, mode, and outcome of the bankruptcy process (see, e.g., Gilson et al., 1990; Bris et al., 2006; Broadie et al.,
are in the Internet Appendix. The main technical difference between this framework and our creditor governance model in addressing agency is that debt priority jointly minimizes (but not eliminates) the financing and investment distortions, whereas creditor governance entirely eliminate the financing distortion without directly addressing the investment distortion. Panel C of Table VII shows that all priority structures observed in practice result in firm values that are below that of our creditor governance approach in line one of Panel A. Only the hypothetical normative case has a firm value that is slightly above that of the creditor governance approach. For some parameter variations, the creditor governance approach even outperforms the normative case. For example, for $K = 20$ our model yields a firm value of 546.19 (see Panel H of Table II), whereas the normative priority approach results in a firm value of 545.19.

Callable debt  We also analyze the possibility that a firm can install callable debt and, thus, repay the initial debt at investment. Details on the calculation are in the Internet Appendix. The advantage of callable debt is that a firm refinances to first-best leverage when all existing debt is called and new debt is issued (Fischer et al., 1989). Thus, callable debt reduces the agency frictions by inducing optimal leverage at refinancing. In practice, however, calling debt entails friction costs due to the repayment and reissuance activity. Fischer et al. (1989), for example, assume a cost of recapitalization upon a debt call between one and ten percent of the debt amount and Christensen et al. (2014) a cost between one and three percent. In addition, Morellec et al. (2015) analyze search costs when seeking to raise private debt, which are relevant for the reissuance. To reflect these notions, we assume friction costs for calling debt of 2% of the debt amount. These friction costs and the requirement to repay the initial debt holders cause agency costs from investment timing distortions. Line one of Panel D in Table VII shows the case in which the firm can call debt at par as in Goldstein, Ju and Leland (2001). Line two summarizes the case in which the firm also selects an optimal call premium as in Christensen et al. (2014). This premium is an amount that the firm has to pay to debt holders besides the par value upon calling debt. In both cases, the firm value is below that of the creditor governance model in line one of Panel A.

Overall, we find that creditor governance is an efficient mechanism to mitigate the agency frictions of debt, which results in higher firm values compared to alternative mechanisms for a wide range of plausible parameters. In addition, the results suggest that

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2007). Whereas we provide a simple representation of renegotiation among claimholders with different priorities, it is beyond the scope of this paper to incorporate these influences.
8. Conclusion

We develop a model that extends the standard debt renegotiation approach to a framework that also incorporates renegotiation outside distress and not only in distress. We find that considering non-distressed renegotiation is key to analyzing debt prices and corporate policies. Specifically, our model explains levels and cross-sectional patterns of debt prices. Further, we show that to study the influence of debt renegotiation parameters such as bargaining power or covenant violation costs on corporate policies, it is crucial to consider a creditor governance approach that goes beyond incorporating standard distressed debt renegotiation.

Our study provides a first step toward understanding and quantifying the consequences of creditor governance on firms. A limitation of our model is that it only applies to firms with access to a competitive debt market such that they can select the financing of the investment cost. In addition, we simplify the analysis by considering only one class of debt, namely private debt. Further theoretical work could analyze how the mix between different classes of debt, such as private and public debt, or the debt ownership structure affects creditor governance. In addition, a prominent literature emphasizes the role of creditor rights for distressed firms’ access to finance, leverage, investment, risk taking, and debt demand (Porta et al., 2008; Vig, 2013; Favara et al., 2017). Our results stimulate further research on the influence of creditor rights or creditor influence on corporate policies outside distress.

Data Availability

The data underlying the empirical sample in this article are from Amir Sufi’s webpage in [Data sets for loan contracts and contract terms used in], at https://amirsufi.net/data.html
Appendix

This appendix presents the solution of the base model.

$S_0\nu [U_0\nu]$ is the first time the firm reaches the initial reorganization [covenant renegotiation] threshold, and $T_0$ is the first time it reaches initial reorganization or covenant renegotiation, i.e., $S_0\nu := \inf \{t \geq 0 : X_t \leq S_0 | X_0 = X \}$, $U_0\nu := \inf \{t \geq 0 : X_t \geq U_0 | X_0 = X \}$, and $T_0 := \inf \{S_0\nu, U_0\nu\}$. In case reorganization [covenant renegotiation] occurs before covenant renegotiation [reorganization], we have $T_0 = S_0\nu [T_0 = U_0\nu]$. We first present the case of $T_0 = S_0\nu$.

Value functions and corporate policies after investment following initial reorganization. The value functions and corporate policies after investment following initial reorganization are similar to those in Fan and Sundaresan (2000), augmented by renegotiation costs. The unlevered firm value is $v (X) = 1 - \tau r - \mu X$. $S_2\nu$ is the firm’s reorganization threshold after investment following initial reorganization. As in Fan and Sundaresan (2000), the sharing rule $1 - \theta_2$, i.e., the equity fraction offered to debt holders against their debt, is determined as the Nash solution to the final reorganization game

$$\theta_2 = \arg \max_{0 \leq \theta_2 \leq 1 - \alpha} \left\{ \hat{\theta}_2 v (S_2) - 0 \right\}^\eta \left\{ (1 - \hat{\theta}_2) v (S_2) - \alpha v (S_2) \right\}^{1-\eta} = \eta (1 - \alpha).$$

The value of equity after investment following initial reorganization, denoted by $e_2 (X)$, corresponds to the present value of the expected payoffs to shareholders until reorganization plus the net payoff at reorganization:

$$e_2 (X) = \mathbb{E}^Q \left[ \int_{t}^{S_2\nu} e^{-r(u-t)} (1 - \tau) (X_u - c_2) \, du + e^{-rS_2\nu} (\theta_2 - k_s)^+ v (S_2) | X_t = X \right].$$

$S_2\nu$ is the first time the firm reaches the reorganization threshold after investment following reorganization, i.e., $S_2\nu = \inf \{t \geq T_0 : X_t \leq S_2 | T_0 = S_0\nu \}$, and $c_2$ is the firm’s coupon after investment following reorganization. We only present the case in which distressed reorganization after covenant renegotiation takes place, i.e., $\theta_2 - k_s >= 0$, which is satisfied for our baseline parameter specification. In case $\theta_2 - k_s < 0$, equity holders default immediately without entering distressed reorganization and the payoff to equity holders at the lower boundary after covenant renegotiation is zero.
Solving the Hamilton-Jacobi-Bellman equation for equity yields

\[ e^2(X) = A^e_0 + A^e_1 X + A^e_2 X^{\beta_2}, \tag{20} \]

in which

\[ \beta_2 = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left( \frac{1}{2} - \frac{\mu}{\sigma^2} \right)^2 + \frac{2r}{\sigma^2}}, \tag{21} \]

\[ A^e_0 = -\frac{1 - \tau}{r} c^2_2, \quad A^e_1 = \frac{1 - \tau}{r - \mu}, \quad A^e_2 = \frac{1 - \tau}{r} \left( \frac{\beta_2}{\beta_2 - 1} \frac{r - \mu}{r - \theta_2 + k_s} \right)^{-\beta_2} \frac{c^1_{2-\beta_2}}{1 - \beta_2}. \]

Equity holders choose the reorganization threshold after investment and initial reorganization:

\[ S_2 = \frac{\beta_2}{\beta_2 - 1} \frac{r - \mu}{r - \theta_2 + k_s} c^2_2. \tag{22} \]

Similarly, the value of total corporate debt after investment following initial reorganization, denoted by \( d^2(X) \), corresponds to the present value of the expected payoffs to debt holders until reorganization plus the payoff at reorganization, i.e.,

\[ d^2(X) = \mathbb{E}^{Q} \left[ \int_t^{S_2} e^{-r(u-t)} c^2_2 du + e^{-rS_2} (1 - \theta_2) v(S_2) \mid X_t = X \right]. \tag{23} \]

Solving the associated Hamilton-Jacobi-Bellman equation, we find that

\[ d^2(X) = A^d_0 + A^d_2 X^{\beta_2}, \tag{24} \]

in which \( \beta_2 \) is defined in Eq. (21), \( A^d_0 = \frac{c^2_2}{2} \), and

\[ A^d_2 = \frac{1}{r} \left( \frac{\beta_2}{\beta_2 - 1} \frac{r - \mu}{r - \theta_2 + k_s} \right)^{-\beta_2} \left( -1 + \beta_2 \frac{k_s}{1 - \theta_2 + k_s} + \tau \beta_2 \frac{1 - \theta_2}{1 - \theta_2 + k_s} \right) \frac{c^1_{2-\beta_2}}{1 - \beta_2}. \tag{25} \]

\( U_1 \) is the threshold for investment after initial reorganization. At \( U_1 \), equity holders choose the first-best capital structure because the firm is an all equity financed firm after initial reorganization and the issue proceeds of new debt accrue to equity holders. The first-best capital structure maximizes firm value, which yields the coupon

\[ c_2 = c^f_2 = \tau \frac{\beta_2 - 1}{r - \mu} \left( 1 - \theta_2 + k_s \right) \left( \tau - \beta_2 \frac{k_s}{1 - \theta_2 + k_s} - \tau \beta_2 \frac{1 - \theta_2}{1 - \theta_2 + k_s} \right) \frac{c^1_{2-\beta_2}}{1 - \beta_2} \frac{1}{s} U_1. \tag{26} \]
We calculate the corresponding first-best firm value as \( f_2(sU_1) = F_{11}sU_1 \), with
\[
F_{11} = \left[ 1 - \tau + \tau \frac{\beta_2 - 1}{\beta_2} \left( 1 - \theta_2 + k_s \right) \left( \tau - \beta_2 \frac{k_s}{1 - \theta_2 + k_s} - \tau \beta_2 \frac{1 - \theta_2}{1 - \theta_2 + k_s} \right)^{\frac{1}{\beta_2}} \right] \frac{1}{r - \mu}. \tag{27}
\]

**Value functions and corporate policies after initial reorganization.** The equity value after initial reorganization, \( e_{1l}(X) \), corresponds to the present value of the expected payoffs to shareholders until investment plus the expected value of the payoff at investment:
\[
e_{1l}(X) = \mathbb{E}_t \left[ \int_{t}^{U_{1'}} e^{-r(u-t)} (1 - \tau) X_u du + e^{-rU_{1l}} (F_{11}sU_1 - I) | X_t = X \right]. \tag{28}
\]
\( U_{1'} \) is the first time the firm reaches the investment threshold after initial reorganization:
\[
U_{1'} = \inf \{ t \geq T_0 : X_t \geq U_1 | T_0 = S_{0'} \} \tag{29}
\]
\( U_1 \) is the firm’s investment threshold after initial reorganization and \( F_{11} \) is given in Eq. (27). Solving the corresponding Hamilton-Jacobi-Bellman equation yields
\[
e_{1l}(X) = A_{1l} e_{1l}^{1l} X + A_{2l} e_{1l}^{2l} X^{\beta_1}, \tag{30}
\]
in which
\[
\beta_1 = \frac{1}{2} - \frac{\mu}{\sigma^2} + \sqrt{\left( \frac{1}{2} - \frac{\mu}{\sigma^2} \right)^2 + \frac{2r}{\sigma^2}}, \tag{31}
\]
\[
A_{1l}^{e_{1l}} = \frac{1 - \tau}{r - \mu}, \quad A_{2l}^{e_{1l}} = \left( \left( sF_{11} - \frac{1 - \tau}{r - \mu} \right) U_1 - I \right) U_1^{-\beta_1}. \tag{32}
\]
Equity holders’ choice of investment boundary, \( U_1 \), is given as
\[
U_1 = \frac{\beta_1}{1 - \beta_1} \frac{(r - \mu) I}{1 - \tau - (r - \mu) sF_{11}}. \tag{33}
\]

**Value functions after covenant renegotiation.** We now consider the case \( T_0 = U_{1'} \). The value of equity after covenant renegotiation, \( e_{1h}(X) \), is analogous to the case after investment following initial reorganization (Eqs. (20)). The reorganization threshold after
covenant renegotiation exhibits the same functional form as the reorganization threshold after investment following initial reorganization (Eq. (22)):

\[ S_1 = \frac{\beta_2}{\beta_2 - 1} \frac{r - \mu}{r} \frac{1}{1 - \theta_2 + k_s} \left( c_0^A + c_1^B \right). \]  

(34)

The value function of total corporate debt is analogous to the value function of corporate debt after investment following initial reorganization (Eqs. (24)–(25)).

In case of reorganization after covenant renegotiation, equity holders bargain with initial and new debt holders over the unlevered value of the assets. A sharing rule is determined by \( \{ \theta_1^o, \theta_1^n \} \), \( \theta_1^o + \theta_1^n = 1 \), denoting the fraction of unlevered assets \( \theta_1 [\theta_1^o, \theta_1^n] \) to equity holders [initial debt holders, new debt holders], respectively. The asymmetric Nash solution to the multilateral bargaining game maximizes the asymmetric Nash product:

\[
\{ \theta_1^o, \theta_1^n \} = \arg \max_{\tilde{\theta}_1^o, \tilde{\theta}_1^n} \left( \tilde{\theta}_1^o v (S_1) \right)^{\eta_0} \left( \tilde{\theta}_1^n v (S_1) - O^o (c_0^A, c_1^B, S_1) \right)^{\eta_0} \left( \tilde{\theta}_1^o v (S_1) - O^n (c_0^A, c_1^B, S_1) \right)^{\eta_0} \tag{35}
\]

with \( \tilde{\theta}_1 = 1 - \tilde{\theta}_1^o - \tilde{\theta}_1^n \). \( O^o (\cdot) \) and \( O^n (\cdot) \) denote the outside option of initial and new debt holders, respectively:

\[
O^o (c_0^A, c_1^B, S_1) = \frac{c_0^A}{c_0^A + c_1^B} \frac{1 - r}{r - \mu} S_1, \tag{36}
\]

\[
O^n (c_0^A, c_1^B, S_1) = \frac{c_1^B}{c_0^A + c_1^B} \frac{1 - r}{r - \mu} S_1 = \alpha v (S_1) - O^o (c_0^A, c_1^B, S_1). \tag{37}
\]

The solution to problem (35) is given by

\[
\theta_1^o (c_0^A, c_1^B) = \eta_0 (1 - \alpha) + \frac{O^o (S_1)}{v (S_1)} = \eta_0 (1 - \alpha) + \alpha \frac{c_0^A}{c_0^A + c_1^B}, \tag{38}
\]

\[
\theta_1^n (c_0^A, c_1^B) = \eta_n (1 - \alpha) + \frac{O^n (S_1)}{v (S_1)} = \eta_n (1 - \alpha) + \alpha \frac{c_1^B}{c_0^A + c_1^B}. \tag{39}
\]

Consequently,

\[
\theta_1 = \eta (1 - \alpha). \tag{40}
\]

The sharing rule \( \{ \theta_1, \theta_1^o (c_0^A, c_1^B), \theta_1^n (c_0^A, c_1^B) \} \) is intuitive: Each party receives the value of its outside option and a fraction of the surplus that corresponds to its respective bargaining power.
The value function of initial debt holders’ corporate debt is given by:

\[ d_{1h} \left( X; c^A_{01} \right) = A^{dA}_{01} + A^{dA}_{2h} X^{\beta_2}, \]  

(41)

in which

\[ A^{dA}_{01} = \frac{c^A_{01}}{r}, \quad A^{dA}_{2h} = S_1^{-\beta_2} \left( -\frac{c^A_{01}}{r} + \eta_0 (1 - \alpha) v (S_1) + O^o \left( c^A_{01}, c^B_1, S_1 \right) \right), \]  

(42)

and \( S_1 \) is given in closed form in Eq. (34). Analogously, the value function of new debt holders’ corporate debt can be written as:

\[ d_{1h} \left( X; c^B_1 \right) = A^{dB}_{01} + A^{dB}_{2h} X^{\beta_2}, \]  

(43)

in which \( A^{dB}_{01} = \frac{c^B_1}{r} \) and

\[ A^{dB}_{2h} = S_1^{-\beta_2} \left( -\frac{c^B_1}{r} + \eta_n (1 - \alpha) v (S_1) + O^n \left( c^A_{01}, c^B_1, S_1 \right) \right). \]  

(44)

Covenant renegotiation. Proof of Proposition 1. The covenant renegotiation problem is stated in Eq. (5). Define \( \tilde{c}_1 := \tilde{c}^A_{01} + \tilde{c}^B_1 \). A change of variables yields

\[
\max_{\{\tilde{c}^A_{01}, \tilde{c}^B_1\}} \left( e_{1h} \left( sU_0; \tilde{c}^A_{01} + \tilde{c}^B_1 \right) + d_{1h} \left( sU_0; \tilde{c}^B_1 \right) - e^{oo} \left( sU_0; c^A_0 \right) \right)^\eta \\
\cdot \left( d_{1h} \left( sU_0; \tilde{c}^A_{01} \right) - d^{oo} \left( sU_0; c^A_0 \right) \right)^{1-\eta} = \\
\max_{\{\tilde{c}^A_{01}, \tilde{c}^B_1\}} \left( e_{1h} \left( sU_0; \tilde{c}^A_{01} \right) + d_{1h} \left( sU_0; \tilde{c}^B_1 - \tilde{c}^A_{01} \right) - e^{oo} \left( sU_0; c^A_0 \right) \right)^\eta \\
\cdot \left( d_{1h} \left( sU_0; \tilde{c}^A_{01} \right) - d^{oo} \left( sU_0; c^A_0 \right) \right)^{1-\eta} = \\
\max_{\{\tilde{c}^A_{01}, \tilde{c}^B_1\}} \left( e_{1h} \left( sU_0; \tilde{c}^A_{01} \right) + d_{1h} \left( sU_0; \tilde{c}^B_1 - \tilde{c}^A_{01} \right) - e^{oo} \left( sU_0; c^A_0 \right) \right)^\eta \\
\cdot \left( d_{1h} \left( sU_0; \tilde{c}^A_{01} \right) - d^{oo} \left( sU_0; c^A_0 \right) \right)^{1-\eta}]. \]

(45)

The last equality uses the fact that \( \tilde{c}_1 \) is bounded by the firm’s debt capacity from above and by zero from below; \( \tilde{c}^A_{01} \) is bounded by \( \tilde{c}_1 \) from above and by zero from below; hence, the range of \( \{\tilde{c}^A_{01}, \tilde{c}_1\} \) is a convex and compact set in \( \mathbb{R}^2 \). This property guarantees the
existence of the maximum. We proceed by solving the following problem for an arbitrary, but fixed, \( \tilde{c}_1 \):

\[
\begin{align*}
\{ c^A_{01} \} &= \arg \max_{\{ \tilde{c}_1 \}} \left( e_{1h} (sU_0; \tilde{c}_1) + d_{1h} (sU_0; \tilde{c}_1 - c^A_{01}) - e^{oo} \right)^\eta \\
&\cdot \left( d_{1h} (sU_0; \tilde{c}_1 - c^A_{01}) - d^{oo} (sU_0; c^A_0) \right)^{1-\eta}.
\end{align*}
\]  

(46)

The surplus from covenant renegotiation to equity holders \((SE(\cdot))\), debt holders \((SD(\cdot))\), and total \((ST(\cdot))\), respectively, is given as

\[
\begin{align*}
SE \left( U_0; c^A_{01}, c^B_1 \right) &= e_{1h} (sU_0; c^A_{01} + c^B_1) + d_{1h} (sU_0; c^B_1) - e^{oo} \left( sU_0; c^A_0 \right), \\
SD \left( U_0; c^A_{01}, c^B_1 \right) &= d_{1h} (sU_0; c^A_{01}) - d^{oo} \left( sU_0; c^A_0 \right), \\
ST \left( U_0; c^A_{01}, c^B_1 \right) &= f_{1h} (sU_0; c^A_{01}, c^B_1) - e_{1h} (sU_0; c^A_0) - d_{1h} \left( sU_0; c^A_0 \right),
\end{align*}
\]

(47) \hspace{1cm} (48) \hspace{1cm} (49)

in which \(f_{1h}(\cdot)\) denotes the firm value after covenant renegotiation. For any given total coupon \(c_1\), total firm value and total surplus are independent of the coupon to initial debt holders \(c^A_{01}\), such that we can write

\[
ST \left( U_0; c^A_{01}, c^B_1 \right) = ST \left( U_0; c_1 \right).
\]

(50)

Firm value is determined by the total coupon, but not by the allocation of the total coupon to new and initial debt holders. Hence, re-writing Eq. (46) by using this insight and the definition of total surplus in Eq. (49) yields that for any given \(c_1\), \(c^A_{01}\) is the solution to the problem

\[
\begin{align*}
c^A_{01} &= \arg \max_{\{ \tilde{c}_1 \}} \left( SE \left( U_0; c^A_{01}, \tilde{c}_1 \right) \right)^\eta \left( ST \left( U_0; \tilde{c}_1 \right) - SE \left( U_0; c^A_{01}, \tilde{c}_1 \right) \right)^{1-\eta}.
\end{align*}
\]

(51)

The first order condition with respect to \(c^A_{01}\) reads:

\[
\frac{\partial}{\partial c^A_{01}} \frac{SE \left( U_0; c^A_{01}, \tilde{c}_1 \right)}{SE \left( U_0; c^A_{01}, \tilde{c}_1 \right)} + (1 - \eta) \frac{\partial}{\partial c^A_{01}} \frac{SE \left( U_0; c^A_{01}, \tilde{c}_1 \right)}{ST \left( U_0; \tilde{c}_1 \right) - SE \left( U_0; c^A_{01}, \tilde{c}_1 \right)} = 0,
\]

(52)

which is equivalent to

\[
SE \left( U_0; c^A_{01}, \tilde{c}_1 \right) = \eta ST \left( U_0; \tilde{c}_1 \right).
\]

(53)

Consequently,

\[
SD \left( U_0; c^A_{01}, \tilde{c}_1 \right) = (1 - \eta) ST \left( U_0; \tilde{c}_1 \right).
\]

(54)
Thus, each party receives a fraction of total surplus corresponding to its respective bar-
gaining power.

Plugging Eqs. (53) and (54) into Eq. (45) yields the maximization problem

\[
c_1 = \arg \max_{\{c_1\}} \left( SE \left( U_0; c_{01}^A, \tilde{c}_1 \right) \right)^\eta \left( ST \left( U_0; \tilde{c}_1 \right) - SE \left( U_0; c_{01}^A, \tilde{c}_1 \right) \right)^{1-\eta}
\]

\[
= \arg \max_{\{c_1\}} (\eta ST \left( U_0; \tilde{c}_1 \right))^\eta \left( (1 - \eta) ST \left( U_0; \tilde{c}_1 \right) \right)^{1-\eta}.
\]  

(55)

The first order condition with respect to \(c_1\) is given by:

\[
\frac{\partial}{\partial c_1} ST \left( U_0; c_1 \right) = 0.
\]  

(56)

which is equivalent to

\[
\frac{\partial}{\partial c_1} ST \left( U_0; c_1 \right) = 0.
\]  

(57)

Due to concavity of total surplus, Condition (57) implies that the total new coupon
maximizes total surplus. Surplus maximization is equivalent to firm value maximization.
Hence, the total new coupon corresponds to the first-best capital structure at \(U_0\):

\[
c_1 = c_{1b} = \tau - \frac{1}{\tau} \frac{r}{r - \mu} \frac{\beta_2 - 1}{\beta_2} (1 - \theta_2 + k_s) \left( \frac{k_s}{1 - \theta_2 + k_s} - \tau \frac{1 - \theta_2}{1 - \theta_2 + k_s} \right) \frac{1}{\beta_2} sU_0,
\]  

(58)

analogous Eq. (26). Thus,

\[
c_1 + c_{01}^A = c_{1b}.
\]  

(59)

The corresponding first-best firm value at \(U_1\) is given as \(F_{1h}sU_1\) with

\[
F_{1h} = \left[ 1 - \tau + \tau^{\frac{1}{\beta_2 - 1}} (1 - \theta_2 + k_s) \left( \frac{1}{\beta_2} \frac{k_s}{1 - \theta_2 + k_s} - \tau \frac{1 - \theta_2}{1 - \theta_2 + k_s} \right) \frac{1}{\beta_2} \right] \frac{1}{r - \mu}.
\]  

(60)

Value functions and corporate policies before covenant renegotiation or
initial reorganization. Constants in Proposition 2. \(A_2^{e_0}, A_3^{e_0}\) jointly solve the system

\[
 M = \begin{bmatrix} S_0^{\beta_1} & S_0^{\beta_2} \\ U_0^{\beta_1} & U_0^{\beta_2} \end{bmatrix},
\]  

(61)

\[
 b^{e_0} = \begin{bmatrix} -A_0^{e_0} - A_1^{e_0} S_0 + (\eta (1 - \alpha) - k_s) \frac{1 - \tau}{r - \mu} S_0 + \eta A_1^{e_1} S_0^{\beta_1} \\ -A_0^{e_0} - A_1^{e_0} U_0 + \eta \left( F_{1h}sU_0 - d^{e_0} \left( U_0; c_{01}^A \right) - I \right) + (1 - \eta) c^{e_0} \left( U_0; c_{01}^A \right) - k_n \end{bmatrix}.
\]  

(62)
$A_{e_1}^c$, $F_{1h}$, $e_{1h} (\cdot)$, and $d_{1h} (\cdot)$ are defined in Eqs. (32), (60), (30)–(32), and (41)–(42), respectively. In particular, in case equity holders’ optimal action in the outside option is covenant violation ($a_{oo} = \text{vio}$), $b^e_0$ simplifies to

$$b^e_0 = \begin{bmatrix} -A^e_0 - A^c_1 s_0 + (\eta (1 - \alpha) - k_s) \frac{1 - \tau}{1 - \mu} s_0 + \eta A^c_2 s^\beta_1 s_0 + F_{1h} s U_0 - I - (1 - \eta) k_v - P_0 - k_u \end{bmatrix}. \quad (63)$$

$A_{d_2}^d, A_{d_3}^d$ jointly solve the system $M \begin{bmatrix} A_{d_2}^d \\ A_{d_3}^d \end{bmatrix}^T = b^d_0$, in which $M$ is given in Eq. (61) and

$$b^d_0 = \begin{bmatrix} -A_0^d + (1 - \eta (1 - \alpha)) \frac{1 - \tau}{1 - \mu} s_0 + (1 - \eta) A_{s_0}^\epsilon \phi_{d_2}^\epsilon s_0 + F_{1h} s U_0 - I - (1 - \eta) k_v - P_0 - k_u \\ -A_0^d + (1 - \eta) (F_{1h} s U_0 - \epsilon^c (U_0; c_0^A) - I) + \eta d^d_0 (U_0; c_0^A) \end{bmatrix}. \quad (64)$$

In particular, in case equity holders’ optimal action in the outside option is covenant violation ($a_{oo} = \text{vio}$), $b^d_0$ simplifies to

$$b^d_0 = \begin{bmatrix} -A_0^d + (1 - \eta (1 - \alpha)) \frac{1 - \tau}{1 - \mu} s_0 + (1 - \eta) A_{s_0}^\epsilon \phi_{d_2}^\epsilon s_0 + F_{1h} s U_0 - I - (1 - \eta) k_v - P_0 - k_u \\ -A_0^d + P_0 \end{bmatrix}. \quad (65)$$

**Proof of Proposition 2.** (i) The value of equity before investment or initial reorganization, $e_0 (X)$, corresponds to the present value of the expected future cash flows to equity holders:

$$e_0 (X) = \mathbb{E}^Q \left[ \int_0^{T_0} e^{-r(t-u)} (1 - \tau) (X_u - c_0^A) \ du \mid X_t = X \right] + \mathbb{E}^Q \left[ 1_{T_0 = s_0^u} e^{-r(s_0^u)} (\theta_0 c_{11} (s_0) - k_s \frac{1 - \tau}{r - \mu} s_0) \mid X_t = X \right] + \mathbb{E}^Q \left[ 1_{T_0 = U_0^u} e^{-r(U_0)} (e_{1h} (s U_0; c_1) - (I + K_v - d_{1h} (s U_0; c_1^B))) \mid X_t = X \right], \quad (66)$$

in which $c_{01}^A$ and $c_{1}^B$ are determined by Eq. (5). The first line of Eq. (66) corresponds to the cash flow to equity holders until initial reorganization or covenant renegotiation. In case of distressed reorganization, equity holders obtain a fraction $\theta_0$ of the unlevered firm
value (second line). The third line shows the value of equity at covenant renegotiation. The associated ordinary differential equation (ODE) reads

\[
\begin{align*}
    e_0(X) &= (\eta (1 - \alpha) - k_s) \frac{1}{r - \mu} X + \eta A_2^{e_i} X^{\beta_1} & 0 \leq X \leq S_0 \\
    re_0(X) &= (1 - \tau) (X - c_0^A) + \mu X e_0(X) + \frac{1}{2} \sigma^2 X^2 e''_0(X) & S_0 < X < U_0 \quad (67) \\
    e_0(X) &= e_{1h} (sX; c_0^A + c_1^B) - (I + k_u - d_{1h} (sX; c_1^B)) & X \geq U_0,
\end{align*}
\]

subject to the boundary conditions

\[
\begin{align*}
    e_0(S_0) &= (\eta (1 - \alpha) - k_s) \frac{1}{r - \mu} S_0 + \eta A_2^{e_i} S_0^{\beta_1}, \quad (68) \\
    e_0(U_0) &= e_{1h} (sU_0; c_1) - (I + k_u - d_{1h} (sU_0; c_1)) \quad (69).
\end{align*}
\]

Standard arguments imply the solution in the main text of Section 3.3, Eqs. (6)–(62).

(ii) The value of debt before covenant renegotiation or initial reorganization, \(d_0 (X)\), corresponds to the present value of expected future cash flows to initial debt holders:

\[
d_0(X) = \mathbb{E}^Q \left[ \int_t^{t_0} e^{-r(u-t)} c_0^A du | X_t = X \right] + \mathbb{E}^Q \left[ 1_{t_0=U_0} e^{-r (U_0-t)} d_{1h} (s U_0; c_0^A) | X_t = X \right] \\
+ \mathbb{E}^Q \left[ 1_{t_0=S_0} e^{-r (S_0-t)} (1 - \theta_0) e_{1h} (S_0) | X_t = X \right]. \quad (70)
\]

The first term in the first line of Eq. (70) shows the value of coupon payments to debt holders until covenant renegotiation or initial reorganization. At covenant renegotiation, initial debt holders have a claim on the total coupon \(c_0^A\) determined by the Nash solution, which corresponds to the second term in the first line of Eq. (70). In reorganization, initial debt holders receive a fraction \((1 - \theta_0)\) of the unlevered equity value, which is shown in line two of Eq. (70). The ODE for the value of initial debt is given by

\[
\begin{align*}
    d_0(X) &= (1 - \eta (1 - \alpha)) \frac{1}{r - \mu} X + (1 - \eta) A_2^{e_i} X^{\beta_1} & 0 \leq X \leq S_0 \\
    rd_0(X) &= c_0^A + \mu X d_0(X) + \frac{1}{2} \sigma^2 X^2 d''_0(X) & S_0 < X < U_0 \quad (71) \\
    d_0(X) &= d_{1h} (sX; c_0^A) & X \geq U_0,
\end{align*}
\]

subject to the boundary conditions

\[
d_0(S_0) = (1 - \eta (1 - \alpha)) \frac{1}{r - \mu} S_0 + (1 - \eta) A_2^{e_i} S_0^{\beta_1}, \quad d_0(U_0) = d_{1h} (s U_0; c_0^A). \quad (72)
\]

Standard arguments imply the solution in the main text of Section 3.3, Eqs. (68)–(64).
References


Figure 1. Timeline of the potential occurrence of debt renegotiation. This figure shows the sequence of the potential occurrence of covenant renegotiation, distressed reorganization, and investment over time. The notation for the corresponding thresholds are in parenthesis. The subscripts apply to the corresponding value functions.
Figure 2. Bargaining power and investment boundaries. This graph shows the investment boundary of the base firm (solid line) and the firm without a covenant (dashed line) against equity holders’ bargaining power. The figure uses base case parameters. All lines are drawn using optimal coupons.

Figure 3. Covenant violation cost and investment boundaries. This graph shows the investment boundary of the base firm (solid line) and the firm without a covenant (dashed line) against the cost of a covenant violation. The figure uses base case parameters. All lines are drawn using optimal coupons.
Figure 4. Covenant violation cost and value of investment covenant. This graph plots the value of including an investment covenant to firms (VNDR) against the violation cost. The figure uses base case parameters. The line is drawn using optimal coupons.

Figure 5. Recovery rate and value of investment covenant. This graph plots the value of including an investment covenant to firms (VNDR) against the recovery rate. The figure uses base case parameters. The line is drawn using optimal coupons.
Figure 6. Control premiums before distressed reorganization. This figure shows average debt control premiums in one simulated economy before distressed reorganization. The reported statistics are the cross-sectional averages of one post-simulation using a sample of model-implied firms matched to the empirical cross-section from Nini et al. (2009). At each time, for one firm, the control premium is the difference between the value of private debt and the value of debt without bargaining power (i.e., $\eta = 1$), expressed as a percentage of the private debt value.

Figure 7. Control premiums before non-distressed renegotiation. This figure shows average debt control premiums in one simulated economy before covenant renegotiation. The reported statistics are the cross-sectional averages of one post-simulation using a sample of model-implied firms matched to the empirical cross-section from Nini et al. (2009). At each time, for one firm, the control premium is the difference between the value of private debt and the value of debt without bargaining power (i.e., $\eta = 1$), expressed as a percentage of the private debt value.
Table I
Corporate policies and firm value

This table shows the implications of creditor governance on firm value and policies for our baseline parameters. “Without covenant” considers the base model without a covenant. “Without covenant, first-best” considers firm value maximizing investment and financing policies in the model without a covenant. In the “Base model,” the firm can renegotiate debt in and outside distress. “Base model, first-best” considers firm value maximizing investment and financing policies in the base model. In all cases, equity holders choose the distressed reorganization policy. $S_0$ is the reorganization boundary, $U_0$ is the investment boundary, and $c_A^0$ is the initial coupon. $lev_U$ and $lev_0$ are leverage at investment and initial leverage, respectively, and $f_0$ is the initial firm value. $AC$ is the agency cost of debt reported as a fraction of first-best firm value and $V_{NDR}$ is the value of the ability to renegotiate outside distress, defined as the firm value increase in the base model compared with the model without a covenant, expressed as a fraction of the firm value in the base model.

<table>
<thead>
<tr>
<th></th>
<th>$S_0$</th>
<th>$U_0$</th>
<th>$c_A^0$</th>
<th>$lev_U$</th>
<th>$lev_0$</th>
<th>$f_0$</th>
<th>$AC$</th>
<th>$V_{NDR}$</th>
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<tr>
<td>Without covenant</td>
<td>2.81</td>
<td>22.94</td>
<td>6.24</td>
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<td>545.88</td>
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<tr>
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<td>0.59</td>
<td>544.71</td>
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</tr>
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</table>

Table II
Corporate policies and firm value under different parameters

This table shows the implications of creditor governance on firm value and policies for different parameters. In Panels A–H, we change one parameter at a time. $\eta$ is equity holders’ bargaining power, $\eta_o$ is the bargaining power of initial debt holders in reorganization after investment, $\alpha$ is the recovery rate in default, $\tau$ is the corporate tax rate, $\sigma$ is the volatility of cash flows, $\mu$ the cash flow drift and $k_u$ and $k_s$ are the cost of renegotiation outside and in distress, respectively. “Without covenant” considers the base model without a covenant. In the “Base model,” the firm can renegotiate debt in and outside distress. In all cases, equity holders choose the distressed reorganization policy. $S_0$ is the reorganization boundary, $U_0$ is the investment boundary, and $c_A^0$ is the initial coupon. $lev_U$ and $lev_0$ are leverage at investment and initial leverage, respectively, and $f_0$ is the initial firm value. $AC$ is the agency cost of debt reported as a fraction of first-best firm value and $V_{NDR}$ is the value of the ability to renegotiate outside distress, defined as the firm value increase in the base model compared with the model without a covenant, expressed as a fraction of the firm value in the base model.

<table>
<thead>
<tr>
<th></th>
<th>$S_0$</th>
<th>$U_0$</th>
<th>$c_A^0$</th>
<th>$lev_U$</th>
<th>$lev_0$</th>
<th>$f_0$</th>
<th>$AC$</th>
<th>$V_{NDR}$</th>
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<tr>
<td>Panel A: Lower bargaining power of equity holders ($\eta = 0.25$)</td>
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<tr>
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<td></td>
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<td>Base model</td>
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<td>0.73</td>
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<td>Panel B: Lower bargaining power of initial debt in reorg. after inv. ($\eta_o = 0.20$)</td>
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</tr>
<tr>
<td>Without covenant</td>
<td>2.97</td>
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<td>Base model</td>
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<td>Panel C: Lower recovery rate ($\alpha = 0.55$)</td>
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</tr>
<tr>
<td>Without covenant</td>
<td>4.99</td>
<td>23.59</td>
<td>9.25</td>
<td>0.63</td>
<td>0.23</td>
<td>533.78</td>
<td>0.77</td>
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<tr>
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<td>14.21</td>
<td>31.04</td>
<td>34.61</td>
<td>0.61</td>
<td>0.61</td>
<td>537.65</td>
<td>0.20</td>
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<tr>
<td>Panel D: Higher tax rate ($\tau = 0.29$)</td>
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<td></td>
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<tr>
<td>Without covenant</td>
<td>5.16</td>
<td>24.58</td>
<td>12.88</td>
<td>0.71</td>
<td>0.31</td>
<td>542.93</td>
<td>2.24</td>
<td></td>
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<tr>
<td>Base model</td>
<td>12.02</td>
<td>34.58</td>
<td>29.63</td>
<td>0.71</td>
<td>0.61</td>
<td>502.42</td>
<td>0.05</td>
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<tr>
<td>Panel E: Higher cash flow volatility ($\sigma = 0.29$)</td>
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<td></td>
</tr>
<tr>
<td>Without covenant</td>
<td>2.95</td>
<td>22.21</td>
<td>7.55</td>
<td>0.71</td>
<td>0.18</td>
<td>544.84</td>
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<td>29.98</td>
<td>46.88</td>
<td>0.69</td>
<td>0.64</td>
<td>727.43</td>
<td>0.06</td>
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<tr>
<td>Panel F: Higher cash flow drift ($\mu = 0.02$)</td>
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<tr>
<td>Without covenant</td>
<td>2.31</td>
<td>21.78</td>
<td>6.28</td>
<td>0.69</td>
<td>0.13</td>
<td>721.42</td>
<td>1.03</td>
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<tr>
<td>Base model</td>
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<td>31.27</td>
<td>34.46</td>
<td>0.64</td>
<td>0.64</td>
<td>542.01</td>
<td>0.27</td>
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<tr>
<td>Panel G: Higher bargaining friction ($k_u = 2$, $k_s = 0.01%$)</td>
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<tr>
<td>Without covenant</td>
<td>2.81</td>
<td>23.03</td>
<td>6.28</td>
<td>0.70</td>
<td>0.16</td>
<td>598.00</td>
<td>1.07</td>
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<tr>
<td>Base model</td>
<td>13.15</td>
<td>31.27</td>
<td>34.46</td>
<td>0.64</td>
<td>0.64</td>
<td>542.01</td>
<td>0.27</td>
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<tr>
<td>Panel H: Lower covenant violation cost ($K=20$)</td>
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</tr>
<tr>
<td>Without covenant</td>
<td>2.81</td>
<td>22.94</td>
<td>6.24</td>
<td>0.71</td>
<td>0.16</td>
<td>599.73</td>
<td>1.13</td>
<td></td>
</tr>
<tr>
<td>Base model</td>
<td>10.67</td>
<td>36.82</td>
<td>38.02</td>
<td>0.68</td>
<td>0.54</td>
<td>546.19</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>
Table III  
Credit spreads

This table shows credit spread levels and the impact of firm parameters on credit spreads. The empirical levels and sensitivities are from Davydenko and Strebulaev (2007). We derive model-implied credit spread levels by using the median firm parameters in Davydenko and Strebulaev (2007). To measure the impact of a firm parameter on model-implied credit spreads, we marginally vary the firm parameter and fix the leverage and mtb ratios by calibrating the investment scale factor $s$ and the coupon $c$. To measure the impact of leverage and mtb ratios on credit spreads, we marginally vary the leverage and mtb ratios. Besides the results for our base model, we also list those for the all-equity financed investment model (EFI), as well as for the debt renegotiation frameworks of Fan and Sundaresan (2000) (FS) and Davydenko and Strebulaev (2007) (DS). In the last column, we summarize the results for the base model without a covenant (Without covenant).

<table>
<thead>
<tr>
<th></th>
<th>Empirical</th>
<th>Base</th>
<th>EFI</th>
<th>FS</th>
<th>DS</th>
<th>Without covenant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Credit spread levels</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Median credit spread</td>
<td>109</td>
<td>119</td>
<td>45</td>
<td>32</td>
<td>31</td>
<td>287</td>
</tr>
<tr>
<td><strong>Panel B: Impact of strategic variables on credit spreads</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquidation cost</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Bargaining power</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Bargaining friction</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Panel C: Impact of non-strategic variables on credit spreads</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MtB</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>N/A</td>
<td>N/A</td>
<td>+</td>
</tr>
<tr>
<td>Leverage</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Volatility</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table IV  
Summary statistics of empirical and simulated samples at matching

This table shows the summary statistics for the empirical cross-section from Nini et al. (2009) and for the simulated base model-implied firm samples at matching. The market leverage in the simulated samples is the market value of debt divided by the market value of the firm. The model-implied mtb ratio is the market value of the model firm divided by the value of invested assets. \textit{Correlation} is the correlation coefficient between mtb and leverage.

<table>
<thead>
<tr>
<th></th>
<th>Empirical sample</th>
<th>Model-implied samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market leverage mean</td>
<td>0.41</td>
<td>0.47</td>
</tr>
<tr>
<td>Market leverage median</td>
<td>0.40</td>
<td>0.43</td>
</tr>
<tr>
<td>Market leverage standard deviation</td>
<td>0.22</td>
<td>0.16</td>
</tr>
<tr>
<td>Market-to-book ratio mean</td>
<td>1.69</td>
<td>1.38</td>
</tr>
<tr>
<td>Market-to-book ratio median</td>
<td>1.39</td>
<td>1.37</td>
</tr>
<tr>
<td>Market-to-book ratio standard deviation</td>
<td>0.90</td>
<td>0.26</td>
</tr>
<tr>
<td>Correlation</td>
<td>-0.79</td>
<td>-0.48</td>
</tr>
</tbody>
</table>
Table V
Control premiums

This table summarizes statistics on control premiums before distressed reorganization and non-distressed renegotiation. Reported statistics are averages of 10,000 simulations using samples of model-implied firms matched to the empirical cross-section from Nini et al. (2009). Quarter before event is the number of quarters before distressed reorganization or non-distressed renegotiation, respectively. The control premium is the difference between the value of private debt and the value of debt without bargaining power (i.e., \( \eta = 1 \)), expressed as a percentage of the private debt value. The average control premium is the cross-sectional average. Standard deviation is the average of the intra-simulation standard deviations of control premiums in a quarter.

<table>
<thead>
<tr>
<th>Quarter before event</th>
<th>-16</th>
<th>-12</th>
<th>-8</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Distressed reorganization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average control premium</td>
<td>0.35</td>
<td>2.28</td>
<td>5.14</td>
<td>10.53</td>
<td>13.22</td>
<td>17.79</td>
<td>29.21</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.34</td>
<td>5.91</td>
<td>8.63</td>
<td>11.57</td>
<td>12.33</td>
<td>12.59</td>
<td>3.63</td>
</tr>
<tr>
<td>Panel B: Non-distressed renegotiation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average control premium</td>
<td>12.50</td>
<td>12.93</td>
<td>13.32</td>
<td>13.58</td>
<td>13.61</td>
<td>13.63</td>
<td>13.65</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.73</td>
<td>2.65</td>
<td>2.57</td>
<td>2.20</td>
<td>1.95</td>
<td>1.54</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Table VI
Empirical and model-implied timing policies of debt renegotiation

This table summarizes key statistics on renegotiation timing. % renegotiated is the portion of debt contracts renegotiated before maturity. To reflect the average empirical contract maturity in the models, we choose a time horizon of 16 quarters in the post-simulations. Effective duration is the mean waiting time to the first renegotiation or final maturity in years. Eff. duration % of maturity is the average time to the first renegotiation or maturity divided by the initial maturity. The initial maturity is set to 16 quarters in the models. Time to first renegotiation is the average time in years to the first renegotiation of contracts that are renegotiated. % distressed renegotiations is the percentage of total debt renegotiations associated with corporate distress. Duration % of maturity is the average time to any renegotiation or to maturity divided by the initial debt maturity, including renegotiations occurring after the first renegotiation. The next four lines summarize the frequencies of renegotiation rounds. Average renegotiation frequency is the mean number of renegotiation rounds of renegotiated contracts. The empirical samples are the loan contract samples of Roberts and Sufi (2009b) and Denis and Wang (2014). In the simulated samples of the base model, firms can renegotiate a financing covenant outside distress and reorganize in distress. We also list the results of the simulations for the base model without a covenant. The empirical statistics in the simulated samples are averages of simulations using samples of model-implied firms matched to the empirical cross-section from Nini et al. (2009).

<table>
<thead>
<tr>
<th>Empirical DW 2014</th>
<th>Empirical RS 2009%</th>
<th>Base model</th>
<th>FS</th>
<th>DS</th>
<th>EFI</th>
<th>Without covenant</th>
</tr>
</thead>
<tbody>
<tr>
<td>% renegotiated</td>
<td>60.6</td>
<td>64.5</td>
<td>55.2</td>
<td>4.7</td>
<td>4.3</td>
<td>4.2</td>
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<tr>
<td>Effective duration</td>
<td>2.0</td>
<td>1.5</td>
<td>2.3</td>
<td>3.9</td>
<td>3.9</td>
<td>3.8</td>
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<tr>
<td>Eff. duration % of maturity</td>
<td>58</td>
<td>64</td>
<td>57.5</td>
<td>97.3</td>
<td>97.6</td>
<td>95.7</td>
</tr>
<tr>
<td>Time to first renegotiation</td>
<td>1.3</td>
<td>1.5</td>
<td>1.0</td>
<td>1.7</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>% distressed renegotiations</td>
<td>18</td>
<td>8.1</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Duration % of maturity</td>
<td>61</td>
<td>31.2</td>
<td>94.9</td>
<td>95.8</td>
<td>95.9</td>
<td>91.8</td>
</tr>
<tr>
<td>% renegotiated once</td>
<td>37</td>
<td>25.7</td>
<td>67.0</td>
<td>71.0</td>
<td>59.5</td>
<td>56.7</td>
</tr>
<tr>
<td>% renegotiated twice</td>
<td>22</td>
<td>15.2</td>
<td>16.8</td>
<td>16.1</td>
<td>14.6</td>
<td>15.8</td>
</tr>
<tr>
<td>% renegotiated three times</td>
<td>13</td>
<td>12.4</td>
<td>7.7</td>
<td>6.7</td>
<td>9.0</td>
<td>9.6</td>
</tr>
<tr>
<td>% renegotiated two to five times</td>
<td>53</td>
<td>48.0</td>
<td>30.8</td>
<td>27.6</td>
<td>34.0</td>
<td>36.4</td>
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<tr>
<td>Average renegotiation frequency</td>
<td>2.7</td>
<td>3.9</td>
<td>1.7</td>
<td>1.5</td>
<td>2.2</td>
<td>2.1</td>
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Table VII
Alternative mechanisms

This table shows the firm value and policies using alternative mechanisms to mitigate the agency frictions. Panel A compares our base model with an investment covenant to the case with a financing covenant. Panel B replicates the debt priority approach of Hackbarth and Mauer (2012). Panel C shows the model, in which we augment the debt priority approach of Hackbarth and Mauer (2012) with the ability to reorganize debt in distress as in Fan and Sundaresan (2000). Panel D considers callable debt, which can be called upon investment. Equity holders choose the financing, investment, and reorganization policies to maximize the value of their claim. $S_0$ is the reorganization boundary, $U_0$ is the investment boundary, and $c^A_0$ is the initial coupon. $lev_U$ and $lev_0$ are leverage at investment and initial leverage, respectively, and $f_0$ is the initial firm value.

<table>
<thead>
<tr>
<th>Alternative mechanism</th>
<th>$S_0$</th>
<th>$U_0$</th>
<th>$c^A_0$</th>
<th>$lev_U$</th>
<th>$lev_0$</th>
<th>$f_0$</th>
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</thead>
<tbody>
<tr>
<td>Panel A: Investment and financing covenants</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Investment covenant, baseline</td>
<td>13.91</td>
<td>30.81</td>
<td>37.20</td>
<td>0.68</td>
<td>0.65</td>
<td>543.73</td>
</tr>
<tr>
<td>Financing covenant, baseline</td>
<td>13.91</td>
<td>30.81</td>
<td>37.20</td>
<td>0.68</td>
<td>0.65</td>
<td>543.73</td>
</tr>
<tr>
<td>Investment covenant, large K</td>
<td>8.83</td>
<td>26.36</td>
<td>17.34</td>
<td>0.68</td>
<td>0.57</td>
<td>543.65</td>
</tr>
<tr>
<td>Financing covenant, large K</td>
<td>7.36</td>
<td>29.77</td>
<td>16.66</td>
<td>0.68</td>
<td>0.45</td>
<td>543.30</td>
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<tr>
<td>Panel B: Debt priority</td>
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<tr>
<td>Equal priority</td>
<td>1.83</td>
<td>24.27</td>
<td>4.73</td>
<td>0.60</td>
<td>0.12</td>
<td>524.40</td>
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<tr>
<td>Junior debt</td>
<td>0.82</td>
<td>23.92</td>
<td>2.00</td>
<td>0.58</td>
<td>0.05</td>
<td>523.43</td>
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<tr>
<td>Senior debt</td>
<td>3.19</td>
<td>28.20</td>
<td>8.54</td>
<td>0.53</td>
<td>0.25</td>
<td>526.63</td>
</tr>
<tr>
<td>Normative priority rule</td>
<td>4.31</td>
<td>25.61</td>
<td>12.03</td>
<td>0.52</td>
<td>0.32</td>
<td>527.34</td>
</tr>
<tr>
<td>Panel C: Debt priority and distressed reorganization</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Equal priority</td>
<td>2.81</td>
<td>22.94</td>
<td>6.24</td>
<td>0.71</td>
<td>0.16</td>
<td>539.73</td>
</tr>
<tr>
<td>Junior debt</td>
<td>1.18</td>
<td>22.57</td>
<td>2.51</td>
<td>0.68</td>
<td>0.06</td>
<td>538.11</td>
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<tr>
<td>Senior debt</td>
<td>4.94</td>
<td>29.40</td>
<td>11.02</td>
<td>0.61</td>
<td>0.32</td>
<td>540.23</td>
</tr>
<tr>
<td>Normative priority rule</td>
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<td>26.22</td>
<td>25.94</td>
<td>0.67</td>
<td>0.57</td>
<td>545.19</td>
</tr>
<tr>
<td>Panel D: Callable debt</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without call premium</td>
<td>8.70</td>
<td>25.71</td>
<td>22.00</td>
<td>0.68</td>
<td>0.46</td>
<td>542.70</td>
</tr>
<tr>
<td>With optimal call premium</td>
<td>10.05</td>
<td>27.36</td>
<td>25.68</td>
<td>0.68</td>
<td>0.52</td>
<td>543.15</td>
</tr>
</tbody>
</table>