Agency Conflicts and Financial Covenants: Theory and Estimates of Control Rights

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Abstract

This paper studies the relationship between financial covenant design, enforcement, and the impacts of violations, and how this relationship has evolved alongside the secular trends in violations and post-violation interventions. I develop an optimal contracting model in which covenants arise endogenously from a hidden effort problem and non-contractible interim action. By allocating contingent control rights, financial covenants mitigate the lack of cash-flow pledgeability and facilitate financing. I estimate the model using Simulated Method of Moments, targeting causally identified moments from the reduced-form covenant literature. The full-sample estimates reveal that violation rates are primarily governed by the hidden effort problem and performance signal structure, while intervention rates are largely driven by the costs and benefits of interim action. Subperiod estimates show that the weakening impact of covenant violations on managerial discipline is reflected in higher intervention rates, but not in the secular decline in violation rates. The rise of PE sponsorship explains around one quarter of the estimated structural shift.

Keywords: Financial covenants; Creditor control rights; Agency conflicts

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1 Introduction

Financial covenants are an important monitoring and governance mechanism in corporate lending. By setting thresholds for borrowers' financial performance, they serve as tripwires that alert creditors when a borrower's financial condition deteriorates and give them the right to accelerate repayment, restrict credit availability, or intervene in firms' operating decisions following a breach. An accumulating body of evidence establishes the causal effects of covenant violations on firm-level outcomes. Exploiting the discontinuity in creditors' control rights at covenant thresholds, studies find that violations reduce investment, tighten credit availability, improve operating performance, and increase managerial turnover (Chava and Roberts [2008]; Roberts and Sufi [2009a]; Nini, Smith, and Sufi [2009]; Nini, Smith, and Sufi [2012]). While this literature credibly identifies the consequences of covenant violations, it provides little guidance on how these consequences relate to the decision to write and enforce covenants, because the assumption that firms just above and just below the threshold are otherwise comparable abstracts away from the variation relevant to studying this relationship.

The importance of this question is underscored by a striking divergence in the secular trends. Over the first two decades of the 2000s, the annual incidence of covenant violations among U.S. public firms fell from approximately 20 percent to below 5 percent, while the share of violations followed by creditor intervention rather than waiver rose from around 40 percent to over 60 percent (Griffin, Nini, and Smith [2024]). This divergence is not merely descriptive background. The opposing movements in violation and intervention rates raise questions that violation-window estimates cannot address and suggest that the two margins may be governed by distinct mechanisms. This paper asks: What is the relationship between financial covenant design, enforcement, and the impacts of violations, and how has this relationship evolved alongside the secular trends in violations and post-violation interventions?

To study this question, I develop an optimal contracting model in which covenants arise endogenously in response to a hidden effort problem between entrepreneurs and lenders, performance signals that are informative of hidden effort, and interim actions that improve cash flow but impose socially inefficient non-pecuniary costs to entrepreneurs, creating an additional layer of agency conflict. Under limited liability and contractual monotonicity, the optimal financial structure is performance-sensitive debt with a contingent action rule: no action when the signal is good and there is an endogenous probability of action when the signal is bad. If the interim action is not contractible initially, there is a role for financial covenants to define control rights. By allocating control rights in a state-contingent way, financial covenants mitigate the lack of cash-flow pledgeabil-

ity and facilitate financing.

I estimate the model using Simulated Method of Moments, targeting several groups of moments: firm technology moments, investment–internal capital sensitivity identified via the 2015–16 oil price shock, covenant violation and intervention rates, and the causal effects of covenant violations on firm investment, operating performance, and forced CEO turnover identified from the quasi-regression-discontinuity design of Roberts and Sufi [2009a] and Nini et al. [2012]. The full-sample estimates reveal that covenant violation rates are primarily governed by the hidden effort problem and performance signal structure, while intervention rates are largely driven by the costs and benefits of interim action. Estimating the model across subperiods shows that the decline in the costs of interim action, reflected in the weakening impact of covenant violations on forced CEO turnover, accounts for much of the rise in intervention rates. The rise of PE sponsorship explains around one quarter of this structural shift, with the remainder persisting after holding borrower composition fixed.

I now turn to a more detailed description. Using a panel of U.S. publicly listed firms and their associated syndicated loans from 1996 to 2020, I confirm contrasting secular trends in covenant design and enforcement. Ex ante covenant coverage and strictness decrease over time, alongside a secular decline in the annual incidence of covenant violations from approximately 20 percent in the early 2000s to below 5 percent by 2015. In contrast, the share of violations followed by creditor intervention rather than waiver rises from around 40 percent to over 60 percent.

To assess how the real consequences of violations have shifted alongside these trends, I exploit the discontinuity in creditors' contractual rights at covenant thresholds in a quasi-regression-discontinuity design, comparing firms that narrowly breach a covenant with those that narrowly comply. The estimates reveal a meaningful shift in the impacts of violations across periods. Before 2010, violations reduce capital expenditures, improve operating performance, and increase the probability of forced CEO turnover. After 2010, the investment and operating performance effects remain robust, whereas the response of managerial discipline weakens substantially: the estimated increase in forced CEO turnover falls by more than half, with the difference across periods marginally significant at the 10 percent level. Separately, I exploit the 2015–2016 oil-price crash as a quasi-experiment to identify the sensitivity of investment to internal cash flow. Together, these designs provide portable, causally identified moments on the real effects of covenant violations and the severity of information asymmetry, helping to discipline models of debt contracting and agency frictions.

To characterize the equilibrium relationship between covenant design, enforcement, and the impacts of violations, I develop a micro-founded optimal contracting model

that endogenizes debt and financial covenants. Entrepreneurs are risk neutral and wealth-constrained, combining their net worth with external borrowing to finance investment in a decreasing-returns-to-scale technology. The project is subject to an information asymmetry problem: entrepreneurs must exert hidden effort to improve the distribution of cash flow. The two key deviations from Innes [1990] and Chaigneau, Edmans, and Gottlieb [2018] are the introduction of an endogenous decision to write a complex contract contingent on a performance signal, and a possibility to take an interim action.

Following Aghion and Bolton [1992], the interim action is assumed to be non-contractible at origination and first-best inefficient. These two properties are critical. The action's first-best inefficiency generates a genuine conflict of interest: entrepreneurs, who bear the full private cost of the action but capture only part of its benefits, prefer inaction; lenders, who benefit from the resulting productivity gains without bearing the private cost, prefer action. The non-contractibility of the interim action, in turn, creates a meaningful role for the allocation of control rights. I first show that the debt structure is endogenous: wealthier entrepreneurs do not include the signal and offer simple contracts, whereas more wealth-constrained entrepreneurs include the signal and offer complex contracts contingent on it.

Under limited liability and contractual monotonicity, I show that wealthier entrepreneurs issue straight debt, whereas wealth-constrained entrepreneurs issue risky, performance-sensitive debt with a financial covenant. The information structure, together with the restrictions on contracting form, implies that the entrepreneur's payoff is zero below a threshold and increases one-for-one above it, yielding a call-option-like payoff, while the lender holds the complementary risky debt claim. Because a higher signal raises the posterior probability that the entrepreneur has exerted high effort, the optimal contract rewards favorable signals by lowering the promised face value of debt, making debt repayments signal-dependent.

The model then characterizes the optimal allocation of control rights. Covenants allocate control rights in a state-contingent way: the entrepreneur retains control following a high signal, whereas following a low signal, control is transferred to the lender with an endogenous probability. Whenever the lender obtains control, the interim action is undertaken. Thus, the otherwise inefficient interim action serves solely to provide incentives: the contingent action rule functions as a reward-and-punishment scheme that strengthens entrepreneurial incentives and increases pledgeable income.

The model further highlights a trade-off that governs the choice between waiver and intervention upon violation. A higher intervention rate boosts incentives, raises pledgeable income, and thus supports a larger investment scale. However, it also in-

creases the frequency of inefficient interim actions, reducing per-unit net present value and ex post efficiency. The optimal covenant design therefore implements a probabilistic action rule that balances incentive provision against the efficiency costs of more frequent intervention. As such, the model provides a theoretical foundation for examining covenant-based governance through firms' covenant coverage, the incidence of covenant violations, and responses to violations.

I next estimate the model structurally using Simulated Method of Moments (SMM), exploiting a novel set of empirically identified causal moments drawn from the extensive reduced-form literature on financial covenants. The nine structural parameters governing technology, the hidden effort problem, performance signal structure, and the costs and benefits of interim action are identified through matching simulated moments to their empirical counterparts across four groups.

The first group consists of moments capturing firm technology, including distributional properties of loan spreads and external financing. The second group targets moments related to the severity of financial frictions, in particular investment–cash flow sensitivity identified using the 2015–16 oil price shock following Lamont [1997], together with unconditional and violation-conditional default rates. The third group links covenant violation and intervention rates to the parameters governing the performance signal structure.

The last and most novel group exploits the causal effects of covenant violations on firm-level investment, operating performance, and forced CEO turnover, identified using the quasi-regression-discontinuity design of Roberts and Sufi [2009a] and Nini et al. [2012]. These moments are central to the structural identification: because each moment is independently identified in the reduced-form literature, it disciplines the structural parameters governing the costs and benefits of interim action in a way that aggregate moments alone cannot.

The full-sample estimates reveal that the relationship between covenant design, enforcement, and the impacts of violations is governed by two distinct dimensions of agency conflict. All parameter estimates are statistically significant and economically substantial. The hidden effort problem and performance signal structure primarily determine covenant design and violation rates: firms facing more severe effort frictions or noisier signals are more likely to include covenants and to trigger violations. The costs and benefits of creditor action, by contrast, mainly govern enforcement intensity, i.e., how frequently creditors intervene rather than waive following a violation.

This finding is further corroborated by the local sensitivity analysis. Covenant violation rates respond meaningfully to perturbations in the hidden effort and signal parameters but are insensitive to changes in the costs and benefits of interim action. In

contrast, intervention rates respond strongly with the latter. This pattern suggests that the two margins of covenant governance, while jointly determined by the agency environment, respond to shifts in the underlying economic primitives in a different way.

The subperiod estimates reveal how the equilibrium relationship has shifted over time. The decline in the costs and benefits of creditor action explains the rise in post-violation intervention rates, while the easing of the hidden effort problem accounts for the secular decline in violation rates. In particular, through the managerial cost of interim action, the weakening impact of covenant violations on forced CEO turnover is reflected in higher intervention rates, but not in the secular decline in violation rates.

The rise of PE sponsorship in syndicated lending provides a natural market-based interpretation of the estimated structural shift. PE exposure nearly doubles across the two periods, and a reweighting counterfactual shows that it accounts for around one quarter of the declines in the costs and benefits of interim action, while the reminder of the shift remains unexplained by borrower composition alone.

Related Literature. This paper makes three contributions to the literature. First, it contributes to the theory of debt covenants and control rights. Building on the incomplete-contracting literature on the allocation of control rights (Aghion and Bolton [1992]; Gârleanu and Zwiebel [2009]), this paper develops a micro-founded contracting model that links the ex ante design of financial covenants to the ex post exercise of creditor control. A key feature is that it explicitly models the choice between waiver and intervention upon violation as an equilibrium outcome rather than as a mechanical consequence of the contractual trigger. The framework provides a unified theoretical foundation for empirical measures of covenant violations and for the real effects of creditor intervention.

Second, the paper contributes to a small but growing structural corporate finance literature on debt covenants and creditor governance (Matvos [2013]; Green [2018]; Greenwald [2019]; Adler [2024]). What distinguishes this paper is that it follows Catherine, Chaney, Huang, Sraer, and Thesmar [2022] in using well-identified reduced-form estimates to discipline a structural model and recover structural primitives that are difficult to identify from observational data alone. I adopt this approach by targeting the causal effects of covenant violations on investment, operating performance, and managerial turnover as estimation moments. These moments are grounded in a well-established reduced-form literature that exploits plausibly exogenous variation in covenant violations to identify their real effects (Chava and Roberts [2008]; Roberts and Sufi [2009a]; Nini et al. [2012]). By doing so, this paper establishes a causal link between the model and the data, rather than using the model simply as a conceptual framework for interpreting empirical findings.

Third, the paper provides a unified account of how the impacts of covenant violations have evolved alongside the secular trends in violations and post-violation interventions. While a large literature identifies the real effects of covenant violations (Nini et al. [2009]; Nini et al. [2012]; Denis and Wang [2014]; Falato and Liang [2016]), and a separate literature documents the recent trends in covenant use and enforcement (Berlin, Nini, and Edison [2020]; Griffin et al. [2024]; Ivashina and Vallee [2025]), these two strands have largely developed separately, leaving open the question of how the impacts of violations relate to the evolution of covenant design and enforcement. By estimating the model across subperiods, I identify distinct structural channels driving the two secular trends: the easing of the hidden effort problem accounts for the decline in violation rates, while the decline in the costs and benefits of creditor action, partly reflected in the weakening effects of covenant violations on managerial turnover, accounts for the rise in intervention rates.

The paper proceeds as follows. Section 2 provides institutional background on financial covenants. Section 3 develops the optimal contracting model. Section 4 describes the data, empirical measures, and aggregate trends. Section 5 presents the reduced-form results on the effects of covenant violations on firm-level outcomes. Section 6 discusses the structural estimation strategy. Section 7 reports the quantitative results, and Section 8 concludes.

2 Background on Financial Covenants

2.1 Institutional Background

Debt covenants have long been considered an important component of credit agreements. Prevailing covenants can generally be classified into three types—affirmative, negative, and financial—based on their prescriptive content. Affirmative and negative covenants impose direct requirements on firm actions that must or must not be undertaken, such as the payout of dividends or the issuance of new debt. Financial covenants are accounting-based risk and performance limits, such as restrictions on a company's leverage, interest coverage, and net worth.

Definition. Financial covenants are conditions set in credit agreements, based on observable accounting variables, that the borrower is obliged to satisfy, together with the specified consequences of violating these conditions. In practice, however, it is difficult to specify contractual provisions governing every possible action a firm may undertake. As a result, many credit agreements rely on financial (maintenance) covenants

that monitor firm performance through observable accounting ratios. These covenants serve as early-warning tripwires: when verifiable financial metrics fall below contractual thresholds, control rights shift to lenders, allowing them to intervene or renegotiate the terms of the loan. For this reason, the analysis focuses on financial covenants in private debt markets, which play a central role in addressing contractual incompleteness.[1]

Prevalence. Financial covenants are widely employed in borrowing contracts, and covenant violations occur far more frequently than actual defaults or bankruptcies. Almost 90 percent of private credit agreements contain at least one financial covenant, and around 15-20 percent of firms report being in violation in any given year (Roberts and Sufi [2009a]). These covenants appear in public debt, private debt, and private equity financing and are typically based on accounting measures from the firm's balance sheet or income statement. The most common provisions are based on earnings measures, in particular, EBITDA, and interest obligations, although many contracts also include restrictions tied to net worth and liquidity.

Among earnings-based covenants, two provisions dominate. The first is the debt-to-EBITDA ratio, which limits a firm's total debt to a multiple of its EBITDA, typically around four. The second is the interest coverage ratio, which requires interest payments relative to EBITDA to remain below a specified threshold, commonly near 0.4. Together, these two covenants appear in roughly 70 percent of loan packages that include financial covenants, underscoring their central role in creditor monitoring and control.

Rationale. Covenants serve two related but distinct economic functions: restricting actions that reduce firm value or transfer wealth away from creditors, and defining the allocation of control rights among the firm's claimants (Gorton and Winton [2003] and Tirole [2006]). The second function arises because agency conflicts make the allocation of control an important element of optimal security design (Aghion and Bolton

[1] I focus on private debt, i.e. bank loans and syndicated credit facilities, rather than public debt, i.e. corporate bonds, for both institutional and theoretical reasons. Institutionally, financial covenants studied here are nearly exclusive to private debt. Corporate bond indentures rely predominantly on *incurrence* covenants, which are triggered only when the firm undertakes a discrete action (e.g., issuing additional debt or paying dividends beyond a threshold), rather than by the ongoing financial condition of the firm. As a result, passive deterioration in firm performance does not generate a technical default in bond markets, making bond covenants ill-suited to study state-contingent creditor control.

Theoretically, the two instruments are fundamentally different in kind not merely in degree. Bond covenants constrain the borrower's *action set* ex ante; loan financial covenants allocate *control rights* as a function of realized firm performance. Even when bond covenants are breached, dispersed bondholders face coordination frictions severe enough to preclude the bilateral renegotiation that makes creditor control effective Gertner and Scharfstein [1991], whereas a concentrated bank syndicate can intervene swiftly and reshape contract terms following a violation Roberts [2015]. As such, loan financial covenants are the right object for studying creditor control as a governance mechanism, which is precisely the question I address.

[1992] and Hart [1995]). Under incomplete contracting, financial covenants specify the circumstances under which creditors may intervene in managerial decisions. Because managerial actions are not directly contractible, observable firm performance can provide a signal of managerial behavior and project quality. When performance deteriorates sufficiently, a covenant violation creates the possibility of a transfer of control from borrowers to creditors. The prospect of losing control and its associated private benefits can discipline managerial behavior, making state-contingent control an instrument for mitigating agency conflicts and facilitating financing (Chava and Roberts [2008]).

The governance role of financial covenants, however, depends not only on the contractual allocation of control rights, but also on how creditors exercise them. A violation creates the opportunity for intervention, but does not determine its form or intensity. Creditors may waive violations, renegotiate contractual terms, tighten restrictions, or intervene more directly in managerial decisions, depending on their incentives and the costs and benefits of intervention. Covenant-based governance thus operates through both the ex ante incentive effects of contingent control and the ex post exercise of creditor control rights. These two components need not evolve together: agency conflicts may continue to make contingent control valuable, while changes in creditors' incentives or constraints alter their willingness to intervene when a violation occurs. Understanding the evolution of covenant governance therefore requires examining how agency conflicts shape control rights and how creditor incentives influence their exercise over time.

Covenant Violation. A breach of a financial covenant constitutes a technical default that grants creditors the right, but not the obligation, to accelerate repayment of the outstanding loan balance. In practice, however, creditors rarely exercise this right mechanically. Instead, violations trigger a range of responses that depend on the severity of the breach, the financial condition of the lender, and the relative bargaining positions of the parties.

At one end of the spectrum, creditors may grant a waiver, temporarily forbearing enforcement in exchange for modest concessions or enhanced monitoring rights. More consequentially, violations often initiate renegotiation of the credit agreement, typically resulting in contractionary amendments such as higher interest rate spreads, reduced credit availability, shortened maturities, additional collateral requirements, or tighter covenant thresholds. These adjustments reflect the shift in bargaining power created by the violation: creditors, now holding the acceleration threat, can extract terms that would have been difficult to obtain under normal contracting conditions.

Beyond these formal contractual adjustments, creditors may also intervene infor-

mally outside the written contract. Lenders may pressure management through board channels, condition waivers on operational or strategic changes, restrict dividend payments or asset sales, or demand governance reforms as a prerequisite for forbearance. In more severe cases, creditors may push for executive turnover, effectively using the control rights unlocked by the violation to reshape the firm's leadership. These interventions are less visible than formal contract amendments but can be equally consequential for firm behavior.

Taken together, this spectrum of responses, from quiet forbearance to active governance intervention, reflects the option value embedded in covenant design. A violation does not mechanically trigger acceleration; rather, it reallocates control rights that creditors can deploy selectively during renegotiation. A growing empirical literature documents that these interventions carry significant real consequences, with covenant violations causally affecting corporate investment, financing, employment and governance (e.g., Chava and Roberts [2008], Roberts and Sufi [2009a], Nini et al. [2012], Falato and Liang [2016]).

Covenant Strictness. Covenant strictness is an important dimension of lending standards, determining how readily contractual performance thresholds are likely to be breached. Empirically, it is commonly defined as the ex ante probability that a loan deal experiences a covenant violation (Murfin [2012]). This probability reflects both contractual terms and the borrower's financial condition at origination, and thus provides a deal-level measure of covenant-based creditor governance.

Covenant strictness exhibits both cyclical and secular variation. Lending standards tend to tighten during periods of financial stress, while covenant-lite structures, which relax or omit maintenance covenants, proliferate during credit booms. Beyond these cyclical fluctuations, however, covenant coverage and strictness have declined substantially over time (Berlin et al. [2020]). These changes have implications for creditor governance: a lower ex ante probability of violation reduces the likelihood that contractual intervention rights are activated, even if creditors' responses to violations remain unchanged. The evolution of the governance role of financial covenants therefore depends not only on how creditors exercise control when violations occur, but also on how frequently contractual triggers are reached.

2.2 Example

The following description of a loan covenant violation, reported by Purple Innovation Inc. in a Form 10-Q disclosure filed on August 8, 2023, provides a typical example of

how a violation is handled by the borrower and its lenders:

> As of June 30, 2023, the Company was engaged in discussions with its lenders regarding compliance with certain financial covenants under its 2020 Credit Agreement. On February 17, 2023, the Company entered into a Fifth Amendment to the Credit Agreement, which revised the applicable financial covenants and reduced the amount available under the revolving line of credit to $50.0 million.

Beyond the reduction in the Company's revolving credit availability, the amendment required in connection with these discussions included an explicit limit on maximum growth capital expenditures, capped at $32.0 million for 2023 and $35.0 million for subsequent years, the introduction of new minimum liquidity requirements and enhanced periodic reporting obligations to the lenders, revisions to covenant definitions that increased the likelihood of future covenant violation, and the payment of approximately $2.9 million in amendment fees and related expenses.

This disclosure illustrates how covenant violations often lead to renegotiation rather than immediate acceleration or actual default. The violation prompted an amendment to the credit agreement that reduced credit availability, imposed additional operational and reporting restrictions, and required amendment fees. In addition, revisions to covenant definitions increased the likelihood of future violations. Overall, these changes reflect a broader restructuring of the contractual relationship following a covenant breach, highlighting how violations frequently lead to contractionary renegotiation and creditor oversight.

3 The Model

This section develops a partial-equilibrium framework that rationalizes the design and enforcement of financial covenants, which are central to the following empirical analysis. After financing is raised, entrepreneurs must choose unobservable effort to improve the distribution of the cash flow. Following Innes [1990] and Holmstrom and Tirole [1997], limited liability and contractual monotonicity make debt the optimal incentive contract. While debt governs the allocation of cash flows, the non-contractibility of interim actions creates a role for the allocation of control rights as an additional instrument for mitigating agency conflicts. In the spirit of Aghion and Bolton [1992] and Dewatripont and Tirole [1994], financial covenants arise to allocate contingent control rights between entrepreneurs and lenders. Covenants thus make up for a lack of cash-

flow pledgeability, by allowing lenders to intervene when firm performance deteriorates.

3.1 Setup

The economy consists of two types of agents: entrepreneurs and lenders. Time is discrete, with two dates, $t = 0, 1$. At $t = 0$, financial contracts are written and investment decisions are made; at $t = 1$, project returns are realized and contractual claims are settled. Both entrepreneurs and lenders are risk neutral. There is a single homogeneous consumption good that can be consumed, stored at the risk-free rate, or invested in the project. The opportunity cost of borrowing is exogenous and equal to $1 + r$.

Technology. There is a continuum of entrepreneurs who differ only in their net worth N.[2] Each entrepreneur has limited internal resources and must therefore rely on external financing from a competitive lending market, represented by a deep-pocket lender. Each entrepreneur has access to a single investment opportunity characterized by a decreasing-returns-to-scale (DRS) technology that uses the consumption good as an input and generates verifiable profits.

An investment of size k at date 0 generates profits $\omega \cdot k^\alpha$ at date 1, where $\alpha \in (0, 1)$ governs the curvature of the production technology. The idiosyncratic productivity shock ω is distributed on $[0, \infty)$, with cumulative distribution function $F(\omega)$ and twice continuously differentiable density $f(\omega)$.

Hidden effort. The model features a moral hazard friction arising from a hidden-action problem: immediately after the contracting stage at date $t = 0$, the entrepreneur must exert costly, unobservable effort to influence the distribution of project profits.

Specifically, the entrepreneur chooses between two effort levels, $e \in \{e_H, e_L\}$. Low effort e_L provides a private per-unit benefit B but does not improve project outcomes, whereas high effort e_H yields no private benefit and shifts the distribution of ω in the sense of first-order stochastic dominance. Formally, I assume that the probability density satisfies the monotone likelihood ratio property (MLRP): for any interim action a (see below), the likelihood ratio

$$\frac{f_{H,a}(\omega)}{f_{L,a}(\omega)}$$

is strictly increasing in ω.

Low effort is socially inefficient because the private benefit B is smaller than the expected productivity gain from high effort, $\varphi := E_H[\omega] - E_L[\omega]$. Specifically, $B < \varphi$, so

[2] The literature alternatively refers to this concept as initial wealth, internal capital, or cash on hand, typically interpreted as liquid resources, such as cash or marketable securities, that can be used to cover the cost of marginal investment.

high effort is socially efficient. The optimal contract must therefore provide incentives for the entrepreneur to exert high effort.

Performance signal. After the choice of hidden effort, a verifiable and contractible performance signal arises naturally, which provides information about the entrepreneur's unobservable effort, as Chaigneau, Edmans, and Gottlieb [2022]. In practice, such signals may correspond to accounting-based financial metrics, including short-term revenue, debt-to-EBITDA ratios, or interest coverage ratios.[3]

For simplicity, the signal is binary $s \in \{0, 1\}$. Let

$$\nu := \Pr(s = 0 \mid e = e_H)$$

denote the probability of a low signal under high effort, and let

$$\delta := \Pr(s = 0 \mid e = e_L) - \Pr(s = 0 \mid e = e_H) > 0$$

measure the informativeness of the signal about effort. Thus, a low signal occurs with probability ν under high effort and $\nu + \delta$ under low effort. A larger δ indicates that the signal more clearly distinguishes between high and low effort. According to Holmström [1979], any signal should be included in a contract if it provides incremental information about the agent's performance, so the contract should be contingent on the signal. However, I assume that drafting a complex contract contingent on the signal entails a linear cost of $\psi \cdot k$ for the entrepreneur, as compared to a simple contract that does not depend on the signal. This assumption introduces a tradeoff: the entrepreneur must weigh the benefit of improved cash-flow pledgeability against the associated contracting cost, which determines an important dimension of debt structure.

Interim action. At an intermediate date $t = 0.5$, there is an opportunity to take an interim action $a \in \{A, N\}$, where A denotes *Action* and N denotes *No Action*.[4] This decision captures operational choices made after investment but before project outcomes are realized, such as day-to-day management effort, adjustments to investment scale, refinancing decisions, or personnel choices. [5]

[3]For example, a one-year loan may contain a financial covenant requiring the ratio of total debt to EBITDA to remain below four in any given quarter. In this case, both parties observe the quarterly debt-to-EBITDA ratio as an interim signal that reflects managerial practices and provides information about future earnings, which directly affect the firm's ability to repay the loan.

[4]If the interim action and the status quo are fully contractible at the design stage, the contract can simply stipulate which course of action will be carried out. In this case, the identity of the party implementing the action is immaterial, and the notion of control right would be meaningless. Control rights become relevant when the contract cannot fully specify the course of action ex ante, leaving the choice to a party's discretion.

[5]Given the timing of decisions, the unobservable effort choice is independent of the interim action a.

The action A improves output by shifting the distribution of productivity ω according to first-order stochastic dominance. In particular, it increases expected productivity:

$$\tau := \int_0^\infty \omega \left(f_{H,A}(\omega) - f_{H,N}(\omega) \right) d\omega = \int_0^\infty \omega \left(f_{L,A}(\omega) - f_{L,N}(\omega) \right) d\omega > 0.$$

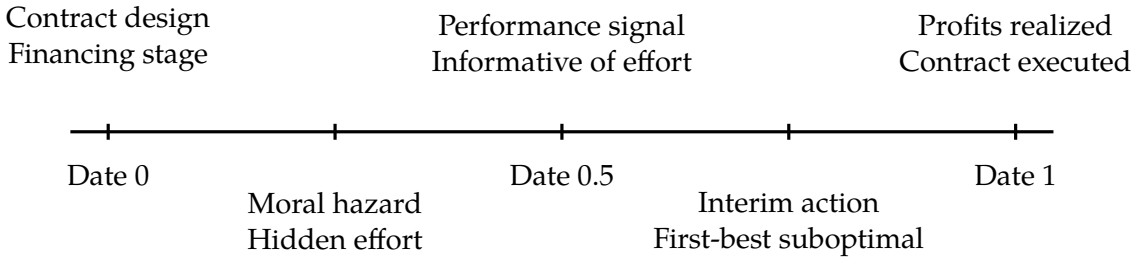
However, undertaking the action entails two costs. First, it reduces the investment scale by a proportion γ. Second, it imposes a private non-pecuniary cost χ to the entrepreneur only. Overall, taking action brings negative net present value (NPV), as

$$\chi > \tau.$$

Thus, the action is socially inefficient from a first-best perspective. Nevertheless, as shown below, it may arise in equilibrium because it can serve as an instrument for providing incentives through financial contracts.

Timeline. The sequence of events is as follows. At date 0, the entrepreneur and the lender negotiate a financing contract and investment takes place. The entrepreneur then privately chooses the level of effort. At the interim date $t = 0.5$, an effort-informative and contractible performance signal is realized, and then the interim action decision is made. At date 1, project profits are realized and contractual payments are settled.

Figure 1: Timeline of within-period events



3.2 Optimal Financial Structure

Assumption 1. *The interim action is contractible initially.*

I first analyze the financing contract contingent and not contingent on the signal separately, and then characterize the endogenous choice between them.

Complex contract. If the signal is included, the financing contract between an entrepreneur and a lender consists of the following elements. First, an investment scale

$k \in [\underline{k}, \infty)$, and thus net borrowing $k - N$. Second, an effort choice $e \in \{e_H, e_L\}$. Third, a contingent action rule q_s, which denotes the probability of taking action $a = A$ conditional on signal s. Finally, a repayment schedule to the lender $\{P_s(\omega, k)\}$. For convenience, I write the repayment as $\{P_s(\omega) \cdot k^\alpha\}$.[6]

I further impose two restrictions on lender repayment $P_s(\omega)$ as in Innes [1990]. First, both parties enjoy limited liability:

$$0 \leq P_s(\omega) \leq \omega, \quad \forall s. \tag{1}$$

Second, only monotone contracts are feasible, such that repayment is weakly increasing in realized productivity:

$$P_s(\omega + \epsilon) - P_s(\omega) \geq 0, \quad \forall s, \ \forall \epsilon > 0. \tag{2}$$

The entrepreneur solves the following contracting program if the signal is acquired. At date 0, the entrepreneur makes a take-it-or-leave-it offer to the representative lender in order to maximize one's expected payoff,

$$\begin{aligned} \max_{\mathbb{A}, \{P_s(\omega)\}, k} \quad & \nu \left\{ k^\alpha \int_0^\infty (\omega - P_0(\omega)) \Big[q_0 (1-\gamma)^\alpha f_{H,A}(\omega) + (1-q_0) f_{H,N}(\omega) \Big] d\omega \ - \ q_0 \chi k^\alpha \right\} \\ & + (1-\nu) \left\{ k^\alpha \int_0^\infty (\omega - P_1(\omega)) \Big[q_1 (1-\gamma)^\alpha f_{H,A}(\omega) + (1-q_1) f_{H,N}(\omega) \Big] d\omega \ - \ q_1 \chi k^\alpha \right\} - \psi k, \end{aligned} \tag{3}$$

subject to the following constraints:

1. lender's participation constraint (PC), requiring that the expected payoff is no less than the opportunity cost of lending,

$$\begin{aligned} & \nu \, k^\alpha \int_0^\infty P_0(\omega) \Big[q_0 (1-\gamma)^\alpha f_{H,A}(\omega) + (1-q_0) f_{H,N}(\omega) \Big] d\omega \\ & + (1-\nu) \, k^\alpha \int_0^\infty P_1(\omega) \Big[q_1 (1-\gamma)^\alpha f_{H,A}(\omega) + (1-q_1) f_{H,N}(\omega) \Big] d\omega \geq (1+r)(k-N), \end{aligned} \tag{4}$$

2. entrepreneur's incentive compatibility constraint (IC), requiring that high effort

[6] This is just a notational simplification and does not imply that $P_s(\omega)$ is independent of k or homogeneous of any degree in k.

is always induced and low effort is off-equilibrium,

$$\begin{aligned}
&\nu\left\{k^\alpha \int_0^\infty (\omega - P_0(\omega))\Big[q_0(1-\gamma)^\alpha f_{H,A}(\omega) + (1-q_0) f_{H,N}(\omega)\Big]d\omega \;-\; q_0\chi k^\alpha\right\} \\
&\quad + (1-\nu)\left\{k^\alpha \int_0^\infty (\omega - P_1(\omega))\Big[q_1(1-\gamma)^\alpha f_{H,A}(\omega) + (1-q_1) f_{H,N}(\omega)\Big]d\omega \;-\; q_1\chi k^\alpha\right\} \\
&\geq (\nu+\delta)\left\{k^\alpha \int_0^\infty (\omega - P_0(\omega))\Big[q_0(1-\gamma)^\alpha f_{L,A}(\omega) + (1-q_0) f_{L,N}(\omega)\Big]d\omega \;-\; q_0\chi k^\alpha\right\} \\
&\quad + (1-\nu-\delta)\left\{k^\alpha \int_0^\infty (\omega - P_1(\omega))\Big[q_1(1-\gamma)^\alpha f_{L,A}(\omega) + (1-q_1) f_{L,N}(\omega)\Big]d\omega \;-\; q_1\chi k^\alpha\right\} + Bk.
\end{aligned} \tag{5}$$

Simple contract. If the signal is not included, the contract covers the following two elements. First, an investment scale $k \in [\underline{k}, \infty)$, and thus net borrowing $k - N$. Second, an effort choice $e \in \{e_H, e_L\}$. And third, a repayment schedule $\{P_s(\omega) \cdot k^\alpha\}$ to the lender. [7]

The entrepreneur thus solves the following contracting program. At date 0, the entrepreneur makes a take-it-or-leave-it offer to the representative lender in order to maximize one's expected payoff,

$$\max_{P(\omega),k} k^\alpha \int_0^\infty (\omega - P(\omega)) f_{H,N}(\omega) d\omega, \tag{6}$$

subject to the lender's participation constraint,

$$k^\alpha \int_0^\infty P_0(\omega) f_{H,N}(\omega) d\omega \geq (1+r)(k-N), \tag{7}$$

and entrepreneur's incentive compatibility constraint,

$$k^\alpha \int_0^\infty (\omega - P(\omega)) f_{H,N}(\omega) d\omega \geq k^\alpha \int_0^\infty (\omega - P(\omega)) f_{L,N}(\omega) d\omega + Bk. \tag{8}$$

In addition, the contract in both cases must satisfy the limited liability constraint (LL) and the monotone contract constraint (MON) as stated in (1) and (2).

3.2.1 First-best

Complete Information benchmark. To establish a benchmark, consider first the case without any information asymmetry. Since $B < \varphi$, high effort e_H is socially efficient.

[7] Since $\chi > \tau$ by assumption, the entrepreneur's payoff is strictly negative for any choice of action, and hence $q = 0$ is optimal in this case.

Moreover, the interim action A is also socially inefficient because its expected productivity gain is smaller than its private cost, $\chi > \tau$. Hence, the first-best allocation features high effort and no interim action. Since effort incentives are no longer a concern, signal has no additional value.

Let $\mu_\omega := E_{H,N}[\omega]$ denote expected productivity under high effort and no interim action. The first-best level of investment maximizes total surplus:

$$k^{fb} = \arg\max_k \mu_\omega k^\alpha - (1+r)k = \left(\frac{\alpha \cdot \mu_\omega}{1+r}\right)^{\frac{1}{1-\alpha}}. \tag{9}$$

Implementation without limited liability. Now reintroduce the hidden effort problem without the limited liability constraint. Although effort remains unobservable, the first-best allocation can still be implemented through a franchise contract. The key insight is that risk neutrality eliminates the trade-off between incentives and risk-sharing, while unlimited liability permits the use of penalties to induce effort without leaving the entrepreneur agency rents. In particular, the lender can impose negative payments on the entrepreneur in states of sufficiently poor performance, making the threat of punishment a less costly means of providing incentives than leaving rents in states of good performance.

Under the franchise contract, the lender receives a constant repayment equal to $\mu_\omega \cdot (k^{fb})^\alpha$, while the entrepreneur receives the residual, $(\omega - \mu_\omega) \cdot (k^{fb})^\alpha$. As the residual claimant, the entrepreneur internalizes the productivity gains from high effort; since $B < \varphi$, high effort is incentive compatible. The entrepreneur earns zero expected rent under the contract, while the allocation remains first-best. [8]

This contract also eliminates the need for action or signal-contingent contracting. Because the interim action destroys net present value, it is never undertaken; because the franchise contract already provides appropriate incentives for effort, writing a complex contract contingent on signal offers no additional benefit. Thus, in the presence of moral hazard, the first-best allocation can be achieved when the limited liability constraint is absent.

3.2.2 Second-best

Now consider the full model with moral hazard and limited liability constraint. Some agency rent must be rendered to provide incentives for high effort. Moreover, the following result shows that the tradeoff between rent extraction and efficiency can be relaxed by a contingent decision rule on the interim action.

[8] There is a continuum of contracts that implement the first-best outcome.

Proposition 1. (*Performance-sensitive debt with contingency*) *If the performance signal is included, the optimal financial structure is* (*risky*) *debt with* (*i*) *performance pricing grids, whereby higher realized signals are associated with lower promised face values, and* (*ii*) *a contingent action rule, under which no intervention occurs when the signal is high, while a positive probability of action may arise when the signal is low.*

The formal proof is presented in Appendix A.1, and the economic intuitions are as follows.

Optimality of debt. The lender's repayment takes the form of risky debt conditional on the signal, $P_s(\omega) = \min\{\omega, D_s\}$. That is, the lender receives the fixed repayment D_s when the realized idiosyncratic shock ω is sufficient to cover the promised face value; otherwise, the lender recovers the available proceeds, and the entrepreneur receives nothing. As shown by Innes [1990], debt is optimal for providing incentives under the MLRP assumption and restrictions on contractual shape.

The MLRP assumption ensures that realized profits are informative about unobservable effort: high outcomes provide evidence of high effort, whereas low outcomes provide evidence of low effort. As discussed above, the limited liability constraint rules out the use of negative wages to punish entrepreneurs in low-profit states. Consequently, the only way to incentivize effort is to reward entrepreneurs with higher wages in high-profit states. Moreover, contractual monotonicity requires that the entrepreneur's marginal wage cannot exceed one-for-one the increase in profits. The greatest possible reward in high-profit states is therefore achieved by granting the entrepreneur all marginal gains above a constant threshold as the residual claimant. Accordingly, the entrepreneur's wage takes the form of a call option, with the face value of risky debt serving as the fixed strike price.

Performance pricing. The promised face value is signal-contingent. A high signal is associated with a lower face value $D_1 < D_0$, for a high signal implies that entrepreneur is more likely to exert high effort, so the wage should be higher, which is implemented by a call option-shape wage with a lower strike price and larger residual value in the right tail.

Contingent action rule. The optimal action rule prescribes no action following a high signal and allows for a positive probability of action following a low signal, $\mathbb{A} := \{q_0 \geq 0,\ q_1 = 0\}$. The rationale for undertaking the inefficient interim action is purely incentive-related. A low signal is more likely when the entrepreneur has chosen low effort, so the prospect of being required to undertake the costly action serves as a punishment. Conversely, a high signal is more likely under high effort, allowing the entrepreneur to avoid the cost of action and retain the associated agency rent. The contingent action

rule thus establishes a reward-punishment scheme that strengthens effort incentives and increases pledgeable income.

The probability of action following a low signal, q_0, is therefore endogenously determined by the trade-off between incentive provision and productive efficiency. A higher q_0 strengthens incentives, increases pledgeable income, and supports a larger investment scale. However, it also increases the frequency with which the inefficient action is undertaken, reducing the net present value of investment and productive efficiency. The optimal probabilistic action rule balances these competing effects.

Proposition 2. (*Innes, 1990*) *If the performance signal is not included, the optimal financial structure is straight* (*risky*) *debt.*

The choice between the two contracting arrangements reflects a trade-off between incentives and efficiency. Including a performance signal to write a complex contract provides additional information about the entrepreneur's hidden effort, thereby alleviating information asymmetry and mitigating agency frictions. In a variable-scale investment setting, when moral hazard is severe, the benefit of increasing pledgeable income and expanding investment can outweigh the reduction in the entrepreneur's per-unit rent associated with signal inclusion.

The linear cost of drafting a complex contract introduces an additional consideration. Under a decreasing-returns-to-scale (DRS) technology, the marginal benefit of a complex contract declines with investment scale, whereas the per-unit cost remains constant. Consequently, there exists a cutoff investment scale, k^*, below which the benefit of including the signal outweighs its cost and a complex contract is written, and above which the signal is not used and a simple contract is written. Since investment scale increases with initial net worth, this cutoff translates into a net-worth threshold that separates the two contracting regimes.

Proposition 3. (*Endogenous debt structure*) *There exists a cutoff level of net worth, N^*, such that entrepreneurs with lower wealth, $N < N^*$, include the performance signal and offer performance-sensitive debt, whereas entrepreneurs with greater wealth, $N \geq N^*$, do not include the signal and offer straight debt.*

The following result characterizes the optimal financial structure and its associated optimality conditions.

Result 1. *The entrepreneur's constrained optimization problem is concave. In the interior region where both the participation* (*PC*) *and incentive compatibility* (*IC*) *constraints bind, the*

first-order conditions fully characterize the optimal contract. When entrepreneurs are wealth-constrained ($N < N^*$), a performance signal is included and the contract is signal-contingent. These conditions determine the investment scale k, the promised face values $\{D_0, D_1\}$, and the contingent action probability q_0. When entrepreneurs are wealthier ($N \geq N^*$), the signal is not used and the FOCs jointly determine the investment scale k and the single face value D.

For brevity, the full set of first-order conditions and derivations is provided in Appendix A.2.

3.3 Allocation of Control Rights

From now on, I drop **Assumption** 1 and consider the optimal financial structure when the interim action is not contractible initially.

Assumption 2. *The interim action cannot be contracted upon initially, but can contract on who is entitled to decide.*

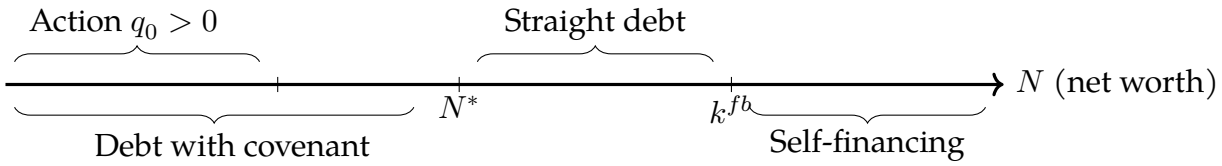
In the complete contracting framework, the entrepreneur and lenders need to design a mechanism to elicit this information and and use it to guide decisions as circumstances unfold. In the spirit of Aghion and Bolton [1992], this mechanism operates through the allocation of control rights in a state-contingent way.[9] Specifically, I show that the contingent action rule characterized in **Proposition** 1 can be implemented through a financial covenant that allocates contingent control rights between entrepreneurs and lenders in an incomplete-contracting environment. The result relies on two properties of the interim action.

Conflict of interests. The interim action creates a conflict of interest between the entrepreneur and lenders. The entrepreneur prefers the status quo because the action entails a private cost while allowing the entrepreneur to capture only part of its benefits, making the action unprofitable. By contrast, the lender has an incentive to favor the action because it benefits from improved project profitability without bearing the entrepreneur's private cost. Consequently, the parties may make different decisions regarding the interim action depending on which party holds the relevant control right.

[9] The commonality with Aghion and Bolton [1992] is that control rights can be contractually allocated even when the future course of action is not specified in the initial contract. The key difference concerns the source of this indeterminacy. Aghion and Bolton [1992] assumes that the state of nature is not contractible, so repayments and future action choices cannot be made contingent directly on its realization. Here, I adopt the complete-contracting perspective as Tirole [2006]: the initial contract is optimal given the parties' limited ex ante knowledge of future preferences and alternatives. Although the interim action itself cannot be specified at the financing stage, the contract can specify which party is entitled to choose the action and the contingencies under which this authority applies.

First-best suboptimality. The interim action is assumed to reduce aggregate welfare and is therefore first-best inefficient. This assumption serves two purposes. First, it generates a conflict of interest between the entrepreneur and the lender. Second, it makes the allocation of control rights economically meaningful. If the interim action were *first-best efficient*, the efficient outcome would involve undertaking the action regardless of the initial allocation of control rights, provided that the parties could renegotiate costlessly. Under the Coase theorem, control rights would not affect the efficient outcome, and the lender would ultimately obtain the authority to undertake the action. [10] Thus, for the endogenous allocation of control rights to play a meaningful role in determining whether the interim action is undertaken, the action must be first-best inefficient.

Result 2. *The optimal financial structure depends on the entrepreneur's initial wealth. When the interim action is not contractible, wealthier entrepreneurs* $(N \geq N^*)$ *issue straight debt, whereas wealth-constrained entrepreneurs* $(N < N^*)$ *issue debt with two additional key features. First, it incorporates performance pricing, such that the promised face value is decreasing in the realized performance signal. Second, it includes a financial covenant that allocates control rights over the interim action in a state-contingent way: under a high signal the entrepreneur retains control, whereas under a low signal control is transferred to the lender with a possibly positive probability.*



The result follows directly from **Result** 1. The numerical algorithm used to solve the system of equations is described in Appendix B. The following text provides some interpretations and associating empirical implications.

The model generates an endogenous choice of signal acquisition, which in turn determines the debt structure. In particular, the extensive margin can be interpreted as the *covenant coverage*, the fraction of firms whose loan contracts include active financial covenants. Wealthier entrepreneurs tend to write simple contracts in the form of straight debt, avoiding covenants entirely. By contrast, entrepreneurs with limited wealth optimally acquire a performance signal and write performance-sensitive debt,

[10] Any form of entrepreneur control, whether pure or contingent, would be renegotiated away because entrepreneurs prefer no action while the lender benefits from its implementation. Since the deep-pocket lender can compensate the entrepreneur for the loss of control, retaining control with the entrepreneur would not be sustainable under costless renegotiation.

which involves including financial covenants. In this context, the cost of signal acquisition is interpreted as the cost of drafting a more complex contract: the additional cost of incorporating a covenant relative to issuing simple straight debt. This prediction aligns with empirical evidence showing that loan agreements for larger and financially healthier firms typically feature fewer restrictive covenants, whereas smaller or financially constrained firms are more likely to have contracts with active covenants. Therefore, the model provides a testable implication for the extensive margin in terms of covenant coverage across firms of different financial capacities.

For firms that are bound by active financial covenants, the model further delivers implications on the consequences of covenant violations.

Financial covenant assigning control rights. Financial covenants serve as contractual tripwires that transfer control rights to lenders when verifiable accounting ratios fall below pre-specified thresholds (Smith and Warner [1979], Rajan and Winton [1995]).[11] The financial covenant characterized in **Result** 2 performs an analogous function. First, it is written on contractible performance measures, namely the realized performance signal. Second, it allocates contingent control rights: when the signal is low, control is transferred to the lender, who implements the interim action with positive probability; when the signal is high, the entrepreneur retains control and no intervention occurs. This way, the financial covenant operationalizes the contingent action rule in an environment where the interim action is not contractible initially. [12]

Covenant violation. In the model, a covenant violation occurs whenever the realized performance signal is low. Conditional on signal acquisition and the inclusion of a financial covenant, a violation occurs with probability ν. This definition closely corresponds to

[11] I focus on financial covenants rather than other contractual provisions, such as affirmative covenants (e.g., requirements to maintain insurance or provide financial statements) or negative covenants (e.g., restrictions on asset sales, dividend payments, or additional borrowing), because financial covenants are the only covenant type that performs a state-contingent allocation of control rights. Affirmative and negative covenants constrain the borrower's action set ex ante but do not alter who holds the right to decide as a function of the firm's realized financial condition. A financial covenant violation, by contrast, automatically transfers control rights to the lender without requiring any discrete corporate action, making financial covenants the natural empirical and theoretical counterpart to the state-contingent control allocation in Aghion and Bolton [1992].

[12] The contingent allocation of control rights is not subject to further renegotiation. When the lender holds control, the entrepreneur would prefer to regain it to avoid the privately costly interim action. However, the entrepreneur is financially constrained, having exhausted borrowing capacity and lacking liquid resources to compensate the lender for relinquishing control. Conversely, when the entrepreneur retains control, the lender has no incentive to acquire it, since the aggregate cost of implementing the action exceeds its expected productivity gain. Thus, the allocation of control rights remains stable following the initial contract. In practice, the transfer of control following a covenant violation is often interpreted as a form of (forced) renegotiation; in the model, however, it reflects the exercise of pre-specified contingent control rights rather than renegotiation of the covenant itself.

the empirical notion of a covenant violation, which is recorded when a financial metric breaches its contractual threshold (Chava and Roberts [2008]). Importantly, violations are *nominal* in the sense that they are triggered mechanically by the contractual threshold being breached and do not, in themselves, determine how the breach is subsequently resolved, whether through waiver, renegotiation, or creditor intervention. In the model, a nominal violation immediately leads to an increase in the loan rate, reflecting the repricing of credit following a breach and the fixed costs associated with covenant violations. Thus, the model delivers a prediction on the intensive margin: the fraction of firms that experience covenant violations in a given period.

Creditor intervention. In the model, a covenant violation creates the possibility of transferring control rights from the entrepreneur to the lender. Conditional on a low performance signal, the lender is assigned control with probability q_0; with probability $1-q_0$, control remains with the entrepreneur. Since the lender prefers to undertake the interim action while the entrepreneur prefers the status quo, this allocation of control rights determines whether the action is implemented. Such creditor intervention has several real effects. First, it improves firm profitability by raising expected productivity. Second, it reduces the scale of investment, capturing the more conservative investment policies that creditors may impose. Third, it imposes a private cost on the entrepreneur, reflecting the loss of benefits associated with continued managerial control.

This mechanism is consistent with empirical evidence showing that some covenant violations are waived (Griffin et al. [2024]), whereas others lead to substantive changes in firms' investment and financial policies. The model therefore generates a testable prediction for the intervention–waiver margin: the fraction of covenant violations that result in creditor intervention rather than being waived. More broadly, the structural framework allows for the quantitative evaluation of the economic consequences of covenant violations. While reduced-form analysis can identify the causal effects of covenant violations on firm outcomes, the structural model makes it possible to quantify the underlying mechanisms and assess their relative contributions.

Covenant strictness. The model distinguishes between two notions of covenant strictness. The first is the ex ante probability of a low signal realization, equivalently, the probability of nominal covenant violation, denoted by ν, which is taken as a parameter. The second is the unconditional probability that the interim action is taken, equal to the product of the probability of a low signal and the conditional probability of creditor intervention given that signal, $\nu \cdot q_0$. In contrast to the nominal violation rate, this second measure is endogenously determined in equilibrium. More generally, stricter covenants correspond to contractual arrangements under which control is transferred to lenders and intervention occurs more frequently in expectation.

This definition provides a theoretical justification to the empirical measure of covenant strictness commonly used in the literature, which is constructed as the ex-ante probability that a borrower violates at least one covenant in the loan package in the period following origination (Murfin [2012]; Demerjian and Owens [2016]).

4 Data, Measurement, and Trends

This section outlines the data and key empirical measures. Section 4.1 describes the data sources, sample selection, and the covenant related variables. Section 4.2 details the construction of empirical measures of covenant coverage, strictness, and covenant violation rate.

4.1 Data and Sample Construction

The datasets are chosen to exploit the fact that technical defaults arise primarily in private debt contracts, which typically contain more numerous and more restrictive covenants than public debt. [13] Consistent with this institutional feature, I focus on the U.S. publicly listed firms and their syndicated bank loans, which provide detailed micro-level information on covenant structures and violations. The empirical analysis therefore combines data from several complementary sources.

Loan and the associated financial covenant data come from the Loan Pricing Corporation (LPC) Dealscan database. The data consist of comprehensive information on syndicated and bilateral private loans made by bank (e.g., commercial and investment) and nonbank (e.g., insurance companies and investment funds) lenders to U.S. corporations since 1984 (see, e.g., Bradley and Roberts [2015]). The information in Dealscan is derived from publicly listed firms' SEC filings and from data provided directly by borrowers and lenders. It includes loan pricing, amounts, and maturities at the facility level, as well as covenant terms at the package level for loans governed by the same lending agreement. Dealscan is sparsely populated before 1996 with few covenant terms, so I drop all observations before 1996. I also employ corresponding 10-Q, 10-K, 8-K SEC filings in the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) database for robustness check.

[13] Bond covenant violations are rare, difficult to date precisely, and typically arise from discrete corporate decisions rather than from passive deterioration in financial condition, making them poorly suited as an identification vehicle for studying creditor control rights. More fundamentally, even when bond covenants are breached, dispersed bondholders cannot easily coordinate to intervene: renegotiation requires exchange offers, tender offers, or formal restructuring. That is a categorically different and far more extreme intervention than the bilateral renegotiation that follows a loan covenant violation and not the creditor control mechanism this paper studies. See Section 2 for further institutional discussion.

Table 1 about here

Table 1 reports the distribution of financial covenant restrictions in the sample of syndicated loans that are extended to non-financial and non-regulated Compustat firms. Financial covenants are prevalent, appearing in 26,895 loan facilities across 17,185 loan packages over the sample period. Among the different covenant types, the most common are maximum debt-to-cash-flow and minimum interest coverage covenants, which appear in 16,996 and 11,681 loan facilities, respectively. Fixed charge coverage covenants are also frequently used, appearing in 10,510 facilities.

Other covenant types occur less frequently but still represent meaningful contractual restrictions, including minimum net worth, maximum leverage ratio, and minimum current ratio covenants. The table also reports the distribution of loan sizes associated with each covenant type. Loans containing leverage and cash-flow-based covenants tend to be associated with relatively large loan amounts, consistent with their widespread use in syndicated lending. Overall, the evidence confirms that cash-flow based covenants constitute the primary financial tripwires in private credit agreements.

Quarterly firm-level fundamentals and balance sheet data are obtained from the Compustat database. Information on CEO characteristics, compensation, and turnover is drawn from the Compustat ExecuComp database. Following Peters and Wagner [2014], CEO turnovers are classified as forced or routine based on a systematic review of Factiva news reports.[14] Division-level balance sheet data are sourced from the Compustat Historical Segment database. DealScan additionally identifies whether a loan is private-equity-sponsored; I use this indicator in Section 7.3 to provide a market-based interpretation of the structural shift in creditor control documented below.

The starting point for the sample construction is to merge firm data from Compustat with loan information from Dealscan by the updated link à la Chava and Roberts [2008] by matching company names and loan origination dates. I remove all regulated (SIC code 4900-4999) and financial (SIC codes 6000-6999) firms. Observations with missing values for the SIC code, total assets, total liabilities, total sales, common shares outstanding, closing share price, and the calendar quarter of the filing are also excluded from the final sample. I also require that a firm have at least four quarters of data and average book assets greater than $10 million in 2000 USD. Imposing these data restrictions leaves a sample of 12,781 firms and 450,802 firm-quarter observations from the first quarter of 1996 and the fourth quarter of 2020.

[14] A turnover is classified as forced if the CEO is reported to have been dismissed, pressured to resign, or demoted, or if the departure satisfies standard criteria for involuntary separation. Turnovers associated with death, mergers, spinoffs, or interim appointments are excluded.

Table 2 about here

Table 2 reports summary statistics for the firm-level accounting variables used in the analysis, covering 450,802 firm-quarter observations for 12,781 firms over 1996 to 2020. The sample exhibits the right-skewed size distribution typical of Compustat data, with a median firm holding $259 million in total assets compared with a substantially larger mean. Firms maintain moderate leverage (24.5 percent debt-to-assets) and substantial liquidity, with cash holdings equal to 21.6 percent of assets on average. Investment and financing activities are modest on average, with capital expenditures and cash acquisitions representing 1.4 percent and 0.6 percent of assets, respectively, but display substantial cross-sectional dispersion, as do firm growth measures, highlighting the heterogeneity in corporate investment and financing decisions.

4.2 Measures

Based on the constructed data sample, I define four empirical measures that capture the covenant environment and its consequences. First, covenant coverage measures whether a firm is bound by at least one active financial covenant in a given quarter. Second, covenant violation records whether a firm breaches a covenant threshold in a given period. Third, creditor intervention distinguishes violations that are waived from those that trigger consequential renegotiation and active creditor discipline.

Covenant Coverage. Covenant coverage captures whether a firm is subject to at least one active loan contract containing financial covenants in a given quarter. Using the above merged data, for each firm-quarter, a firm is classified as covenant-covered if it has at least one outstanding loan facility that remains active during the quarter and includes one or more financial covenants. The resulting indicator variable equals one when the firm is bound by at least one financial covenant in that quarter, and zero otherwise.

Covenant Violation. A firm is considered to be in violation of a covenant, also referred to as a *technical default*, when the reported value of a stipulated accounting variable breaches the contractual threshold. In this study, a covenant violation is empirically identified in a given fiscal year if any relevant financial measure falls below (or exceeds) its corresponding minimum (or maximum) covenant threshold in at least one quarter within that year. [15] This definition is consistent with the notion of a *nomi-*

[15] As noted by Chava and Roberts [2008], although this definition is conceptually straightforward, its practical measurement presents significant empirical challenges. These include the dynamic nature of

nal violation, whereby a violation is triggered automatically whenever the contractual threshold is breached, regardless of the extent by which the threshold is breached or its subsequent consequences. For robustness, I also employ the SEC-reported covenant violation measure developed by Nini et al. [2012], which identifies violations using a text-search algorithm applied to firms' 10-Q, 10-K, and 8-K SEC filings.

Creditor Intervention. Following Roberts and Sufi [2009a] and Griffin et al. [2024], I further classify covenant violations into two categories based on how lenders respond to the breach. The first category consists of *waivers*, in which the violation is formally waived by the lender without any substantive amendment to the loan contract. The second category corresponds to *creditor intervention*, in which the violation leads to a consequential renegotiation of the lending agreement. Such renegotiations typically involve contractionary amendments to loan terms, including increases in loan spreads, reductions in loan commitments, requirements for partial principal repayment, or conditions that force the borrower to raise capital or dispose of assets. In some cases, the disclosure also indicates creditor involvement in the firm's operating or financial decisions. This classification distinguishes between violations that are effectively resolved without altering the contractual relationship and those that trigger active creditor intervention.

4.3 Aggregate Trends

This subsection documents the secular trends in financial covenant use and enforcement: at the loan level, covenant intensity declines and composition shifts from balance sheet toward cash flow-based covenants; at the firm level, covenant coverage and violation rates fall steadily, while intervention intensity conditional on violation rises markedly.

4.3.1 Loan-level Covenant Prevalence

Figure 2 about here

Figure 2 documents the secular decline in covenant intensity in newly originated loans. The average number of covenants per loan falls from roughly 1.5 in 2000 to 0.5 by 2019, the median drops from 2 to 0 after 2010, and the share of loans carrying at least one covenant declines from 65 to 30 percent. Alongside this broad loosening, the

loan agreements, where covenant thresholds may change over the life of the contract and amendments are frequent, rendering the complete evolution of these contracts imperfectly observable to the econometrician. I address all these measurement issues following their methods.

composition shifts away from balance sheet covenants (tangible net worth, fixed charge coverage) toward cash flow-based ones: maximum debt-to-cash-flow covenants peak near 75 percent in the mid-2010s, which is consistent with changes in accounting information precision and technology.

4.3.2 Covenant Coverage and Violation

Figure 3 about here

Figure 3 presents the time-series evolution of financial covenant coverage. The figure reports the share of firms subject to active financial covenants in each quarter, which corresponds in the model to the prevalence of complex debt contracts. The covenant share held steady near 40 percent in the early 2000s before declining to roughly 20 percent by the mid-2010s, consistent with the broader reduction in covenant usage documented in loan-level data.

Figure 4 about here

Figure 4 plots covenant violation rates from 1997 to 2019, distinguishing *any violation* from *new violation*, the latter defined as a violation among firms with no breach in the preceding four quarters. Both series peak in the early 2000s, with any-violation near 15 percent and new-violation near 7 percent, and decline steadily thereafter, reaching below 5 percent and roughly 3 percent respectively by the mid-2010s. These trends confirm that financial covenants as tripwires are triggered less frequently.

Figure 5 about here

Figure 5 plots the annual probability of creditor intervention following a covenant violation, defined as lender responses beyond a simple waiver, such as restrictive amendments or reductions in credit availability. Consistent with Roberts and Sufi [2009a], the intervention rate fluctuated around 30–40 percent in the early 2000s before rising sharply from the mid-2000s onward, stabilizing near 60–70 percent thereafter. This shift indicates that creditors have become substantially more likely to exercise control rights upon violation.

Overall, these trends reveal two reinforcing secular shifts: covenant coverage and violation rates decline steadily, while the intervention rate rises from the mid-2000s onward. Disentangling the quantitative implications of these opposing forces requires a structural framework in which both the covenant inclusion decision and creditor intervention arise endogenously, which the previous section develops.

5 Covenant Violation and Corporate Policies

It is well documented that financial covenant violations are associated with substantial changes in corporate investment, financing, and managerial decisions. As in the model from Section 3, financial covenants allocate contingent control rights to creditors when firm performance deteriorates. A covenant violation therefore represents more than a mechanical breach of a contractual threshold: it triggers a renegotiation state in which lenders may impose tighter borrowing terms, restrict investment, or exert influence over managerial decisions. As a result, violations can alter firms' real and financial policies even when underlying investment opportunities remain unchanged.

Empirically, this mechanism implies that the onset of a covenant violation should lead to observable adjustments in firm behavior that reflect the impact of creditor control rights. Prior studies (Nini et al. [2009]; Nini et al. [2012]; Denis and Wang [2014]; Falato and Liang [2016]) document that violations are frequently followed by reductions in capital expenditures, tighter financing and employment policies, and increased managerial turnover.

In this section, I examine the causal effects of new financial covenant violations on firm-level outcomes using a more recent sample described in Section 4. The outcomes include capital expenditures, accounting-based operating performance, executive compensation and forced CEO turnover. Moreover, I also estimate the effects separately across subperiods to examine how the consequences of covenant violations have evolved alongside the secular decline in violation rates and the increase of creditor intervention. These estimates provide updated empirical moments that help discipline the structural parameters governing the costs and benefits of creditor intervention.

5.1 Covenant Violations and Quasi-Discontinuity

I follow the *quasi-discontinuity* design à la Roberts and Sufi [2009a], which adapts the standard regression discontinuity (RD) framework to the setting of financial covenant violations. The key institutional feature exploited for identification is that financial covenants are written as hard thresholds on specific accounting ratios. When a firm's ratio crosses the threshold, creditors are assigned the control right to accelerate repayment, forcing the borrower to renegotiate. This transfer of control rights is *discontinuous*: it happens regardless of the amount by which the threshold is breached. The discontinuity creates an identification opportunity in that firms on either side of the threshold are similar in their underlying fundamentals but face sharply different creditor relationships.

The full sample covers the period 1996 to 2020. I exclude observations after 2020Q4

to avoid contamination from the COVID-19 forbearance period, during which covenant violations became widespread and creditor responses were substantially altered by regulatory and policy interventions. As a result, violation status no longer reflects quasi-random variation in firm fundamentals, violating the identifying assumption underlying the empirical design. [16]

In contrast to a standard regression discontinuity design, which identifies treatment effects by restricting attention to observations within a narrow bandwidth around a threshold, the quasi-discontinuity approach achieves identification by flexibly controlling for the underlying financial ratios that determine covenant compliance. Rather than limiting the sample to firms close to a specific covenant threshold, the specification includes flexible polynomial functions of the covenant control variables. These terms absorb the smooth, continuous relationship between firm fundamentals and the outcome variables. Identification therefore comes from the residual discontinuity in outcomes associated with entering the covenant-violation state, after removing the smooth variation that can be explained by the continuous functions of the underlying financial ratios. Formally, the specification estimates a first-difference regression of the form:

$$y_{i,t+4} - y_{i,t} = \beta\,\text{Violation}_{i,t} + \theta'\mathbf{X}_{i,t} + \kappa' h(\mathbf{X}_{i,t}) + \lambda'\mathbf{X}_{i,t-4} + \gamma'\mathbf{Z}_{i,t} + \alpha_j + \delta_t + \phi_f + \varepsilon_{i,t}, \quad (10)$$

where $y_{i,t+4} - y_{i,t}$ is the four-quarter change in the outcome of interest for firm i in quarter t. $\text{Violation}_{i,t}$ is an indicator equal to one for a *new* financial covenant violation. $\mathbf{X}_{i,t}$ denotes the vector of six covenant control variables that determine covenant compliance, and $h(\mathbf{X}_{i,t})$ collects higher-order polynomial terms of these variables. $\mathbf{X}_{i,t-4}$ represents the four-quarter lag of the same controls, while $\mathbf{Z}_{i,t}$ is a vector of additional firm-level controls. α_j, δ_t, and ϕ_f denote industry, calendar-quarter, and fiscal-quarter fixed effects, respectively. Standard errors are clustered at the firm and calendar-quarter levels.

The covenant controls $\mathbf{X}_{i,t}$ consist of six variables that capture the ratios most commonly written into financial covenant agreements : the ratio of operating cash flow to lagged total assets; the leverage ratio (total debt to total assets); the ratio of interest expense to lagged total assets; the ratio of net worth to total assets; the current ratio (current assets divided by current liabilities); and the market-to-book ratio. All six are included linearly, squared, and cubed. The firm-level controls $\mathbf{Z}_{i,t}$ include the contemporaneous level and first difference of log assets and of the PPE-to-assets ratio, which

[16] The COVID-19 period is characterized by a sharp, economy-wide deterioration in firm performance that led to a surge in covenant violations driven by a common aggregate shock rather than firm-specific fundamentals. At the same time, creditor responses were materially affected by regulatory forbearance and widespread renegotiation practices, weakening the link between covenant breaches and the exercise of creditor control rights. Consequently, violation events during this period do not represent comparable discontinuities in creditor control, undermining the quasi-discontinuity identification strategy.

absorb variation in firm size, growth, and capital intensity. The fixed effects α_j (38 SIC-based industry dummies), δ_t (calendar quarter dummies), and ϕ_f (fiscal quarter dummies) control for industry-level time trends in outcomes, aggregate macro conditions, and seasonal patterns in financial reporting and violation frequency, respectively.

5.2 Full Sample Corporate Responses

The regression results for the full sample from 1996 to 2020 are presented in Table 3 to 5 for three groups of firm level outcomes: capital and investment, accounting-based performance, executive compensation and managerial turnover rate. Within each panel, columns (1) through (4) present progressively saturated specifications, adding higher-order polynomial controls, lagged covenant controls, and the four-quarter lagged violation indicator in turn. All flow variables, including operating cash flow, capital expenditures, and cash acquisitions are annualized.

Table 3 about here

Table 3 reports estimates of equation (10) for four measures of corporate investment: log asset growth, log PPE growth, capital expenditures, and cash acquisitions (the latter two scaled by average assets). Across all specifications, new covenant violations are associated with economically meaningful investment declines: four-quarter log asset growth falls by 3.3–3.7 percentage points, log PPE growth by 3.4–4.7 percentage points, capital expenditures by 0.4–0.5 percentage points of assets, and cash acquisitions by 0.47–0.78 percentage points. These results are robust to higher-order, lagged, and repeated-violation controls, and thus imply that covenant violations induce more conservative investment policies.

Table 4 about here

Table 4 reports estimates of equation (10) for three measures of operating performance: operating income, sales growth, and operating-cost growth. Across all specifications, new covenant violations are associated with a modest but significant improvement in operating profitability of roughly 1.93 percentage points of average assets, alongside declines in sales growth of 5.1–5.7 percentage points and operating-cost growth of 5.9–7.0 percentage points. These results are robust to higher-order, lagged, and repeated-violation controls, and imply that creditor-induced profitability gains are driven by cost retrenchment rather than revenue expansion.

Table 5 about here

Table 5 reports estimates of equation (10) for the probability of forced CEO turnover within four quarters of a new violation. Across all specifications, new covenant violations increase the likelihood of forced CEO turnover by roughly 3.8 percentage points, with the magnitude stable across covenant controls and lagged variables. These results are consistent with creditors leveraging the threat of acceleration to impose managerial discipline following control rights transfer.

Overall, theses results are qualitatively similar and quantitatively comparable to prior studies (Nini et al. [2009]; Nini et al. [2012]), which implies that the *average impact* of covenant violation, and hence the strength of covenant-based creditor control rights has remained stable across time.

5.3 Subperiod Sample Corporate Responses

The pooled estimates above capture the average effect of covenant violations over the full sample period, but the secular trends documented in Section 4.3 raise the concern that the strength of covenant-based creditor governance has changed over time. To assess this, I split the sample at 2010, a plausible breakpoint from which the covenant violation rate drops sharply, covenant-lite lending surges in the post-crisis credit market, and institutional lenders increasingly displace banks in syndicated lending, and re-estimate the baseline specifications separately for the 1996–2009 and 2010–2020 subperiod samples. Table 6, 7, and 8 report estimates of equation (10) for measures of corporate investment, operating performance, and forced CEO turnover rate, respectively.

Table 6 about here

Table 7 about here

Table 8 about here

The pre-2010 subsample results closely mirror the full-sample findings across all all sets of outcomes. On investment, a new covenant violation reduces four-quarter log asset growth by approximately 3.0 percentage points and PPE growth by 3.1 percentage points, while capital expenditures fall by roughly 0.4 percentage points and cash acquisitions by 0.5 percentage points of average assets,, which indicates an significant investment conservatism upon covenant violation. As for accounting performance, operating income improves by approximately 1.9 percentage points of average assets, with operating costs contracting by 6.4 percentage points against a smaller 5.8 percentage point decline in sales, consistent with cost retrenchment driving the profitability gain.

Finally, forced CEO turnover rises by approximately 4.9 percentage points following a violation, modestly larger than the full-sample estimate of 3.7 percentage points. As such, these results confirm that in the pre-2010 period, covenant-based creditor governance operates through reduced investment, performance enhancement, and heightened managerial discipline.

Tables 9–11 report the post-2010 subperiod estimates. The results reveal an interesting divergence from the pre-2010 period: while the investment and operating performance response to covenant violations remains robust, the impact on managerial discipline has weaken markedly, with effects that are smaller in magnitude and largely lose statistical significance.

Table 9 about here

Table 9 reports post-2010 estimates for the four investment measures. The investment response remains robust relative to the pre-2010 period: four-quarter log asset growth declines by approximately 4.3 percentage points and PPE growth by 4.7 percentage points, compared with 3.0 and 3.1 percentage points before 2010. Capital expenditures continue to fall by roughly 0.4 percentage points of average assets, broadly unchanged from the earlier subperiod. Cash acquisitions decline by approximately 0.5 percentage points of average assets but lose statistical significance. Overall, creditors continue to exert substantial restrictive influence over firms' investment decisions following covenant violations.

Table 10 about here

Table 10 reports post-2010 estimates for the three operating performance measures. The improvement in operating profitability remains broadly stable: the point estimate on operating income stays positive at approximately 1.9 percentage points of average assets, comparable in magnitude to the pre-2010 estimate. The underlying composition shifts modestly, however. The contraction in sales growth eases from 5.8 to 3.6 percentage points and the reduction in operating costs narrows from 6.4 to 4.0 percentage points, with both estimates remaining marginally significant. The overall improvement in operating income is therefore no longer derived entirely from a decrease in operating costs, as the cost and sales channels partially offset each other to a somewhat lesser degree. Overall, the effect of covenant violations on operating performance remains present and directionally stable in the post-2010 period.

Table 11 about here

Table 11 reports post-2010 estimates for the probability of forced CEO turnover within four quarters of a new violation. Covenant-based control rights typically empower creditors to demand substantial organizational changes, up to and including the engagement of turnaround management and the replacement of top executives. However, the post-2010 estimates reveal a starkly different pattern. The point estimates range from 2.1 to 2.6 percentage points across specifications, roughly half the pre-2010 magnitude, and are statistically insignificant throughout. The attenuation is substantial both in economic magnitude and statistical reliability, suggesting that the impact of covenant violations on managerial discipline has decreased remarkably in the post-2010 period, in that covenant violations hardly result in forced CEO turnover.

To further test whether the effect has changed across periods, I re-estimate the baseline specification augmented with an interaction term between the violation indicator and a post-2010 dummy. The estimated difference of around 3 percentage points is marginally significant at the 10 percent level, which points to a meaningful attenuation in the impact of covenant violations on the probability of forced CEO turnover and, more broadly, in their managerial discipline effect.

6 Estimation and Identification

This section discusses the structural estimation method and identification strategy.

6.1 Estimation

Most of the model parameters are estimated using the simulated method of moments (SMM). However, a small number of objects are calibrated directly from the data. In particular, the risk-free interest rate, r, is set equal to 0.014, corresponding to the average three-month Treasury bill rate net of the rate of growth of the Consumer Price Index over the sample period.

In the estimation and quantitative analysis that follow, the contracting environment developed in Section 3 is interpreted in fully *normalized* form. Rather than working with balance-sheet levels as is common in the moral hazard literature (see Holmstrom and Tirole [1997]; Tirole [2006]), all variables are expressed in units scaled by firm total assets, so that the model operates in intensity rather than level space. The state variable N, the entrepreneur's net worth relative to firm scale, is accordingly defined as *internal financing capacity*, and the decision variable k as *marginal investment intensity*. External financing is given by $k - N$, and all other equilibrium objects, including repayment

schedules, are are likewise expressed in normalized units. [17]

Taking the normalized model to the data requires an empirical counterpart to internal financing capacity, N. Rather than imposing a parametric distribution, I measure internal financing capacity directly from Compustat as the firm's net worth ratio, defined as shareholders' equity divided by total assets:

$$N_i = \frac{\text{Shareholders' Equity}_i}{\text{Total Assets}_i} \in (0, 1).$$

To ensure strict positivity as required by the model, I impose a lower bound $\underline{N}$ on the empirical measure. I then treat the resulting empirical distribution of N_i as exogenous in estimation: simulated firms are generated by repeatedly drawing from this distribution, allowing the model to match the observed cross-sectional heterogeneity in internal financing capacity and hence other financial decisions.

The remaining nine parameters are estimated via SMM: the curvature of the profit function, α, the expectation of idiosyncratic productivity under high effort and no action, $\mu_\omega := E_{H,N}[\omega]$, the log volatility of idiosyncratic productivity, σ_ω, the improvement in expected productivity of high effort, $\varphi := E_{H,\cdot}[\omega] - E_{L,\cdot}[\omega]$, the private benefit of low effort, B, the improvement in expected productivity from interim action, $\tau := E_{\cdot,A}[\omega] - E_{\cdot,N}[\omega]$, the managerial cost of interim action, χ, the probability of low signal under high effort, ν, and the informativeness of the performance signal, δ.

Although computationally intensive, the SMM procedure is conceptually straightforward. For a given parameter vector, I simulate a cross-section of firms by drawing net worth from the empirical distribution of N and solving the optimal contract for each firm. This yields model-implied outcomes, which are used to construct a vector of simulated moments. In parallel, I compute the corresponding vector of empirical moments from the data sample. The SMM estimator selects the parameter vector that minimizes the weighted distance between simulated and empirical moments. This procedure ensures that the model reproduces key features of the joint distribution of firm investment, profitability, and financial structure observed in the data.

[17] This normalization is necessary for empirical implementation. Structural corporate finance models that map equilibrium objects directly into balance-sheet quantities, such as total assets or operating income scaled by total assets, implicitly require a model of asset accumulation and accounting measurement that is absent from the present contracting framework. Total assets in Compustat reflect historical investment, depreciation conventions, and scale effects that are not state variables in the contracting problem, so that variables such as oibdpq/atq lack a direct structural counterpart in the model. The normalization adopted here ensures that all model objects correspond to contracting-relevant intensities, maintaining consistency between the theoretical framework and the empirical moments used in estimation.

6.2 Model Identification

The effectiveness of SMM relies on model identification, which requires selecting moments that are sensitive to variations in the structural parameters. I now describe and motivate the set of moments that I choose to match. Because the firm's real and financial decisions are interdependent, all of the model parameters affect all of these moments in some way. However, it is still meaningful to categorize the moments broadly into three groups: those reflecting technology, those capturing moral hazard frictions, and those representing covenant and control rights.

The first group of moments is designed to identify the technology parameters governing project profitability and scale. Consistent with the normalized interpretation of the model, these moments are derived from equilibrium financing outcomes rather than accounting profitability ratios. The first moment is the cross-sectional elasticity of loan spreads with respect to net worth, $\frac{\text{Cov}(\log spread, \log N)}{\text{Var}(\log N)}$, which is primarily sensitive to the curvature parameter α. A higher α amplifies the responsiveness of optimal investment intensity to internal capital, thereby strengthening the dependence of equilibrium spreads on net worth. The second moment is the cross-sectional variance of log external financing intensity, $\text{Var}\left[\log\left(1+\frac{k-N}{N}\right)\right]$, which is primarily sensitive to productivity volatility σ_ω. In the model, more productive firms optimally choose higher investment k, which requires greater external financing. Greater dispersion in idiosyncratic productivity therefore translates into greater dispersion in firms' reliance on external capital relative to internal net worth. This moment thus captures the cross-sectional heterogeneity in financing needs generated by the productivity process, providing direct identification of σ_ω. The third moment, $\mathbb{E}\left[\log\left(1+\frac{k-N}{N}\right)\right]$, captures average external financing intensity and is sensitive to expected log-productivity μ_ω. A higher expected productivity raises total surplus, relaxes the lender's participation constraint, and allows firms to sustain larger net borrowing relative to internal capital.

The next three moments capture the key features of the moral hazard friction. The first is the investment–internal capital sensitivity discussed in Section 6.3 following Lamont [1997], which provides the important source of identification for the moral hazard parameters. In the model, variation in net worth N induces differences in the optimal investment scale $k(N)$ through the financing constraint. Since the model is static, there is no time-series notion of shocks. Instead, we interpret ΔN and Δk as cross-sectional differences across firms. That is, for two firms that differ in their initial wealth, a higher level of internal capital ΔN leads to a change in the optimal investment scale Δk through the endogenous financing contract. The model-implied analog of the empirical investment–cash flow sensitivity is therefore the population projection

coefficient of $(k - N)$ on N across firms, simulated at a given parameter vector Θ:

$$\hat{\pi} \xrightarrow{p} \pi(\Theta) \equiv \frac{\text{Cov}_\Theta(k(N) - N,\, N)}{\text{Var}_\Theta(N)},$$

where $\hat{\pi}$ is the estimated investment-cash flow sensitivity in regression 13. Intuitively, more severe moral hazard, reflecting either a larger private benefit B or a smaller productivity improvement φ, tightens the financing constraint, amplifies the sensitivity of investment to internal wealth, and thus raises $\pi(\Theta)$. To separately identify the moral hazard parameters, I additionally target both the unconditional default rate and the default rate conditional on covenant violation, both of which increase with the severity of the agency friction and provide complementary identifying variation.

The next three moments pertain to the performance signal and interim action. I match moments capturing both the extensive and intensive margins of covenant coverage and enforcement: the average share of firms that are have no external borrowing, the average (unconditional) share of firms that are in covenant violation, and the average probability of creditor intervention conditional on violation. These moments are helpful to identify the probability of low signal ν and signal informativeness δ.

Finally, the last set of moments is identified via the quasi-regression discontinuity design discussed in Section 5, which exploits the discontinuity in creditor control rights at the covenant violation threshold. The RDD compares outcomes for firms just above versus just below the threshold, and under the assumption that waivers carry no real consequences, the reduced-form estimate $\hat{\beta}_y$ for outcome y satisfies

$$\begin{aligned}\hat{\beta}_y \xrightarrow{p} \beta_y(\Theta) &\equiv E_\Theta[\Delta y \mid \text{violation, covenant}] - E_\Theta[\Delta y \mid \text{no violation, covenant}] \\ &= E_\Theta\left[q_0 \cdot m_y(\Theta) + (1 - q_0) \cdot 0 \mid N \leq N^*\right],\end{aligned}$$

where q_0 is the equilibrium probability of creditor intervention conditional on violation and $m_y(\Theta)$ is the model-implied effect of active intervention on outcome y, simulated at parameter vector Θ, and the expectation is taken over the distribution of net worth N for covenant-violating firms.[18]

The effects of covenant violations on corporate investment, accounting performance,

[18] These moments match local treatment effects, differences in outcomes across the violation threshold, rather than unconditional levels or dispersions of the model-implied project payoff ωk^α. While ωk^α does not map directly onto *oibdpq/atq* in levels due to the normalization of the model, the treatment effect of creditor intervention on ωk^α corresponds naturally to the treatment effect of covenant violation on *oibdpq/atq* in the data. Formally, if the two objects are related by a multiplicative scaling factor κ, so that $y^{\text{data}} = \kappa \cdot y^{\text{model}}$, then differences across the threshold satisfy $\Delta y^{\text{data}} = \kappa \cdot \Delta y^{\text{model}}$, and κ is absorbed into the relevant structural parameter in estimation rather than requiring explicit unit reconciliation. This multiplicative invariance of RDD coefficients to level scaling makes these moments well-suited to the normalized contracting framework.

and managerial discipline provide direct empirical counterparts for γ, τ, and χ, respectively. The effect on capital expenditures identifies γ through the model-implied decline in investment following creditor intervention, measured empirically by the discontinuity in the four-quarter change in capital expenditures scaled by assets at the violation threshold. [19] The effect on operating income identifies τ through the productivity enhancement from interim action, captured by the positive discontinuity in the four-quarter change in operating income scaled by average assets.

Because the pecuniary cost inferred from forced CEO turnover captures only one observable component of the overall managerial cost of interim action, the estimate based on forced CEO turnover alone cannot adequately identify χ. I therefore use two additional moments for estimation: the average probability of creditor intervention conditional on covenant violation and the semi-elasticity of this probability with respect to firm net worth. A higher action cost χ makes interim action less attractive, implying both a lower conditional intervention probability and a weaker sensitivity of intervention to firm net worth.

6.3 Investment-Internal Capital Sensitivity

6.3.1 Agency Frictions and Internal Capital

A central prediction of models featuring financial frictions is that firm investment should depend not only on the availability of profitable opportunities but also on the firm's internal capital. In the frictionless Modigliani–Miller benchmark, investment is determined solely by the marginal product of capital, and internal cash flow is irrelevant. By contrast, when moral hazard between entrepreneurs and lenders limits the amount of external financing capacity, firms that experience an adverse cash flow shock are unable to fully offset the shortfall through external markets. Investment therefore falls not because project quality has deteriorated, but because the tightening of the borrowing constraint forces a reduction in internally funded expenditure. The sensitivity of investment to instrumented cash flow shocks, holding investment opportunities fixed, thus provides a direct empirical measure of the severity of this friction: a higher sensitivity implies a tighter constraint and a larger wedge between internal and external financing costs.

This subsection builds on Lamont [1997] and exploits the structure of internal capital markets within oil conglomerate firms to identify this sensitivity. When a multidivision firm experiences a cash flow shock in one of its segments, the headquarters

[19] The parameter γ is calibrated directly to the corresponding data moment rather than estimated by SMM, as including it as an SMM parameter would create a collinearity problem.

must decide how to allocate the resulting shortfall across all divisions. If capital markets were frictionless, non-oil divisions could replace any foregone internal funds by borrowing externally at the same cost, leaving their investment unchanged. The observation that investment in unaffected divisions responds to the cash flow shock of the oil segment, even though facing no change in their own investment opportunities, is therefore direct evidence that internal capital is valued above external capital, and constitutes a reduced-form measure of the moral hazard friction I seek to quantify structurally.

6.3.2 Sample and Quasi-Experiment

I construct a firm-annual panel from Compustat Annual Fundamentals and Segments databases over 2010–2019, spanning five years before and after the 2015–16 oil price crash. Oil-dependent firms are defined as those for which at least 25 percent of pre-shock cash flow originates from oil and gas extraction segments (SIC 13), ensuring meaningful exposure to the oil shock while retaining non-oil operations. Firms must have at least two pre-shock observations and at least one identifiable non-oil segment, with non-oil segments conservatively defined to exclude industries related to petroleum or its substitutes. The resulting firm-level panel comprises 12,864 firm-year observations, and the segment-level panel of non-oil segments contains 74,912 observations.

The 2015–16 oil price collapse provides a quasi-experimental shock to firm-level cash flow that is plausibly exogenous to the investment opportunities of non-oil business segments. [20] For non-oil divisions, this shock reduced the cash flow and collateral value of the parent firm's oil segment but did not directly affect their productivity or market demand. Identification therefore relies on the exclusion restriction that the oil price shock affects non-oil segment investment only through the parent's internal capital allocation.

I implement this strategy using a two-stage approach. In the first stage, I estimate the causal effect of the oil shock on firm-level cash flow with a difference-in-differences specification:

$$\frac{\text{Cash Flow}_{j,t}}{\text{Total Asset}_{j,t-1}} = \alpha + \beta \cdot (\text{Oil Firm}_j \times \text{Post}_t) + \gamma X_{j,t-1} + \theta_j + \tau_t + u_{j,t}, \tag{11}$$

where Oil Firm_j indicates oil-dependent firms, Post$t$ equals one for 2015 onward, and $X_{j,t-1}$ includes lagged firm controls such as log assets, leverage, Tobin's Q, sales growth, and cash flow ratio. Firm fixed effects θ_j absorb time-invariant determinants, while year

[20] Between mid-2014 and early 2016, West Texas Intermediate crude fell from approximately \$105 to \$27 per barrel, a nearly 75 percent decline driven by an unexpected surge in North American shale production and OPEC's decision not to curtail output.

fixed effects τ_t capture macro shocks. The coefficient β identifies the differential within-firm change in cash flow for oil-dependent firms relative to non-oil controls.

The instrument isolates the shock-driven component of cash flow:

$$\widehat{\text{Cash Flow}}_{j,t}^{\text{shock}} = \hat{\beta} \cdot (\text{Oil Firm}_j \times \text{Post}_t), \tag{12}$$

excluding contributions from controls and fixed effects to ensure exogeneity.

In the second stage, I estimate investment–cash flow sensitivity at the non-oil segment level:

$$\frac{\text{Investment}_{i,j,t}}{\text{Total Asset}_{j,t-1}} = \delta + \pi \frac{\widehat{\text{Cash Flow}}_{j,t-1}^{\text{shock}}}{\text{Total Asset}_{j,t-1}} + \phi Z_{i,j,t} + \eta_i + \tau_t + \varepsilon_{i,j,t}, \tag{13}$$

where i indexes segments and j parent firms. Investment is segment-level capital expenditure scaled by lagged firm assets, and the instrumented cash flow is lagged by one year to reflect capital budgeting timing. Segment controls $Z_{i,j,t}$ include lagged segment sales growth, revenue share within the firm, and number of segments. Firm and year fixed effects are included, and standard errors are clustered at the parent-firm level. The sample is restricted to non-oil segments of multi-segment firms observed both pre- and post-shock, so identification comes from within-firm differential investment responses rather than compositional changes.

Table 12 about here

The regression results are summarized in Table 12. The first-stage estimates confirm that the 2015–16 oil price collapse generated a large and precisely estimated cash flow shock for oil-dependent firms: relative to non-oil controls, oil firms experienced a decline in cash flow of 8.4 percentage points of lagged total assets ($\hat{\beta} = -0.084$, SE = 0.016), reflecting the sharp compression in operating margins as crude prices fell nearly 75 percent. This differential decline is identified within firm and year fixed effects, isolating the shock-driven component of cash flow from confounding macroeconomic trends or time-invariant firm characteristics.

The second-stage estimates reveal that this instrumented cash flow shock propagates meaningfully to the investment of non-oil segments. A one percentage point decline in firm-level cash flow reduces non-oil segment investment by 4.7 basis points of assets ($\hat{\pi} = 0.047$, SE = 0.017). Since non-oil segments face no direct change in their own productivity or market demand, this response cannot reflect deteriorating investment opportunities; it arises purely through the tightening of the parent firm's internal capital allocation. This identification is precisely what the internal capital markets design is constructed for. The magnitude of the estimate $\hat{\pi}$ thus provides a clean,

reduced-form measure of the severity of financial frictions in the sample: firms cannot costlessly substitute external financing for the lost internal funds, so the oil shock propagates across divisional boundaries and compresses investment in otherwise unaffected segments. This estimated sensitivity serves as the key empirical moment that disciplines the structural model in Section 3.

7 Quantitative Results

This section presents the quantitative results around the paper's central question. I first estimate the model on the full sample to study, within an agency problem framework, the equilibrium relationship between the use and enforcement of covenants and the impacts of covenant violations. I then conduct local sensitivity analysis to examine how the equilibrium relationship responds to perturbations in the underlying structural parameters, tracing how each parameter shapes the different margins of covenants. Next, I re-estimate the model across subperiods to understand how this relationship has evolved with the secular trends in covenant violations and creditor interventions. Finally, I conduct a decomposition exercise to assess the extent to which the rise of private equity (PE) sponsorship accounts for the estimated structural shifts.

7.1 Full Sample Results

Tables 13 and 14 present the central estimation results, with Table 13 reporting actual versus simulated moments, and Table 14 reporting the parameter estimates. All parameter estimates are significantly different from zero, including all estimates of the parameters governing the cost and benefit of interim action and control rights. The estimated model reveals that the equilibrium relationship between covenant use and enforcement, and the impacts of covenant violations is shaped by economically substantial agency conflicts across three dimensions: the hidden effort problem and performance signal structure, measured by private benefit B, effort productivity improvement φ, probability of a low signal under high effort ν, and signal informativeness δ; and interim action and creditor control rights, measured by reduction in capital expenditure γ, managerial cost χ, and performance enhancement τ.

Table 13 about here

Table 14 about here

Moral hazard. The private benefit of low effort is estimated at $\hat{B} = 0.336$, implying that a manager who exerts low effort captures private benefits equivalent to approximately 33.6 percent of the firm's net worth. The effort productivity gain is $\hat{\varphi} = 0.47$, meaning that high effort raises expected productivity by about 47 percent of net worth. This margin provides the reason that financially constrained firms include financial covenants in their borrowing contracts: without the threat of loosing control, the incentive constraint would be so tight that the pledgeable income and investment scale are ineffectively low.

Signal structure. The baseline covenant violation probability is $\hat{\nu} = 0.281$, indicating that unconditionally around 10 percent of firms with covenants trigger a violation in a given year. The signal informativeness parameter $\hat{\delta} = 0.205$ implies the probability of a low signal rises by roughly 20.5 percent under low effort. This information advantage is what makes covenants effective.

Interim action and creditor control. When a violation occurs, creditors intervene with probability $\hat{q}_0$, which is estimated to be approximately 0.46. Conditional on intervention upon violation, investment falls by $\hat{\gamma} = 0.0086$, or roughly 0.86 percent of capital, a modest but economically meaningful reduction. The interim action improves productivity by $\hat{\tau} = 0.24$, but imposes a managerial cost of $\hat{\chi} = 0.257$. This is consistent with the model's mechanism that interim action is costly ex-post, but is valuable ex-ante because the contingent control makes up for limited cash flow pledgeability.

Technology. Baseline productivity $\hat{\mu}_\omega = 1.213$ implies that the average firm generates expected output of approximately 1.23 units per unit of capital raised to the power α. Productivity volatility $\hat{\sigma}_\omega = 0.212$ indicates substantial cross-sectional dispersion in firm-level productivity, which translates into a distribution of equilibrium external financing intensity and credit spreads, in line with the observed heterogeneity in the syndicated loan market. The curvature parameter $\hat{\alpha} = 0.728$ implies modestly diminishing returns to scale, and is close to the estimate in Nikolov and Whited [2014].

7.2 Local Sensitivity Analysis

To quantify the economic magnitude of each dimension of agency conflict and assist in interpreting the parameter estimates, I examine how the key moments of covenant governance respond to targeted perturbations in the structural parameters. I consider 5 percent decreases in each parameter individually, holding all others at their estimated values.

First, the covenant violation rate increases with the severity of the hidden effort problem and decreases with the informativeness of the performance signal structure.

Specifically, a 5 percent decrease in φ and B leads to a 2.27 percent increase and a 5.26 percent decrease in covenant violation rates, respectively. Furthermore, a 5 percent decrease in ν and δ results in 11.74 and 3.95 percent decreases, respectively. However, covenant violation rates do not respond to changes in τ or χ, since entrepreneurs at the margin of offering debt with or without covenants are sufficiently wealthy to retain full control rights and avoid interim action.

Second, the intervention rate increases strongly with the relative benefits of interim action. Specifically, a 5 percent decrease in τ and χ results in a 6.35 percent decrease and a 9.7 percent increase in intervention rates, respectively. Overall, the results confirm that each parameter has an economically meaningful and distinct impact on covenant violation rates and enforcement intensity.

7.3 Secular Trend in Covenants

Section 4.3 documents the secular decline in covenant violation rates and the concurrent rise in intervention rates over the past two decades, revealing that the two margins of covenant governance have diverged over time. This subsection investigates how the equilibrium relationship between covenant use, enforcement, and the impacts of covenant violations has evolved alongside these trends by asking whether and how the underlying agency environment has shifted. To this end, I divide the sample into two subperiods, before and after 2010, and apply the same estimation procedure to each subsample.

7.3.1 A Structural Shift in Creditor Control Rights.

Table 15 reports the estimated parameters on subperiod samples. Two broad conclusions emerge. First, a combination of parameter shifts jointly explains the secular decline in covenant violation and the higher creditor intervention rate observed in the data. Second, the estimates reveal an evolution in the costs and benefits of creditor action in the aftermath of covenant violations.

Table 15 about here

The Wald test on individual parameters indicates that both the performance effect τ and the managerial cost χ of creditor action declined significantly in the post-2010 sample. The estimated performance effect falls from 0.298 to 0.197, a decline of approximately 34 percent, while the managerial cost falls from 0.323 to 0.208, or approximately 36 percent.

These shifts reveal a clear evolution in the costs and benefits of creditor action. Before 2010, creditor intervention operates evenly through the impacts on investment, performance, and management: violations trigger reductions in capital expenditure, improvements in operating performance, and discipline to the management, consistent with an active monitoring and restructuring role. After 2010, the investment and the operating performance effect remain largely intact, but and managerial discipline effect has substantially weakened.

These structural shifts jointly answer the paper's central question of how the equilibrium relationship between covenant use, enforcement, and the impacts of covenant violations has evolved alongside the secular trends. The decline in the costs and benefits of creditor action, captured by the fall in τ and χ, powerfully explains the rise in intervention rates, while the less severe hidden effort problem accounts for the secular decline in violation rates. The two secular trends are therefore governed by distinct structural channels. Through the managerial cost of creditor action χ, the weakening impact of covenant violations on forced CEO turnover translates into higher intervention rates, but is silent on the secular decline in violation rates.

7.3.2 The Rise of PE-sponsorship.

A natural market observable that helps interpret these parameter changes is the rise of private-equity (PE) sponsorship in U.S. corporate lending. In the sample, the share of PE-sponsored borrowers rises from approximately 5 percent in the late 1990s to roughly 18 percent by the post-2010 period, with PE exposure averaging 17.4 percent after 2010 compared with 10.5 percent before. [21] This timing is consistent with the broader expansion of PE participation in leveraged lending following the global financial crisis. Consistent with the structural estimates, simple descriptive regressions show that PE exposure is associated with lower covenant violation rates and, conditional on a violation, a substantially higher probability of creditor intervention (see Appendix F).

The rise of PE sponsorship is economically relevant because it introduces an additional layer of borrower-side governance that can substitute for traditional creditor functions. Unlike dispersed shareholders, PE sponsors actively monitor portfolio firms and possess both the incentives and resources to intervene when performance deteriorates, reducing the marginal role of creditor-imposed managerial discipline. This

[21] Throughout the paper, PE sponsorship refers to a loan-level characteristic rather than the ownership status of the borrower. Following Haque and Kleymenova [2023], a syndicated loan is "PE-sponsored" when a PE fund provides the equity capital for the underlying transaction, typically leveraged buyouts, while lenders provide the debt financing. I classify a firm-quarter as PE-exposed when the firm has an active DealScan tranche with the `Sponsored` indicator equal to 'Yes." Thus, the measure captures PE-sponsored syndicated debt among firms in the Compustat–DealScan sample.

mechanism is consistent with the estimated parameter changes: the easing of the hidden effort problem reflects weaker reliance on external contractual discipline, while the decline in the managerial cost parameter χ indicates that covenant violations impose fewer direct private costs on managers when sponsor oversight is more prevalent.

Recent evidence on PE-sponsored syndicated loans provides further support for this interpretation. Haque and Kleymenova [2023] finds that lenders impose significantly limited punishment upon violations, and PE-backed borrowers retain greater access to credit as compared to non-PE firms. This pattern closely matches the evolution of creditor control identified in the structural estimates: both the cost and benefit of creditor action diminish. Thus, the rise of PE sponsorship offers a plausible market-based interpretation of the estimated structural shift in the micro-channels of creditor control rights and the observed secular trend in covenant violation and enforcement.

7.4 Decomposing the Structural Shift

To understand whether and how the estimated structural shift in creditor control reflects a genuine change in contracting primitives or instead mirrors the secular rise of PE-sponsored borrowers in the syndicated loan market, I implement a reweighting counterfactual following DiNardo, Fortin, and Lemieux [1996]. PE-sponsored firms differ systematically from non-sponsored borrowers in covenant tightness, monitoring intensity, and post-violation outcomes. Their near-doubling of market share between the pre- and post-2010 periods therefore mechanically alters the composition of the estimation sample in ways that may shift estimated structural parameters without any change in the underlying contracting environment.

The reweighting proceeds as follows. For each post-2010 observation i, I construct a scalar weight

$$\pi_i^{\text{CF}} = \frac{\hat{p}(X_i)}{1-\hat{p}(X_i)} \cdot \frac{1-\bar{p}}{\bar{p}}, \tag{14}$$

where $\hat{p}(X_i) = \Pr(\text{post-2010} \mid X_i, \text{PE}_i = 1)$ is estimated from a logit regression of an indicator for the post-2010 period on the full vector of borrower and deal characteristics X_i among PE-sponsored loans, and $\bar{p}$ is the unconditional share of PE-sponsored loans in the pre-2010 sample. These weights rebalance the post-2010 PE subsample so that its covariate distribution matches the pre-2010 PE composition, leaving the non-sponsored subsample unchanged. I then recompute the empirical moment vector on the reweighted sample and re-estimate the structural model to obtain the counterfactual parameter vector $\hat{\theta}^{\text{CF}}_{\text{post}}$.

The total parameter shift decomposes as

$$\underbrace{\hat{\theta}_{\text{post}} - \hat{\theta}_{\text{pre}}}_{\text{total shift}} = \underbrace{\hat{\theta}_{\text{post}} - \hat{\theta}^{\text{CF}}_{\text{post}}}_{\text{PE composition}} + \underbrace{\hat{\theta}^{\text{CF}}_{\text{post}} - \hat{\theta}_{\text{pre}}}_{\text{residual}}, \tag{15}$$

where the PE-composition component isolates how much of the estimated shift is mechanically attributable to the changing borrower mix, and the residual captures genuine evolution in contracting primitives holding composition fixed. If the residual component is small relative to the total shift, the structural change reflects primarily a compositional artifact rather than a change in the economic environment; if it is large, the secular decline in creditor control is a genuine feature of how contracts are written, not merely of who writes them.

Table 16 about here

Table 16 decomposes the post-2010 decline in the performance-effect parameter τ and the managerial-cost parameter χ into a PE-composition component and a residual component. The increase in PE sponsorship accounts for a meaningful but limited share of the estimated structural shift: 24 percent of the decline in τ and 30 percent of the decline in χ. The residual component, which holds the PE composition at its pre-2010 level, accounts for the remaining 76 percent and 70 percent, respectively.

Two conclusions emerge. First, the rise of PE sponsorship meaningfully contributes to the weakening of the managerial channel: the lower estimated managerial cost of creditor intervention among PE-sponsored borrowers is consistent with Haque and Kleymenova [2023], who document more limited managerial punishment following covenant violations in PE-sponsored firms. Second, and more importantly, the dominant share of the structural shift persists after accounting for changing borrower composition, suggesting that the decline in creditor control reflects a broader evolution in how control rights are exercised in syndicated lending rather than a mechanical consequence of PE expansion, such as the rise of non-bank lending and institutional investors.

8 Conclusion

This paper studies the relationship between financial covenant design, enforcement, and the impacts of violations, and how this relationship has evolved alongside the secular trends in violations and post-violation interventions. To answer this question, I develop an optimal contracting model and estimate it using Simulated Method of Moments, targeting causally identified moments from the reduced-form covenant literature.

The full-sample estimates reveal that the two margins of covenant governance are governed by distinct structural channels. Violation rates are primarily shaped by the hidden effort problem and performance signal structure, while intervention rates are largely driven by the costs and benefits of interim action, which is further confirmed by the local sensitivity analysis.

Re-estimating the model across subperiods answers the second half of the research question. The easing of the hidden effort problem accounts for the secular decline in violation rates, while the decline in the costs and benefits of creditor action accounts for the rise in intervention rates. Through the managerial cost of interim action, the weakening impact of covenant violations on forced CEO turnover translates into higher intervention rates, but does not speak to the secular decline in violation rates. The rise of PE sponsorship explains around one quarter of this structural shift, with the reminder reflecting a broader evolution in how creditors exercise control rights in syndicated lending.

This paper helps to bridge the gap between reduced-form identification of the effects of covenant violations and the theory of covenant design within a unified quantitative framework. The model focuses on agency conflicts between entrepreneurs and lenders and is purposefully parsimonious on the lender side. A natural extension is to incorporate lender side frictions and heterogeneity, which would allow the model to speak to the supply-side determinants of financial covenants (Murfin [2012]; Chodorow-Reich and Falato [2022]; Degerli and Wang [2026]). I leave this to future research.

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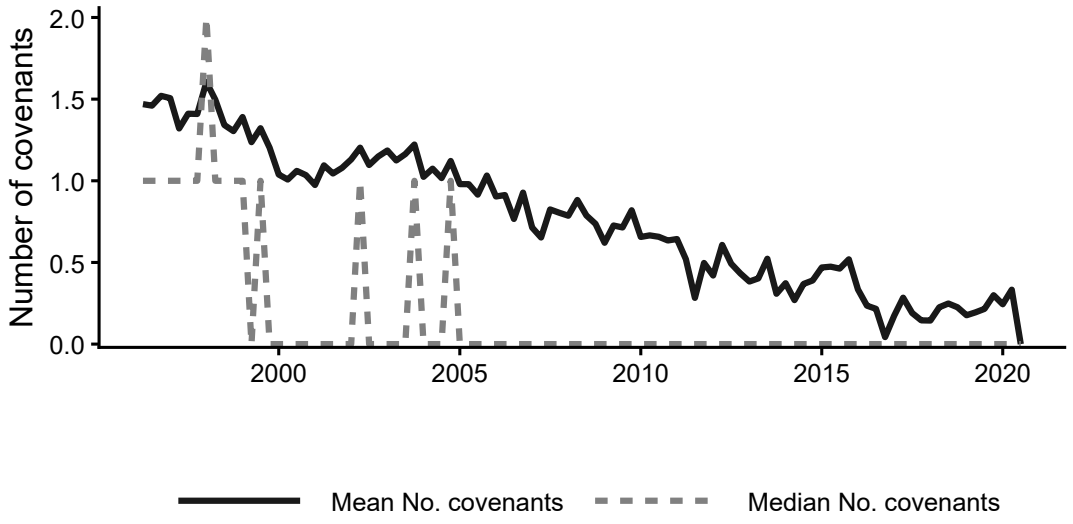
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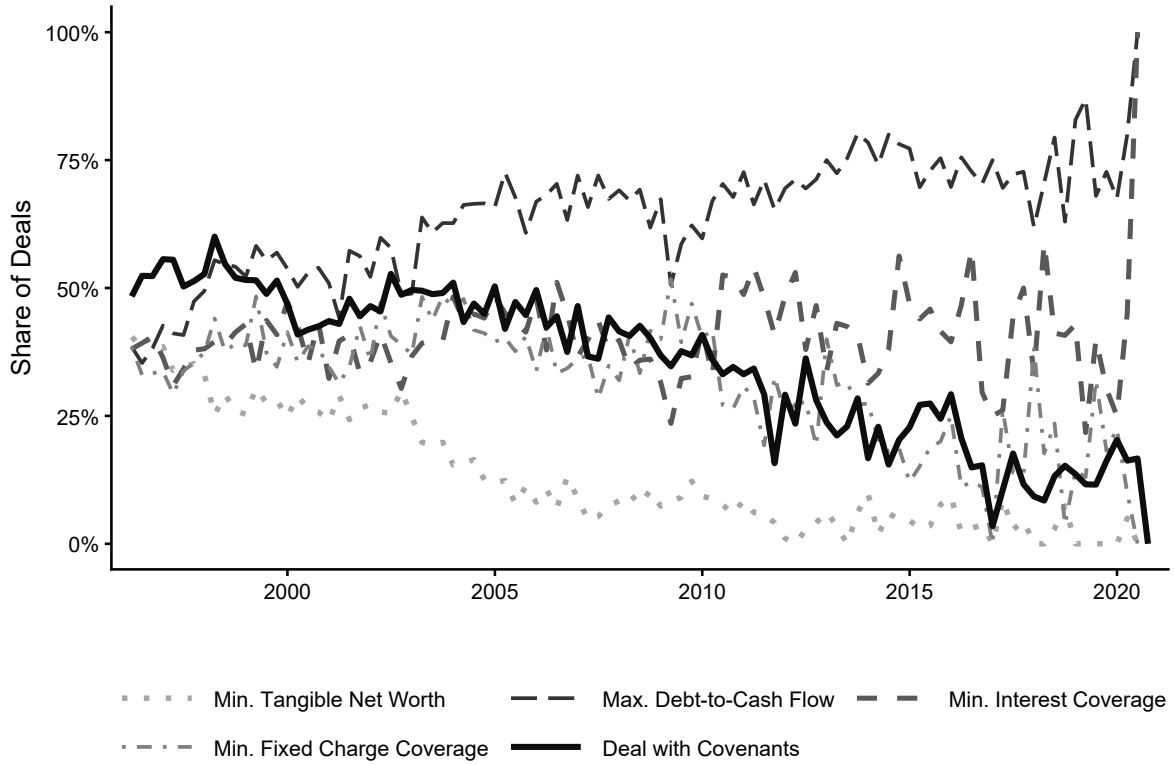
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(a) Panel A: Number of Financial Covenants per Deal



(b) Panel B: Share of Deals with Financial Covenants

Figure 2: Loan (Deal)-Level Financial Covenant Prevalence. This figure plots time-series trends in the use of financial covenants in syndicated loan contracts. Panel A reports the average and median number of covenants per loan, and Panel B reports the proportion of loans containing financial covenants, along with the prevalence of selected four covenant types over time.

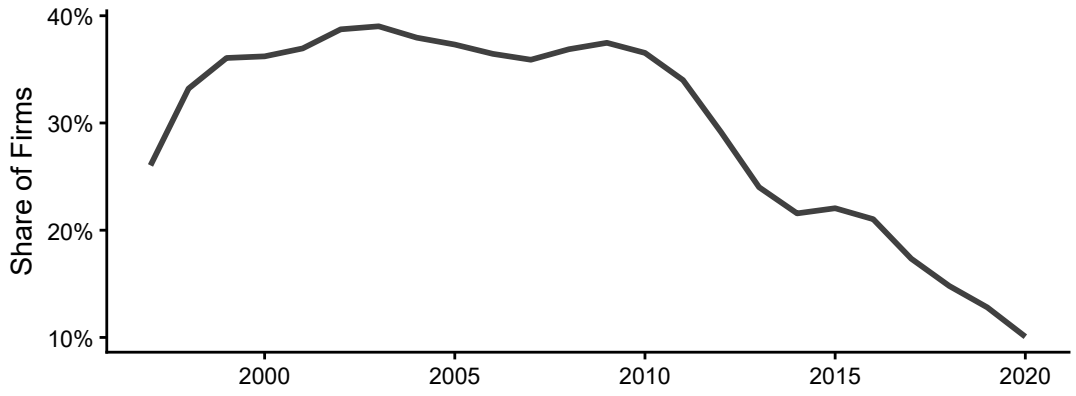


Figure 3: Financial Covenant Coverage Over Time. The figure plots the quarterly share of firms subject to active financial covenants.

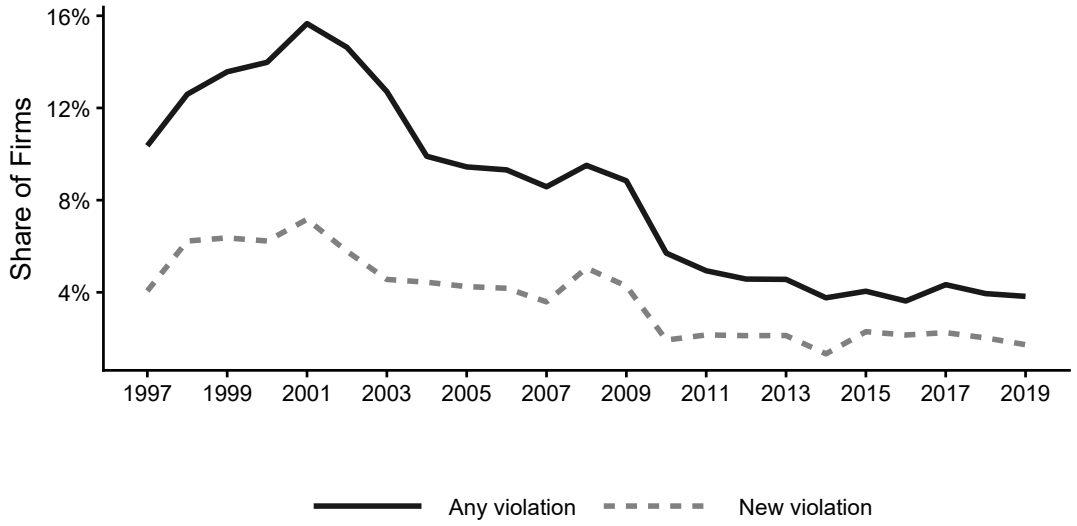


Figure 4: Covenant Violation Rates Over Time. The figure plots the quarterly shares of firms experiencing any covenant violation and a new violation, defined as a breach following four consecutive quarters without a violation.

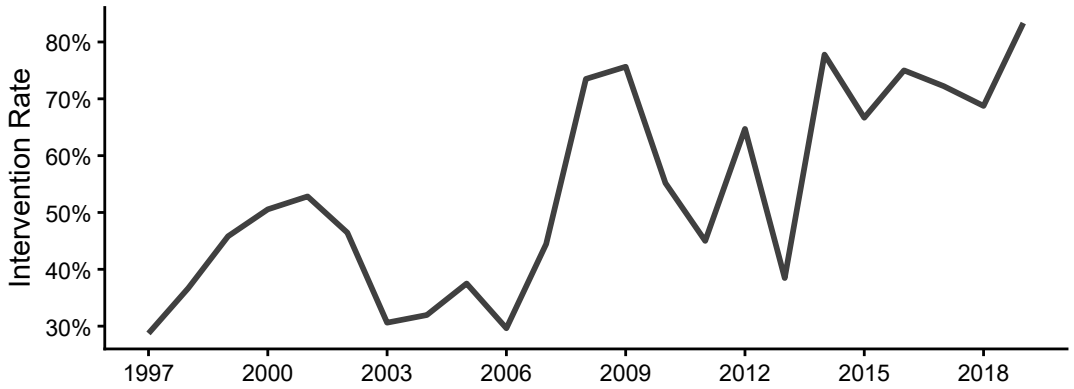


Figure 5: Creditor Intervention Rates Over Time. This figure plots the annual probability that creditors intervene after a covenant violation. The figure shows a pronounced increase with fluctuations in the likelihood of intervention over the sample period.

Table 1: Summary of Financial Covenants

	Number of Facilities	Number of Packages	Loan Amount ($Bil) Average	Median	Total
All Loan Tranche	63747	42101	3.80	0.12	242328.12
All Financial Covenant	26895	17185	0.36	0.10	9553.58
Max. Debt to Cash Flow	16996	10061	0.32	0.12	5521.94
Min. Interest Coverage	11681	6903	0.41	0.15	4794.94
Min. Fixed Charge Coverage	10510	6240	0.17	0.07	1742.47
Min. Tangible Net Worth	4709	3453	0.16	0.02	776.70
Min. Net Worth	4449	2909	0.21	0.08	919.64
Max. Senior Debt to Cash Flow	3376	1734	0.24	0.10	795.42
Max. Debt to Tangible Net Worth	2875	2048	0.12	0.01	341.54
Max. Leverage Ratio	2873	2140	0.53	0.20	1530.47
Min. Current Ratio	2761	1981	0.25	0.03	679.73
Min. Debt Service Coverage	2692	1627	0.23	0.02	629.43
Min. Cash Interest Coverage	413	227	0.24	0.10	97.74
Max. Debt to Equity	239	164	0.59	0.06	142.06
Max. Loan to Value	52	33	0.19	0.08	9.86

Notes: The table presents financial covenant restrictions found in loans to non-financial, non-regulated firms in the intersection of the merged Compustat and Dealscan database between 1996 and 2020. Packages are collections of loans (i.e., tranches) entered into under one collective agreement. Loan Amount is the face value of the loan in billions of USD.

Table 2: Summary Statistics of Firm Characteristics

	N	Mean	SD	10th	Median	90th
Total assets	450,802	4134.636	21700.371	18.298	259.039	6197.198
Total debt	448,216	1232.362	7985.526	0.000	27.243	1917.962
Operating cash flow / average assets	399,882	0.005	0.077	-0.075	0.024	0.063
Leverage ratio	447,925	0.245	0.261	0.000	0.188	0.565
Interest expense / average assets	357,670	0.006	0.008	0.000	0.003	0.013
Net worth / assets	450,511	0.465	0.364	0.113	0.504	0.847
Current ratio	439,771	3.138	3.735	0.797	1.999	6.289
Market-to-book ratio	450,511	2.255	2.319	0.846	1.507	4.273
Change in Ln(assets)	427,798	0.019	0.226	-0.102	0.006	0.121
PPE / assets	449,233	0.256	0.240	0.026	0.173	0.653
Change in Ln(PPE)	420,837	0.022	0.281	-0.082	0.002	0.134
CAPX / average assets	414,557	0.014	0.019	0.001	0.007	0.033
Cash acquisitions / average assets	404,545	0.006	0.024	0.000	0.000	0.006
Net debt issuance / average assets	424,635	0.009	0.073	-0.031	0.000	0.051
Change in Ln(total debt)	347,000	0.017	0.586	-0.218	-0.002	0.266
Cash / assets	450,184	0.216	0.248	0.009	0.112	0.622
Ln(1 + shareholder payout)	422,660	0.925	1.672	0.000	0.000	3.588
Sales / average assets	427,798	0.260	0.212	0.036	0.216	0.525
Operating costs / average assets	399,882	0.259	0.209	0.058	0.207	0.513
Change in Ln(sales)	408,435	0.021	0.424	-0.236	0.022	0.271
Change in Ln(operating costs)	394,624	0.022	0.313	-0.189	0.021	0.233

Notes: This table presents summary statistics for a sample of 12,781 firms and 450,802 firm-quarter observations over the period 1996 to 2020. Obs. denotes the number of firm-quarter observations with non-missing values. 10th, Median, and 90th denote the 10th, 50th, and 90th percentiles, respectively.

Table 3: Impact of New Covenant Violations on Investment Conservatism

Panel A: Asset Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0500^{***}	-0.0367^{***}	-0.0330^{***}	-0.0337^{***}
	(0.0069)	(0.0063)	(0.0061)	(0.0061)
Log assets (level)	-0.0054^{***}	-0.0097^{***}	-0.0101^{***}	-0.0102^{***}
	(0.0013)	(0.0013)	(0.0013)	(0.0013)
PPE / assets (level)	0.0539^{***}	0.0620^{***}	0.0589^{***}	0.0589^{***}
	(0.0121)	(0.0127)	(0.0124)	(0.0124)
Operating income / lagged assets	0.6288^{***}	1.215^{***}	1.203^{***}	1.204^{***}
	(0.0749)	(0.0824)	(0.0804)	(0.0804)
Leverage ratio	-0.0768^{**}	-0.0189	-0.0264	-0.0262
	(0.0231)	(0.0491)	(0.0522)	(0.0523)
Interest expense / lagged assets	$1.169^{\cdot}$	9.716^{***}	9.397^{***}	9.429^{***}
	(0.6205)	(1.937)	(2.009)	(2.010)
Net worth / assets	$0.0394^{\cdot}$	0.1055^{***}	0.1268^{***}	0.1265^{***}
	(0.0205)	(0.0256)	(0.0329)	(0.0329)
Current ratio	-0.0052^{***}	0.0123^{**}	0.0121^{**}	0.0120^{**}
	(0.0008)	(0.0036)	(0.0037)	(0.0037)
Market-to-book ratio	0.0569^{***}	0.1324^{***}	0.1580^{***}	0.1579^{***}
	(0.0022)	(0.0071)	(0.0078)	(0.0078)
New covenant violation $(t-4)$				-0.0279^{***}
				(0.0065)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	192,439	192,439	192,439	192,439
R^2	0.114	0.132	0.138	0.138

Panel B: PPE Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0470^{***}	-0.0382^{***}	-0.0340^{***}	-0.0344^{***}
	(0.0087)	(0.0084)	(0.0083)	(0.0083)
Log assets (level)	0.0014	-0.0021	-0.0025	$-0.0025^{\cdot}$
	(0.0015)	(0.0015)	(0.0015)	(0.0015)
PPE / assets (level)	-0.1867^{***}	-0.1801^{***}	-0.1841^{***}	-0.1841^{***}
	(0.0226)	(0.0225)	(0.0223)	(0.0223)
Operating income / lagged assets	0.6340^{***}	1.025^{***}	0.9512^{***}	0.9519^{***}
	(0.0715)	(0.0900)	(0.0950)	(0.0951)
Leverage ratio	-0.0331	-0.0889	$-0.1389^{\cdot}$	$-0.1388^{\cdot}$
	(0.0252)	(0.0704)	(0.0784)	(0.0784)
Interest expense / lagged assets	2.521^{***}	13.47^{***}	10.85^{***}	10.87^{***}
	(0.6811)	(2.593)	(2.671)	(2.673)
Net worth / assets	0.1154^{***}	0.1889^{***}	0.2295^{***}	0.2293^{***}
	(0.0207)	(0.0310)	(0.0385)	(0.0385)
Current ratio	0.0046^{**}	0.0145^{**}	0.0137^{**}	0.0137^{**}
	(0.0014)	(0.0046)	(0.0046)	(0.0046)
Market-to-book ratio	0.0411^{***}	0.1142^{***}	0.1338^{***}	0.1337^{***}
	(0.0020)	(0.0075)	(0.0085)	(0.0085)
New covenant violation $(t-4)$				$-0.0180^{\cdot}$
				(0.0095)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	191,025	191,025	191,025	191,025
R^2	0.121	0.128	0.131	0.131

Table 3: (Continued)

Panel C: Capital Expenditures / avg. assets | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0050^{***}	-0.0053^{***}	-0.0041^{**}	-0.0040^{**}
	(0.0013)	(0.0013)	(0.0013)	(0.0013)
Log assets (level)	-9.66×10^{-5}	-4.55×10^{-5}	9.97×10^{-5}	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
PPE / assets (level)	-0.0213^{***}	-0.0212^{***}	-0.0217^{***}	-0.0217^{***}
	(0.0022)	(0.0022)	(0.0022)	(0.0022)
Operating income / lagged assets	0.0208^{***}	0.0229^{***}	0.0590^{***}	0.0590^{***}
	(0.0039)	(0.0050)	(0.0076)	(0.0076)
Leverage ratio	-0.0009	-0.0106^{*}	-0.0119^{*}	-0.0120^{*}
	(0.0019)	(0.0047)	(0.0056)	(0.0056)
Interest expense / lagged assets	$0.1039^{\cdot}$	1.192^{***}	1.006^{***}	1.004^{***}
	(0.0529)	(0.1970)	(0.1923)	(0.1925)
Net worth / assets	-0.0012	$-0.0036^{\cdot}$	0.0006	0.0006
	(0.0010)	(0.0019)	(0.0025)	(0.0025)
Current ratio	0.0006^{***}	0.0011^{**}	0.0016^{***}	0.0016^{***}
	(7.57×10^{-5})	(0.0003)	(0.0004)	(0.0004)
Market-to-book ratio	-6.84×10^{-5}	-0.0009	0.0002	0.0002
	(0.0001)	(0.0007)	(0.0007)	(0.0007)
New covenant violation $(t-4)$				0.0022
				(0.0013)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	190,657	190,657	190,657	190,657
R^2	0.044	0.044	0.047	0.047

Panel D: Cash Acquisitions / avg. assets | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0078^{**}	-0.0070^{**}	-0.0048^{*}	$-0.0047^{\cdot}$
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Log assets (level)	-0.0007^{***}	-0.0009^{***}	-0.0007^{***}	-0.0007^{***}
	(0.0001)	(0.0002)	(0.0002)	(0.0002)
PPE / assets (level)	0.0141^{***}	0.0202^{***}	0.0170^{***}	0.0170^{***}
	(0.0015)	(0.0018)	(0.0017)	(0.0017)
Operating income / lagged assets	0.0380^{***}	0.0236^{***}	0.0338^{***}	0.0336^{***}
	(0.0043)	(0.0069)	(0.0086)	(0.0086)
Leverage ratio	-0.0219^{***}	-0.0674^{***}	-0.0871^{***}	-0.0871^{***}
	(0.0023)	(0.0085)	(0.0090)	(0.0090)
Interest expense / lagged assets	-0.2175^{**}	1.266^{***}	-0.0801	-0.0853
	(0.0691)	(0.2909)	(0.3082)	(0.3083)
Net worth / assets	-0.0057^{***}	-0.0134^{***}	0.0050	0.0051
	(0.0014)	(0.0027)	(0.0032)	(0.0032)
Current ratio	0.0013^{***}	0.0056^{***}	0.0079^{***}	0.0080^{***}
	(0.0001)	(0.0006)	(0.0006)	(0.0006)
Market-to-book ratio	0.0020^{***}	0.0080^{***}	0.0078^{***}	0.0079^{***}
	(0.0001)	(0.0008)	(0.0008)	(0.0008)
New covenant violation $(t-4)$				0.0044^{*}
				(0.0021)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	183,921	183,921	183,921	183,921
R^2	0.016	0.018	0.026	0.026

Notes: The table reports OLS estimates with dependent variables measured as four-quarter changes ($h = 4$ quarters). Panel A: asset growth (log difference of total assets). Panel B: PPE growth (log difference of net property, plant, and equipment). Panel C: capital expenditures scaled by average assets. Panel D: cash acquisitions scaled by average assets. *New covenant violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm characteristics and covenant control variables. Higher-order covenant controls add squared and cubic terms; lagged covenant controls add their four-quarter lags; lagged violation adds an indicator for a violation four quarters prior. Standard errors are clustered by firm (gvkey) and calendar quarter. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.10$.

Table 4: Impact of New Covenant Violations on Operating Performance

Panel A: Operating Income / avg. assets | $h = 4$ quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	0.0298^{***}	0.0320^{***}	0.0191^{***}	0.0193^{***}
	(0.0049)	(0.0050)	(0.0042)	(0.0042)
Log assets (level)	0.0103^{***}	0.0092^{***}	0.0063^{***}	0.0063^{***}
	(0.0006)	(0.0006)	(0.0005)	(0.0005)
PPE / assets (level)	0.0249^{***}	0.0287^{***}	0.0240^{***}	0.0241^{***}
	(0.0048)	(0.0045)	(0.0043)	(0.0043)
Operating income / lagged assets	-1.061^{***}	-0.8924^{***}	-1.490^{***}	-1.490^{***}
	(0.0404)	(0.0422)	(0.0561)	(0.0562)
Leverage ratio	0.0384^{***}	0.0670^{**}	-0.0051	-0.0052
	(0.0091)	(0.0200)	(0.0216)	(0.0216)
Interest expense / lagged assets	-1.464^{***}	-2.642^{**}	$-1.360^{\cdot}$	$-1.371^{\cdot}$
	(0.2575)	(0.8266)	(0.7694)	(0.7694)
Net worth / assets	0.0085	-0.0140	-0.0639^{***}	-0.0638^{***}
	(0.0066)	(0.0109)	(0.0140)	(0.0140)
Current ratio	-0.0042^{***}	0.0044^{**}	$0.0028^{\cdot}$	$0.0028^{\cdot}$
	(0.0004)	(0.0015)	(0.0015)	(0.0015)
Market-to-book ratio	-0.0008	0.0010	0.0047	0.0048
	(0.0008)	(0.0032)	(0.0032)	(0.0032)
New covenant violation $(t-4)$				0.0103^{**}
				(0.0033)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	188,372	188,372	188,372	188,372
R^2	0.140	0.149	0.182	0.182

Panel B: Sales Growth (log) | $h = 4$ quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0549^{***}	-0.0508^{***}	-0.0573^{***}	-0.0571^{***}
	(0.0096)	(0.0093)	(0.0091)	(0.0091)
Log assets (level)	0.0075^{***}	0.0051^{***}	0.0032^{*}	0.0032^{*}
	(0.0013)	(0.0013)	(0.0012)	(0.0012)
PPE / assets (level)	0.0324^{*}	0.0645^{***}	0.0638^{***}	0.0638^{***}
	(0.0156)	(0.0155)	(0.0154)	(0.0154)
Operating income / lagged assets	-1.064^{***}	-1.200^{***}	-1.600^{***}	-1.601^{***}
	(0.0745)	(0.0931)	(0.1321)	(0.1321)
Leverage ratio	0.1518^{***}	0.2585^{***}	0.1278^{*}	0.1278^{*}
	(0.0208)	(0.0578)	(0.0599)	(0.0599)
Interest expense / lagged assets	-1.894^{**}	-0.9319	-1.439	-1.447
	(0.6119)	(2.076)	(2.210)	(2.210)
Net worth / assets	0.1418^{***}	0.1651^{***}	0.1019^{**}	0.1020^{**}
	(0.0162)	(0.0262)	(0.0314)	(0.0315)
Current ratio	0.0003	0.0175^{***}	$0.0084^{\cdot}$	$0.0084^{\cdot}$
	(0.0014)	(0.0046)	(0.0046)	(0.0046)
Market-to-book ratio	0.0255^{***}	0.1110^{***}	0.1288^{***}	0.1288^{***}
	(0.0021)	(0.0085)	(0.0088)	(0.0088)
New covenant violation $(t-4)$				0.0067
				(0.0080)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	185,744	185,744	185,744	185,744
R^2	0.057	0.062	0.068	0.068

Table 4: (Continued)

Panel C: Operating Costs Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0672^{***}	-0.0704^{***}	-0.0590^{***}	-0.0592^{***}
	(0.0102)	(0.0101)	(0.0094)	(0.0094)
Log assets (level)	-0.0063^{***}	-0.0097^{***}	-0.0080^{***}	-0.0080^{***}
	(0.0011)	(0.0012)	(0.0011)	(0.0011)
PPE / assets (level)	$0.0196^{\cdot}$	0.0252^{*}	0.0244^{*}	0.0244^{*}
	(0.0108)	(0.0115)	(0.0111)	(0.0111)
Operating income / lagged assets	0.7459^{***}	0.6392^{***}	1.064^{***}	1.064^{***}
	(0.0754)	(0.0743)	(0.1169)	(0.1170)
Leverage ratio	0.0098	0.1565^{***}	0.1508^{**}	0.1509^{**}
	(0.0174)	(0.0428)	(0.0453)	(0.0453)
Interest expense / lagged assets	2.018^{***}	4.047^{**}	2.056	2.067
	(0.4708)	(1.517)	(1.585)	(1.585)
Net worth / assets	0.0912^{***}	0.1261^{***}	0.1381^{***}	0.1380^{***}
	(0.0125)	(0.0175)	(0.0210)	(0.0210)
Current ratio	0.0049^{***}	0.0039	0.0036	0.0035
	(0.0008)	(0.0033)	(0.0034)	(0.0034)
Market-to-book ratio	0.0284^{***}	0.0833^{***}	0.0998^{***}	0.0998^{***}
	(0.0012)	(0.0052)	(0.0057)	(0.0057)
New covenant violation $(t-4)$				-0.0102
				(0.0066)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	188,215	188,215	188,215	188,215
R^2	0.093	0.101	0.108	0.108

Notes: This table reports OLS estimates of equation (10). The dependent variables are measured as four-quarter changes ($h = 4$ quarters). Panel E: operating income scaled by average assets. Panel F: sales growth (log difference of total sales). Panel G: operating costs growth (log difference of total operating costs). *New Covenant Violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm-level controls and covenant control variables. Higher-order covenant controls (Models 2–4) include squared and cubic terms; lagged covenant controls (Models 3–4) include two lags of first differences; lagged violation (Model 4) adds an indicator for a violation four quarters prior. All models include industry, calendar-quarter, and fiscal-quarter fixed effects. Standard errors (in parentheses) are clustered by firm and calendar quarter. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.10$.

Table 5: Impact of New Covenant Violations on Executive Compensation

Panel A: Total Compensation / assets | h = 1 year

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0007^{*}	-0.0008^{*}	$-0.0006^{\cdot}$	-0.0005
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Log assets (level)	-0.0018^{***}	-0.0018^{***}	-0.0018^{***}	-0.0018^{***}
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
PPE / assets (level)	-0.0011^{**}	-0.0017^{***}	-0.0016^{***}	-0.0016^{***}
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Operating income / lagged assets	-0.0076^{***}	-0.0127^{***}	-0.0059^{**}	-0.0059^{**}
	(0.0010)	(0.0016)	(0.0019)	(0.0019)
Leverage ratio	-0.0043^{***}	-0.0096^{***}	-0.0068^{*}	-0.0068^{*}
	(0.0007)	(0.0020)	(0.0025)	(0.0025)
Interest expense / lagged assets	0.0202^{*}	0.0512^{**}	0.0112	0.0106
	(0.0076)	(0.0173)	(0.0219)	(0.0218)
Net worth / assets	-0.0010	0.0009	0.0015	0.0015
	(0.0006)	(0.0008)	(0.0012)	(0.0012)
Current ratio	-0.0002^{**}	-0.0007^{***}	-0.0007^{**}	-0.0007^{**}
	(5.56×10^{-5})	(0.0002)	(0.0002)	(0.0002)
Market-to-book ratio	0.0014^{***}	0.0017^{***}	0.0019^{***}	0.0019^{***}
	(0.0001)	(0.0003)	(0.0003)	(0.0003)
New covenant violation $(t-1)$				0.0002
				(0.0002)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Year, Fiscal Year-End			
S.E. Clustered by	Firm & Calendar Year			
Observations	29,506	29,506	29,506	29,506
R^2	0.326	0.335	0.343	0.343

Panel B: Cash Compensation / assets | h = 1 year

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	$-0.0002^{\cdot}$	$-0.0002^{\cdot}$	-6.64×10^{-5}	-3.93×10^{-5}
	(9.48×10^{-5})	(9.25×10^{-5})	(8.85×10^{-5})	(8.36×10^{-5})
Log assets (level)	-0.0004^{***}	-0.0004^{***}	-0.0004^{***}	-0.0004^{***}
	(3.26×10^{-5})	(3.59×10^{-5})	(3.21×10^{-5})	(3.14×10^{-5})
PPE / assets (level)	-0.0003^{**}	-0.0004^{**}	-0.0003^{*}	-0.0003^{*}
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Operating income / lagged assets	$-0.0006^{\cdot}$	-0.0016^{***}	0.0015^{*}	0.0015^{*}
	(0.0003)	(0.0004)	(0.0006)	(0.0006)
Leverage ratio	-0.0014^{***}	-0.0027^{***}	-0.0033^{***}	-0.0033^{***}
	(0.0002)	(0.0005)	(0.0005)	(0.0005)
Interest expense / lagged assets	0.0104^{***}	0.0239^{***}	$0.0096^{\cdot}$	$0.0088^{\cdot}$
	(0.0022)	(0.0048)	(0.0048)	(0.0050)
Net worth / assets	-0.0003^{*}	0.0002	-0.0002	-0.0001
	(0.0001)	(0.0002)	(0.0004)	(0.0004)
Current ratio	$-9.08\times10^{-5***}$	-0.0002^{***}	-0.0003^{***}	-0.0003^{***}
	(1.33×10^{-5})	(3.87×10^{-5})	(5.04×10^{-5})	(5.20×10^{-5})
Market-to-book ratio	0.0001^{***}	0.0003^{***}	0.0004^{***}	0.0004^{***}
	(1.37×10^{-5})	(6.18×10^{-5})	(6.90×10^{-5})	(6.61×10^{-5})
New covenant violation $(t-1)$				0.0003^{*}
				(0.0001)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Year, Fiscal Year-End			
S.E. Clustered by	Firm & Calendar Year			
Observations	29,506	29,506	29,506	29,506
R^2	0.273	0.279	0.308	0.309

Table 5: (Continued)

Panel C: Forced CEO Turnover | h = 1 year

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	0.0407^{**}	0.0366^{**}	0.0340^{*}	0.0377^{**}
	(0.0132)	(0.0127)	(0.0126)	(0.0134)
Log assets (level)	0.0015	0.0014	0.0012	0.0020
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Δ Log assets	-0.0629^{***}	-0.0613^{***}	-0.0728^{***}	-0.0708^{***}
	(0.0058)	(0.0063)	(0.0075)	(0.0074)
PPE / assets	$-0.0242^{\cdot}$	-0.0388^{*}	-0.0393^{*}	-0.0392^{*}
	(0.0133)	(0.0141)	(0.0142)	(0.0143)
Δ PPE / assets	0.0071	0.0085	-0.0034	0.0010
	(0.0393)	(0.0396)	(0.0406)	(0.0399)
Log employees	-0.0022	-0.0014	-0.0016	-0.0016
	(0.0022)	(0.0022)	(0.0022)	(0.0022)
Operating income / lagged assets	-0.0513^{**}	-0.0816^{**}	-0.0954^{**}	-0.0942^{**}
	(0.0174)	(0.0277)	(0.0310)	(0.0306)
Leverage ratio	-0.0253	-0.0266	-0.0361	-0.0352
	(0.0198)	(0.0629)	(0.0647)	(0.0642)
Interest expense / lagged assets	0.0640	0.2728	0.9916^{*}	$0.8772^{\cdot}$
	(0.1330)	(0.4222)	(0.4398)	(0.4494)
Net worth / assets	-0.0517^{**}	-0.0635^{**}	-0.0860^{**}	-0.0827^{*}
	(0.0142)	(0.0212)	(0.0301)	(0.0304)
Current ratio	-0.0003	-0.0121^{**}	-0.0109^{*}	-0.0105^{*}
	(0.0012)	(0.0041)	(0.0040)	(0.0040)
Market-to-book ratio	-0.0081^{***}	-0.0469^{***}	-0.0538^{***}	-0.0526^{***}
	(0.0016)	(0.0070)	(0.0072)	(0.0072)
New covenant violation $(t-1)$				0.0381^{**}
				(0.0109)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Year, Fiscal Year-End			
S.E. Clustered by	Firm & Calendar Year			
Observations	30,073	30,073	30,073	30,073
R^2	0.025	0.029	0.031	0.032

Notes: This table reports OLS estimates with dependent variables measured as one-year changes ($h = 1$ year) for Panels A and B, and as a five-quarter indicator for Panel C. Panel A: total CEO compensation scaled by total assets. Panel B: cash compensation scaled by total assets. Panel C: forced CEO turnover indicator (equals one if the firm experiences a forced CEO turnover in the quarter of a new covenant violation or in any of the following four quarters). *New covenant violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm-level controls and covenant control variables. Higher-order covenant controls (Models 2–4) include squared and cubic terms; lagged covenant controls (Models 3–4) include two lags of first differences; lagged violation (Model 4) adds an indicator for a violation one period prior. All models include industry, calendar-year (or calendar-quarter for Panel C), and fiscal-year-end (or fiscal-quarter for Panel C) fixed effects. Standard errors (in parentheses) are clustered by firm and calendar year for Panels A and B, and by calendar quarter for Panel C. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.10$.

Table 6: Impact of New Covenant Violations on Investment Conservatism: Pre 2010 Subperiod Sample

Panel A: Asset Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0437^{***}	-0.0316^{***}	-0.0293^{***}	-0.0299^{***}
	(0.0070)	(0.0065)	(0.0064)	(0.0064)
Log assets (level)	-0.0060^{**}	-0.0101^{***}	-0.0106^{***}	-0.0106^{***}
	(0.0017)	(0.0018)	(0.0017)	(0.0017)
PPE / assets (level)	0.0628^{***}	0.0712^{***}	0.0642^{***}	0.0641^{***}
	(0.0162)	(0.0167)	(0.0163)	(0.0163)
Operating income / lagged assets	0.8990^{***}	1.401^{***}	1.308^{***}	1.309^{***}
	(0.1030)	(0.1070)	(0.0973)	(0.0973)
Leverage ratio	-0.0989^{**}	-0.0842	-0.1344^{*}	-0.1344^{*}
	(0.0289)	(0.0609)	(0.0631)	(0.0632)
Interest expense / lagged assets	$1.501^{\cdot}$	13.05^{***}	12.37^{***}	12.42^{***}
	(0.8345)	(2.563)	(2.654)	(2.656)
Net worth / assets	0.0358	0.1157^{***}	0.1048^{**}	0.1045^{**}
	(0.0261)	(0.0325)	(0.0347)	(0.0347)
Current ratio	-0.0043^{***}	0.0194^{***}	0.0189^{***}	0.0188^{***}
	(0.0011)	(0.0049)	(0.0049)	(0.0049)
Market-to-book ratio	0.0580^{***}	0.1324^{***}	0.1583^{***}	0.1581^{***}
	(0.0030)	(0.0097)	(0.0106)	(0.0106)
New covenant violation $(t-4)$				-0.0239^{**}
				(0.0071)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	112,605	112,605	112,605	112,605
R^2	0.137	0.154	0.162	0.162

Panel B: PPE Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0424^{***}	-0.0333^{***}	-0.0303^{**}	-0.0307^{**}
	(0.0093)	(0.0092)	(0.0091)	(0.0090)
Log assets (level)	0.0032	-0.0006	-0.0012	-0.0012
	(0.0019)	(0.0020)	(0.0020)	(0.0020)
PPE / assets (level)	-0.1467^{***}	-0.1434^{***}	-0.1496^{***}	-0.1497^{***}
	(0.0204)	(0.0209)	(0.0213)	(0.0213)
Operating income / lagged assets	0.8927^{***}	1.278^{***}	1.139^{***}	1.139^{***}
	(0.0820)	(0.0992)	(0.1127)	(0.1127)
Leverage ratio	-0.0136	-0.0731	-0.1541	-0.1540
	(0.0338)	(0.0971)	(0.1151)	(0.1151)
Interest expense / lagged assets	2.547^{**}	12.59^{***}	9.764^{**}	9.793^{**}
	(0.9476)	(3.465)	(3.470)	(3.475)
Net worth / assets	0.1290^{***}	0.2240^{***}	0.2562^{***}	0.2560^{***}
	(0.0272)	(0.0466)	(0.0528)	(0.0528)
Current ratio	0.0056^{**}	0.0189^{**}	0.0168^{**}	0.0168^{**}
	(0.0016)	(0.0060)	(0.0060)	(0.0060)
Market-to-book ratio	0.0417^{***}	0.1144^{***}	0.1287^{***}	0.1286^{***}
	(0.0027)	(0.0093)	(0.0104)	(0.0104)
New covenant violation $(t-4)$				$-0.0173^{\cdot}$
				(0.0100)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	111,892	111,892	111,892	111,892
R^2	0.121	0.129	0.132	0.132

Table 6: (Continued)

Panel C: Capital Expenditures / avg. assets | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0048^{**}	-0.0051^{**}	-0.0038^{*}	-0.0038^{*}
	(0.0016)	(0.0016)	(0.0016)	(0.0015)
Log assets (level)	-0.0001	1.54×10^{-6}	0.0002	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
PPE / assets (level)	-0.0236^{***}	-0.0239^{***}	-0.0246^{***}	-0.0246^{***}
	(0.0033)	(0.0034)	(0.0034)	(0.0034)
Operating income / lagged assets	0.0263^{***}	0.0351^{***}	0.0708^{***}	0.0708^{***}
	(0.0061)	(0.0066)	(0.0104)	(0.0104)
Leverage ratio	-0.0043	-0.0277^{***}	-0.0268^{***}	-0.0268^{***}
	(0.0027)	(0.0059)	(0.0068)	(0.0068)
Interest expense / lagged assets	$0.1447^{\cdot}$	2.099^{***}	1.856^{***}	1.855^{***}
	(0.0785)	(0.2520)	(0.2488)	(0.2494)
Net worth / assets	-0.0018	-0.0040	0.0014	0.0014
	(0.0015)	(0.0029)	(0.0035)	(0.0035)
Current ratio	0.0006^{***}	$0.0009^{\cdot}$	0.0015^{**}	0.0015^{**}
	(0.0001)	(0.0005)	(0.0005)	(0.0005)
Market-to-book ratio	-0.0002	-0.0015	-0.0005	-0.0005
	(0.0002)	(0.0010)	(0.0010)	(0.0010)
New covenant violation $(t-4)$				0.0008
				(0.0016)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	111,083	111,083	111,083	111,083
R^2	0.046	0.048	0.050	0.050

Panel D: Cash Acquisitions / avg. assets | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0078^{**}	-0.0071^{*}	$-0.0050^{\cdot}$	$-0.0049^{\cdot}$
	(0.0028)	(0.0029)	(0.0029)	(0.0028)
Log assets (level)	-0.0010^{***}	-0.0013^{***}	-0.0011^{***}	-0.0011^{***}
	(0.0001)	(0.0002)	(0.0002)	(0.0002)
PPE / assets (level)	0.0160^{***}	0.0227^{***}	0.0193^{***}	0.0193^{***}
	(0.0020)	(0.0024)	(0.0022)	(0.0022)
Operating income / lagged assets	0.0444^{***}	0.0307^{***}	0.0335^{**}	0.0332^{**}
	(0.0064)	(0.0088)	(0.0105)	(0.0105)
Leverage ratio	-0.0225^{***}	-0.0718^{***}	-0.0855^{***}	-0.0855^{***}
	(0.0033)	(0.0116)	(0.0122)	(0.0122)
Interest expense / lagged assets	-0.3266^{***}	1.514^{***}	0.0881	0.0777
	(0.0886)	(0.3755)	(0.3709)	(0.3718)
Net worth / assets	-0.0075^{**}	-0.0123^{**}	0.0065	0.0066
	(0.0022)	(0.0039)	(0.0044)	(0.0044)
Current ratio	0.0014^{***}	0.0057^{***}	0.0075^{***}	0.0076^{***}
	(0.0002)	(0.0008)	(0.0009)	(0.0009)
Market-to-book ratio	0.0019^{***}	0.0087^{***}	0.0083^{***}	0.0084^{***}
	(0.0002)	(0.0011)	(0.0011)	(0.0011)
New covenant violation $(t-4)$				0.0058^{*}
				(0.0026)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	107,864	107,864	107,864	107,864
R^2	0.019	0.022	0.029	0.029

Notes: The table reports OLS estimates with dependent variables measured as four-quarter changes ($h = 4$ quarters). Panel A: asset growth (log difference of total assets). Panel B: PPE growth (log difference of net property, plant, and equipment). Panel C: capital expenditures scaled by average assets. Panel D: cash acquisitions scaled by average assets. *New covenant violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm characteristics and covenant control variables. Higher-order covenant controls add squared and cubic terms; lagged covenant controls add their four-quarter lags; lagged violation adds an indicator for a violation four quarters prior. Standard errors are clustered by firm (gvkey) and calendar quarter. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.10$.

Table 7: Impact of New Covenant Violations on Operating Performance: Pre 2010 Subperiod Sample

Panel A: Operating Income / avg. assets | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	0.0299^{***}	0.0318^{***}	0.0189^{***}	0.0193^{***}
	(0.0048)	(0.0051)	(0.0042)	(0.0042)
Log assets (level)	0.0097^{***}	0.0088^{***}	0.0060^{***}	0.0060^{***}
	(0.0007)	(0.0007)	(0.0006)	(0.0006)
PPE / assets (level)	0.0338^{***}	0.0324^{***}	0.0263^{***}	0.0264^{***}
	(0.0055)	(0.0054)	(0.0054)	(0.0054)
Operating income / lagged assets	-1.136^{***}	-0.9328^{***}	-1.509^{***}	-1.510^{***}
	(0.0576)	(0.0562)	(0.0789)	(0.0789)
Leverage ratio	0.0120	0.0259	-0.0617^{*}	-0.0617^{*}
	(0.0104)	(0.0271)	(0.0298)	(0.0298)
Interest expense / lagged assets	-1.292^{***}	-1.510	-0.5560	-0.5821
	(0.3308)	(0.9037)	(0.8579)	(0.8572)
Net worth / assets	-0.0074	-0.0416^{**}	-0.0996^{***}	-0.0994^{***}
	(0.0082)	(0.0138)	(0.0175)	(0.0175)
Current ratio	-0.0039^{***}	0.0019	0.0005	0.0005
	(0.0005)	(0.0018)	(0.0018)	(0.0018)
Market-to-book ratio	-0.0028^{*}	-0.0062	-0.0023	-0.0022
	(0.0011)	(0.0041)	(0.0041)	(0.0041)
New covenant violation $(t-4)$				0.0159^{***}
				(0.0034)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	109,231	109,231	109,231	109,231
R^2	0.149	0.158	0.190	0.190

Panel B: Sales Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0632^{***}	-0.0557^{***}	-0.0583^{***}	-0.0582^{***}
	(0.0109)	(0.0107)	(0.0104)	(0.0104)
Log assets (level)	0.0053^{**}	$0.0030^{\cdot}$	0.0018	0.0018
	(0.0015)	(0.0016)	(0.0016)	(0.0016)
PPE / assets (level)	0.0533^{***}	0.0833^{***}	0.0803^{***}	0.0803^{***}
	(0.0148)	(0.0154)	(0.0150)	(0.0150)
Operating income / lagged assets	-0.9639^{***}	-0.9990^{***}	-1.312^{***}	-1.312^{***}
	(0.0839)	(0.0998)	(0.1421)	(0.1420)
Leverage ratio	0.1544^{***}	0.2488^{**}	$0.1381^{\cdot}$	$0.1381^{\cdot}$
	(0.0264)	(0.0742)	(0.0789)	(0.0789)
Interest expense / lagged assets	-1.863^{*}	-4.210	-5.910^{*}	-5.920^{*}
	(0.8150)	(2.738)	(2.829)	(2.830)
Net worth / assets	0.1447^{***}	0.1740^{***}	0.1456^{***}	0.1456^{***}
	(0.0191)	(0.0341)	(0.0395)	(0.0395)
Current ratio	8.44×10^{-5}	0.0243^{***}	0.0166^{**}	0.0166^{**}
	(0.0015)	(0.0059)	(0.0059)	(0.0059)
Market-to-book ratio	0.0251^{***}	0.0982^{***}	0.1186^{***}	0.1186^{***}
	(0.0026)	(0.0105)	(0.0118)	(0.0118)
New covenant violation $(t-4)$				0.0058
				(0.0083)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	109,784	109,784	109,784	109,784
R^2	0.063	0.068	0.073	0.073

Table 7: (Continued)

Panel C: Operating Costs Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0728^{***}	-0.0753^{***}	-0.0637^{***}	-0.0640^{***}
	(0.0112)	(0.0110)	(0.0101)	(0.0101)
Log assets (level)	-0.0065^{***}	-0.0102^{***}	-0.0081^{***}	-0.0081^{***}
	(0.0015)	(0.0016)	(0.0015)	(0.0015)
PPE / assets (level)	0.0330^{*}	0.0453^{**}	0.0428^{**}	0.0428^{**}
	(0.0138)	(0.0142)	(0.0138)	(0.0138)
Operating income / lagged assets	0.9103^{***}	0.7552^{***}	1.168^{***}	1.169^{***}
	(0.1102)	(0.0921)	(0.1386)	(0.1387)
Leverage ratio	$0.0391^{\cdot}$	0.2391^{***}	0.2336^{***}	0.2337^{***}
	(0.0232)	(0.0600)	(0.0630)	(0.0630)
Interest expense / lagged assets	1.248^{*}	0.7349	-1.515	-1.492
	(0.5411)	(2.202)	(2.344)	(2.343)
Net worth / assets	0.0927^{***}	0.1355^{***}	0.1316^{***}	0.1315^{***}
	(0.0170)	(0.0258)	(0.0283)	(0.0283)
Current ratio	0.0055^{***}	0.0145^{***}	0.0142^{***}	0.0142^{**}
	(0.0010)	(0.0039)	(0.0041)	(0.0041)
Market-to-book ratio	0.0294^{***}	0.0985^{***}	0.1158^{***}	0.1157^{***}
	(0.0017)	(0.0067)	(0.0073)	(0.0072)
New covenant violation $(t-4)$				$-0.0138^{\cdot}$
				(0.0072)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	109,119	109,119	109,119	109,119
R^2	0.106	0.115	0.123	0.123

Notes: This table reports OLS estimates of equation (10). The dependent variables are measured as four-quarter changes ($h = 4$ quarters). Panel E: operating income scaled by average assets. Panel F: sales growth (log difference of total sales). Panel G: operating costs growth (log difference of total operating costs). *New Covenant Violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm-level controls and covenant control variables. Higher-order covenant controls (Models 2–4) include squared and cubic terms; lagged covenant controls (Models 3–4) include two lags of first differences; lagged violation (Model 4) adds an indicator for a violation four quarters prior. All models include industry, calendar-quarter, and fiscal-quarter fixed effects. Standard errors (in parentheses) are clustered by firm and calendar quarter. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.10$.

Table 8: Impact of New Covenant Violations on Forced CEO Turnover: Pre 2010

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	0.0516^{**}	0.0464^{**}	0.0438^{**}	0.0492^{**}
	(0.0122)	(0.0125)	(0.0132)	(0.0142)
Log assets (level)	0.0034	0.0023	0.0019	0.0031
	(0.0027)	(0.0030)	(0.0029)	(0.0030)
Δ Log assets	-0.0678^{***}	-0.0656^{***}	-0.0764^{***}	-0.0733^{***}
	(0.0085)	(0.0098)	(0.0113)	(0.0111)
PPE / assets (level)	-0.0069	-0.0154	-0.0167	-0.0156
	(0.0181)	(0.0176)	(0.0178)	(0.0176)
Δ PPE / assets	-0.0435	-0.0518	-0.0705	-0.0640
	(0.0599)	(0.0591)	(0.0594)	(0.0591)
Operating cash flow / average assets	-0.0774^{**}	-0.1375^{**}	-0.1268^{*}	-0.1242^{*}
	(0.0236)	(0.0398)	(0.0457)	(0.0446)
Leverage ratio	-0.0186	0.0233	-0.0089	-0.0054
	(0.0253)	(0.1026)	(0.1081)	(0.1070)
Interest expense / average assets	0.1312	-0.3352	0.3313	0.1099
	(0.1868)	(0.6345)	(0.5816)	(0.5950)
Net worth / assets	$-0.0343^{\cdot}$	-0.0478	$-0.0949^{\cdot}$	$-0.0896^{\cdot}$
	(0.0174)	(0.0328)	(0.0475)	(0.0485)
Current ratio	-0.0008	-0.0111^{*}	$-0.0094^{\cdot}$	$-0.0089^{\cdot}$
	(0.0016)	(0.0047)	(0.0046)	(0.0046)
Market-to-book ratio	-0.0052^{*}	-0.0338^{***}	-0.0399^{***}	-0.0382^{***}
	(0.0019)	(0.0070)	(0.0069)	(0.0068)
New covenant violation $(t-1)$				0.0402^{*}
				(0.0136)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Quarter, Fiscal Quarter			
S.E. Clustered by	Calendar Quarter			
Observations	15,606	15,606	15,606	15,606
R^2	0.030	0.033	0.036	0.038

Notes: This table reports OLS estimates of equation (10) using forced CEO turnover as the outcome. The dependent variable *forced_5q* equals one if the firm experiences a forced CEO turnover in the quarter of a new covenant violation or in any of the following four quarters. *New Covenant Violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm-level controls and the six covenant control variables: operating cash flow scaled by average assets; leverage ratio; interest expense to average assets; net worth to total assets; current ratio; and market-to-book ratio. Higher-order covenant controls (Model 2–4) include squared and cubic terms of covenant variables; lagged covenant controls (Model 3–4) include two lags of the first differences of covenant variables; lagged violation (Model 4) adds an indicator for a violation four quarters prior. All models include industry, calendar-quarter, and fiscal-quarter fixed effects. Standard errors (in parentheses) are clustered by calendar quarter. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$, $^{\cdot}p < 0.15$.

Table 9: Impact of New Covenant Violations on Investment Conservatism: Post 2010 Subperiod Sample

Panel A: Asset Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0593^{**}	-0.0471^{**}	-0.0429^{*}	-0.0434^{*}
	(0.0179)	(0.0168)	(0.0164)	(0.0164)
Log assets (level)	-0.0034^{*}	-0.0081^{***}	-0.0085^{***}	-0.0086^{***}
	(0.0016)	(0.0016)	(0.0016)	(0.0016)
PPE / assets (level)	0.0515^{**}	0.0601^{**}	0.0606^{**}	0.0607^{**}
	(0.0171)	(0.0182)	(0.0177)	(0.0177)
Operating income / lagged assets	0.2851^{**}	0.8646^{***}	0.9821^{***}	0.9827^{***}
	(0.0867)	(0.1041)	(0.1237)	(0.1237)
Leverage ratio	-0.0307	0.0769	0.1094	0.1099
	(0.0348)	(0.0709)	(0.0784)	(0.0785)
Interest expense / lagged assets	0.7533	$4.741^{\cdot}$	$4.852^{\cdot}$	$4.864^{\cdot}$
	(0.9602)	(2.616)	(2.740)	(2.739)
Net worth / assets	$0.0559^{\cdot}$	0.0963^{*}	0.1475^{*}	0.1470^{*}
	(0.0305)	(0.0387)	(0.0571)	(0.0572)
Current ratio	-0.0060^{***}	0.0040	0.0032	0.0031
	(0.0011)	(0.0049)	(0.0051)	(0.0051)
Market-to-book ratio	0.0552^{***}	0.1295^{***}	0.1536^{***}	0.1535^{***}
	(0.0029)	(0.0096)	(0.0102)	(0.0102)
New covenant violation $(t-4)$				-0.0354^{*}
				(0.0153)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	79,834	79,834	79,834	79,834
R^2	0.095	0.112	0.117	0.117

Panel B: PPE Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0556^{*}	-0.0503^{*}	-0.0467^{*}	-0.0471^{*}
	(0.0216)	(0.0207)	(0.0202)	(0.0202)
Log assets (level)	0.0003	-0.0026	-0.0031	-0.0031
	(0.0023)	(0.0021)	(0.0021)	(0.0021)
PPE / assets (level)	-0.2369^{***}	-0.2252^{***}	-0.2270^{***}	-0.2269^{***}
	(0.0440)	(0.0434)	(0.0430)	(0.0430)
Operating income / lagged assets	0.3289^{**}	0.6317^{***}	0.6694^{***}	0.6698^{***}
	(0.1010)	(0.1346)	(0.1430)	(0.1431)
Leverage ratio	-0.0278	-0.0489	-0.0739	-0.0736
	(0.0348)	(0.0977)	(0.1048)	(0.1048)
Interest expense / lagged assets	2.223^{*}	12.41^{**}	10.30^{*}	10.30^{*}
	(0.9668)	(3.874)	(4.099)	(4.099)
Net worth / assets	0.1172^{***}	0.1438^{***}	0.1863^{**}	0.1860^{**}
	(0.0311)	(0.0392)	(0.0581)	(0.0580)
Current ratio	0.0036	0.0101	0.0099	0.0098
	(0.0025)	(0.0072)	(0.0072)	(0.0072)
Market-to-book ratio	0.0406^{***}	0.1116^{***}	0.1405^{***}	0.1404^{***}
	(0.0030)	(0.0117)	(0.0133)	(0.0133)
New covenant violation $(t-4)$				-0.0203
				(0.0240)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	79,133	79,133	79,133	79,133
R^2	0.125	0.130	0.133	0.133

Table 9: (Continued)

Panel C: Capital Expenditures / avg. assets | $h = 4$ quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0049^{*}	-0.0050^{*}	$-0.0042^{\cdot}$	$-0.0041^{\cdot}$
	(0.0023)	(0.0022)	(0.0023)	(0.0023)
Log assets (level)	-2.18×10^{-5}	-5.94×10^{-5}	2.87×10^{-5}	4.26×10^{-5}
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
PPE / assets (level)	-0.0177^{***}	-0.0167^{***}	-0.0171^{***}	-0.0171^{***}
	(0.0024)	(0.0022)	(0.0022)	(0.0022)
Operating income / lagged assets	0.0137^{**}	0.0022	0.0372^{***}	0.0371^{***}
	(0.0048)	(0.0075)	(0.0103)	(0.0103)
Leverage ratio	0.0037	0.0067	0.0034	0.0033
	(0.0026)	(0.0066)	(0.0083)	(0.0083)
Interest expense / lagged assets	0.0683	0.1293	0.0484	0.0466
	(0.0675)	(0.1980)	(0.2032)	(0.2029)
Net worth / assets	0.0003	-0.0023	7.72×10^{-5}	0.0001
	(0.0014)	(0.0024)	(0.0035)	(0.0035)
Current ratio	0.0005^{***}	0.0015^{**}	0.0020^{***}	0.0020^{***}
	(0.0001)	(0.0005)	(0.0005)	(0.0005)
Market-to-book ratio	5.8×10^{-5}	8.66×10^{-6}	0.0010	0.0010
	(0.0001)	(0.0008)	(0.0010)	(0.0010)
New covenant violation $(t-4)$				0.0054^{*}
				(0.0023)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	79,573	79,573	79,573	79,573
R^2	0.041	0.041	0.044	0.044

Panel D: Cash Acquisitions / avg. assets | $h = 4$ quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0074	-0.0065	-0.0047	-0.0047
	(0.0045)	(0.0045)	(0.0045)	(0.0045)
Log assets (level)	-0.0003	-0.0003	-0.0001	-0.0001
	(0.0002)	(0.0003)	(0.0003)	(0.0003)
PPE / assets (level)	0.0121^{***}	0.0175^{***}	0.0145^{***}	0.0145^{***}
	(0.0025)	(0.0028)	(0.0028)	(0.0028)
Operating income / lagged assets	0.0311^{***}	0.0119	0.0316^{*}	0.0316^{*}
	(0.0058)	(0.0114)	(0.0151)	(0.0151)
Leverage ratio	-0.0209^{***}	-0.0643^{***}	-0.0937^{***}	-0.0937^{***}
	(0.0031)	(0.0133)	(0.0136)	(0.0136)
Interest expense / lagged assets	-0.0669	0.9574^{*}	-0.2179	-0.2179
	(0.1026)	(0.4322)	(0.5009)	(0.5010)
Net worth / assets	$-0.0029^{\cdot}$	-0.0140^{***}	0.0026	0.0026
	(0.0016)	(0.0034)	(0.0044)	(0.0044)
Current ratio	0.0012^{***}	0.0056^{***}	0.0086^{***}	0.0086^{***}
	(0.0002)	(0.0009)	(0.0010)	(0.0010)
Market-to-book ratio	0.0021^{***}	0.0072^{***}	0.0072^{***}	0.0072^{***}
	(0.0002)	(0.0013)	(0.0014)	(0.0014)
New covenant violation $(t-4)$				0.0002
				(0.0034)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	76,056	76,056	76,056	76,056
R^2	0.013	0.014	0.023	0.023

Notes: The table reports OLS estimates with dependent variables measured as four-quarter changes ($h = 4$ quarters). Panel A: asset growth (log difference of total assets). Panel B: PPE growth (log difference of net property, plant, and equipment). Panel C: capital expenditures scaled by average assets. Panel D: cash acquisitions scaled by average assets. *New covenant violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm characteristics and covenant control variables. Higher-order covenant controls add squared and cubic terms; lagged covenant controls add their four-quarter lags; lagged violation adds an indicator for a violation four quarters prior. Standard errors are clustered by firm (gvkey) and calendar quarter. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.10$.

Table 10: Impact of New Covenant Violations on Operating Performance: Post 2010 Subperiod Sample

Panel A: Operating Income / avg. assets | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	0.0277^{*}	0.0302^{*}	0.0190	0.0189
	(0.0125)	(0.0123)	(0.0113)	(0.0113)
Log assets (level)	0.0109^{***}	0.0097^{***}	0.0070^{***}	0.0069^{***}
	(0.0008)	(0.0009)	(0.0007)	(0.0007)
Δ_4 Log assets	-0.0287^{***}	-0.0293^{***}	0.0036	0.0036
	(0.0044)	(0.0044)	(0.0047)	(0.0047)
PPE / assets (level)	0.0186^{*}	0.0276^{***}	0.0243^{***}	0.0243^{***}
	(0.0071)	(0.0067)	(0.0062)	(0.0062)
Δ_4 PPE / assets	-0.0258	-0.0222	-0.0232	-0.0233
	(0.0269)	(0.0264)	(0.0268)	(0.0268)
Operating income / lagged assets	-0.9951^{***}	-0.8580^{***}	-1.469^{***}	-1.469^{***}
	(0.0487)	(0.0592)	(0.0755)	(0.0755)
Leverage ratio	0.0634^{***}	0.0985^{***}	$0.0568^{\cdot}$	$0.0569^{\cdot}$
	(0.0135)	(0.0278)	(0.0290)	(0.0290)
Interest expense / lagged assets	-1.483^{***}	-4.044^{**}	$-2.571^{\cdot}$	$-2.570^{\cdot}$
	(0.3697)	(1.372)	(1.297)	(1.297)
Net worth / assets	0.0264^{*}	0.0138	-0.0229	-0.0230
	(0.0100)	(0.0156)	(0.0197)	(0.0197)
Current ratio	-0.0048^{***}	0.0073^{**}	0.0055^{*}	0.0054^{*}
	(0.0006)	(0.0021)	(0.0022)	(0.0022)
Market-to-book ratio	0.0014	$0.0076^{\cdot}$	0.0118^{*}	0.0117^{*}
	(0.0010)	(0.0045)	(0.0048)	(0.0048)
New covenant violation $(t-4)$				-0.0051
				(0.0074)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	79,141	79,141	79,141	79,141
R^2	0.135	0.145	0.178	0.178

Panel B: Sales Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	-0.0214	-0.0244	-0.0363^{*}	-0.0361^{*}
	(0.0178)	(0.0182)	(0.0177)	(0.0178)
Log assets (level)	0.0115^{***}	0.0094^{***}	0.0068^{***}	0.0068^{***}
	(0.0017)	(0.0018)	(0.0016)	(0.0016)
PPE / assets (level)	0.0155	0.0491	$0.0508^{\cdot}$	$0.0508^{\cdot}$
	(0.0303)	(0.0295)	(0.0295)	(0.0295)
Operating income / lagged assets	-1.238^{***}	-1.566^{***}	-2.108^{***}	-2.108^{***}
	(0.1314)	(0.1518)	(0.2185)	(0.2185)
Leverage ratio	0.1563^{***}	0.2770^{**}	0.1196	0.1194
	(0.0341)	(0.0921)	(0.0913)	(0.0913)
Interest expense / lagged assets	$-1.889^{\cdot}$	4.113	$5.154^{\cdot}$	$5.150^{\cdot}$
	(1.007)	(2.820)	(3.058)	(3.059)
Net worth / assets	0.1469^{***}	0.1574^{***}	0.0307	0.0309
	(0.0292)	(0.0400)	(0.0488)	(0.0488)
Current ratio	0.0012	0.0077	-0.0041	-0.0041
	(0.0026)	(0.0073)	(0.0071)	(0.0071)
Market-to-book ratio	0.0260^{***}	0.1239^{***}	0.1353^{***}	0.1354^{***}
	(0.0031)	(0.0121)	(0.0114)	(0.0114)
New covenant violation $(t-4)$				0.0097
				(0.0162)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	75,960	75,960	75,960	75,960
R^2	0.054	0.061	0.069	0.069

Table 10: (Continued)

Panel C: Operating Costs Growth (log) | h = 4 quarters

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	$-0.0431^{\cdot}$	-0.0481^{*}	$-0.0396^{\cdot}$	$-0.0397^{\cdot}$
	(0.0222)	(0.0219)	(0.0214)	(0.0214)
Log assets (level)	-0.0050^{**}	-0.0082^{***}	-0.0071^{***}	-0.0071^{***}
	(0.0015)	(0.0018)	(0.0016)	(0.0016)
PPE / assets (level)	0.0044	0.0004	0.0009	0.0009
	(0.0170)	(0.0178)	(0.0173)	(0.0173)
Operating income / lagged assets	0.5735^{***}	0.4825^{***}	0.8947^{***}	0.8948^{***}
	(0.0900)	(0.1074)	(0.1886)	(0.1886)
Leverage ratio	-0.0114	0.0987	0.0721	0.0721
	(0.0246)	(0.0597)	(0.0645)	(0.0644)
Interest expense / lagged assets	2.796^{***}	7.133^{***}	5.748^{**}	5.749^{**}
	(0.7796)	(1.765)	(1.776)	(1.777)
Net worth / assets	0.0994^{***}	0.1163^{***}	0.1343^{***}	0.1343^{***}
	(0.0188)	(0.0242)	(0.0333)	(0.0333)
Current ratio	0.0043^{***}	$-0.0086^{\cdot}$	$-0.0096^{\cdot}$	$-0.0096^{\cdot}$
	(0.0011)	(0.0050)	(0.0051)	(0.0051)
Market-to-book ratio	0.0275^{***}	0.0649^{***}	0.0788^{***}	0.0788^{***}
	(0.0018)	(0.0069)	(0.0080)	(0.0080)
New covenant violation $(t-4)$				-0.0015
				(0.0148)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Qtr., Fiscal Qtr.			
S.E. Clustered by	Firm & Calendar Quarter			
Observations	79,096	79,096	79,096	79,096
R^2	0.080	0.087	0.093	0.093

Notes: This table reports OLS estimates of equation (10). The dependent variables are measured as four-quarter changes ($h = 4$ quarters). Panel A: operating income scaled by average assets. Panel B: sales growth (log difference of total sales). Panel C: operating costs growth (log difference of total operating costs). *New Covenant Violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm-level controls and covenant control variables. Higher-order covenant controls (Models 2–4) include squared and cubic terms; lagged covenant controls (Models 3–4) include two lags of first differences; lagged violation (Model 4) adds an indicator for a violation four quarters prior. All models include industry, calendar-quarter, and fiscal-quarter fixed effects. Standard errors (in parentheses) are clustered by firm and calendar quarter. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.10$.

Table 11: Impact of New Covenant Violations on Forced CEO Turnover: Post 2010

Variable	Model 1	Model 2	Model 3	Model 4
New covenant violation	0.0259	0.0234	0.0210	0.0230
	(0.0188)	(0.0180)	(0.0203)	(0.0206)
Log assets	−0.0006	−0.0005	−0.0002	0.0003
	(0.0035)	(0.0034)	(0.0037)	(0.0038)
Δ Log assets	−0.0571***	−0.0572***	−0.0717***	−0.0712***
	(0.0079)	(0.0076)	(0.0131)	(0.0127)
PPE / assets	−0.0429*	−0.0631**	−0.0630**	−0.0639**
	(0.0176)	(0.0189)	(0.0193)	(0.0191)
Δ PPE / assets	0.0583	0.0670	0.0573	0.0603
	(0.0402)	(0.0405)	(0.0428)	(0.0414)
Log employees	−0.0027	−0.0021	−0.0026	−0.0026
	(0.0034)	(0.0033)	(0.0035)	(0.0035)
Operating income / lagged assets	−0.0236	−0.0254	−0.0626	−0.0627
	(0.0232)	(0.0312)	(0.0400)	(0.0401)
Leverage ratio	−0.0316	−0.0614	−0.0385	−0.0375
	(0.0292)	(0.0635)	(0.0695)	(0.0700)
Interest expense / lagged assets	−0.0008	1.154·	1.990*	1.954*
	(0.1683)	(0.5229)	(0.6748)	(0.6786)
Net worth / assets	−0.0640*	−0.0752*	−0.0701*	−0.0691*
	(0.0228)	(0.0261)	(0.0257)	(0.0252)
Current ratio	0.0002	−0.0131·	−0.0129·	−0.0126·
	(0.0018)	(0.0060)	(0.0066)	(0.0067)
Market-to-book ratio	−0.0116***	−0.0614***	−0.0708***	−0.0702***
	(0.0020)	(0.0110)	(0.0101)	(0.0101)
New covenant violation $(t-1)$				0.0357·
				(0.0186)
Higher-order covenant controls	No	Yes	Yes	Yes
Lagged covenant controls	No	No	Yes	Yes
Lagged violation	No	No	No	Yes
Fixed Effects	Industry, Calendar Year, Fiscal Year-End			
S.E. Clustered by	Firm & Calendar Year			
Observations	14,467	14,467	14,467	14,467
R^2	0.026	0.034	0.036	0.037

Notes: This table reports OLS estimates of equation (10) using forced CEO turnover as the outcome. The dependent variable *forced_5q* equals one if the firm experiences a forced CEO turnover in the quarter of a new covenant violation or in any of the following four quarters. *New Covenant Violation* equals one for the first quarter of a financial covenant violation after at least four clean quarters. All specifications include firm-level controls and the six covenant control variables: operating cash flow scaled by average assets; leverage ratio; interest expense to average assets; net worth to total assets; current ratio; and market-to-book ratio. Higher-order covenant controls (Model 2–4) include squared and cubic terms of covenant variables; lagged covenant controls (Model 3–4) include two lags of the first differences of covenant variables; lagged violation (Model 4) adds an indicator for a violation four quarters prior. All models include industry, calendar-quarter, and fiscal-quarter fixed effects. Standard errors (in parentheses) are clustered by calendar quarter. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$, $^{\cdot}p < 0.15$.

Table 12: Oil Price Shock, Firm Cash Flow, and Non-Oil Segment Investment

Panel A: First-Stage Regression — Effect of the Oil Price Shock on Firm Cash Flow

	Dependent variable: Cash Flow$_{j,t}$/Assets$_{j,t-1}$
	Coefficient
Treatment	
Oil Firm × Post	-0.0839^{***}
	(0.0158)
Controls	
Log Total Assets (lag)	-0.0347^{*}
	(0.0165)
Leverage (lag)	0.0285
	(0.0678)
Tobin's Q (lag)	0.0088
	(0.0080)
Sales Growth (lag)	-1.14×10^{-6}
	(1.18×10^{-6})
Cash Flow Ratio (lag)	0.2423
	(0.1642)
Firm FE / Year FE	Yes / Yes
S.E. Clustered by	Firm
Observations	12,864
R^2 / Within R^2	0.501 / 0.138

Panel B: Second-Stage Regression — Effect of Shocked Cash Flow on Non-Oil Segment Investment

	Dependent variable: Investment$_{i,j,t}$/Assets$_{j,t-1}$
	Coefficient
Treatment	
Instrumented Cash Flow (lag)	0.0467^{**}
	(0.0169)
Controls	
Leverage (lag)	-0.0090^{**}
	(0.0033)
Number of Segments	4.04×10^{-5}
	(0.0002)
Segment Sales Growth (lag)	-4.72×10^{-6}
	(9.95×10^{-5})
Segment Revenue Share	0.0423^{***}
	(0.0017)
Firm FE / Year FE	Yes / Yes
S.E. Clustered by	Firm
Observations	57,114
R^2 / Within R^2	0.552 / 0.305

Notes: Panel A reports OLS estimates of the first-stage specification. The dependent variable is firm-level operating cash flow scaled by lagged total assets. *Oil Firm* equals one if at least 25% of the firm's pre-shock cash flow originates from the oil and gas extraction industry (2-digit SIC 13); *Post* equals one for fiscal years 2015 onward. Panel B reports IV estimates at the segment level. The dependent variable is capital expenditure for non-oil segments scaled by lagged total firm assets. The key regressor is the instrumented firm-level cash flow derived from the oil price shock and lagged one period. All controls are lagged one period. Firm and year fixed effects are included in both panels. Financial firms (SIC 6000–6999) and utilities (SIC 4900–4999) are excluded. Sample period: 2010–2019. Standard errors clustered at the firm level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

Table 13: Simulated Moments Estimates

Name	**Data Moments**	**Model Moments**
Elasticity of spread to net worth	-0.130	-0.163
Variance of external financing intensity	0.283	0.249
Average external financing intensity	0.435	0.351
Investment-internal capital sensitivity	0.0467	0.0262
Average default rate	0.020	0.020
Share of no loan	0.450	0.365
Covenant violation rate	0.101	0.169
Intervention rate upon violation	0.469	0.461
Average effect of violation on operating income	0.0193	0.0276
Semi-elasticity of intervention and net worth	-0.104	-0.0569
Elasticity of spread to external financing intensity	0.217	0.164
Average default rate upon violation	0.087	0.138

Notes: This table reports the simulated and actual moments of the full sample. The estimation is done with SMM, which chooses structural parameters by matching the moments from a simulated cross section of firms to the corresponding moments from the actual data.

Table 14: Structural Parameter Estimates

	α	μ_ω	σ_ω	φ	B	ν	δ	τ	χ
Full	0.728	1.213	0.212	0.470	0.336	0.281	0.205	0.240	0.257
SE	(0.159)	(0.126)	(0.043)	(0.224)	(0.203)	(0.0468)	(0.039)	(0.055)	(0.037)
t-stat	4.598	9.593	4.930	2.098	1.655	6.005	4.362	6.154	6.946

Notes: This table reports the point estimate of all parameters that are estimated with SMM for the full sample.

Table 15: Structural Parameter Estimates: Subperiod Sample

	α	μ_ω	σ_ω	φ	B	ν	δ	τ	χ
Pre-2010	0.720	1.223	0.196	0.469	0.332	0.282	0.205	0.298	0.323
	(0.133)	(0.192)	(0.038)	(0.225)	(0.206)	(0.118)	(0.045)	(0.033)	(0.039)
Post-2010	0.718	1.214	0.184	0.329	0.256	0.266	0.167	0.197	0.208
	(0.142)	(0.163)	(0.036)	(0.175)	(0.155)	(0.076)	(0.062)	(0.023)	(0.033)

Notes: This table reports the SMM point estimates of all model parameters, obtained separately for the pre- and post-2010 subsamples.

Table 16: Decomposing the Post-2010 Shift in Creditor Control

	τ	χ
Actual post-2010	0.197	0.208
PE-counterfactual post-2010	0.221	0.242
Total shift from pre-2010	−0.101	−0.115
PE-composition component	−0.024	−0.034
Residual component	−0.077	−0.081
Share due to PE composition	23.76%	29.56%
Share due to residual	76.24%	70.44%

Notes: This table decomposes the post-2010 change in the estimated performance effect τ and managerial cost χ of creditor action. The PE-counterfactual estimates are obtained by reweighting post-2010 observations to match the pre-2010 distribution of PE sponsorship, recomputing the empirical moments, and re-estimating the structural model. The PE-composition component measures the portion of the total parameter shift attributable to the change in PE composition, while the residual component captures the remaining shift after holding PE composition fixed. The share explained by PE composition is the ratio of the PE-composition component to the total shift.

A Appendix: Proof of Results

A.1 Proof of Proposition 1.

The proof proceeds in two steps. The first step demonstrates the optimality of debt and the second shows the form of contingent action rule.

Step 1. Conditional on each realization of the signal, the optimal contract is in the form of debt, i.e., the repayment to investors is $\min\{R, w_s\}$ where w_s is the promised per-unit repayment, or face value of the debt. Now consider an arbitrary repayment scheme $r_s(R)$ that satisfies limited liability, contractual monotonicity, and the entrepreneur's incentive constraint. Then there always exists a debt contract that offers the insider the same expected payment conditional on each signal realization, and it is easy to show the uniqueness of the debt face value. That is to say, $\forall s$,$\exists$ a unique w_s such that

$$\int_0^{R_m} \max\{R - w_s, 0\} f(R|e_H, s) dR = \int_0^{R_m} (R - r_s(R)) f(R|e_H, s) dR$$

Consider the non-trivial case in which $r_s(R) \neq \min\{R, w_s\}$ on a set with strictly positive measure. We would like to show that any repayment $r_s(R)$ is strictly dominated by the corresponding debt repayment $\min\{R, w_s\}$ in the sense of incentive concerns.

We claim that the entrepreneur's incentive to shirk is higher with repayment $r_s(R)$, i.e.

$$\int_0^{R_m} (R - r_s(R)) f(R|e_L, s) dR > \int_0^{R_m} \max\{R - w_s, 0\} f(R|e_L, s) dR$$

To demonstrate this claim, we study the function

$$h_s(R) = (R - r_s(R)) - \max\{R - w_s, 0\}$$

Obviously $h_s(R)$ is non-zero with positive probability and has mean zero under distribution $f(\cdot|e_H, s)$, it must be strictly positive and strictly negative in sets of states with positive probability. Furthermore, because $(R - r_s(R))$ limited liability and contractual monotonicity, there exists $R_1 \in (0, R_m)$ such that $h_s(R) \geq 0$ when $R \leq R_1$ and

$h_s(R) < 0$ when $R > R_1$. This way,

$$
\begin{aligned}
0 &= \int_0^{R_m} h_s(R) f(R|e_H, s) dR \\
&= \int_0^{R_m} h_s(R) \frac{f(R|e_H, s)}{f(R|e_L, s)} f(R|e_L, s) dR \\
&= \int_0^{R_1} h_s(R) \frac{f(R|e_H, s)}{f(R|e_L, s)} f(R|e_L, s) dR + \int_{R_1}^{R_m} h_s(R) \frac{f(R|e_H, s)}{f(R|e_L, s)} f(R|e_L, s) dR \\
&< \int_0^{R_1} h_s(R) \frac{f(R_1|e_H, s)}{f(R_1|e_L, s)} f(R|e_L, s) dR + \int_{R_1}^{R_m} h_s(R) \frac{f(R_1|e_H, s)}{f(R_1|e_L, s)} f(R|e_L, s) dR \\
&= \frac{f(R_1|e_H, s)}{f(R_1|e_L, s)} \int_0^{R_m} h_s(R) f(R|e_L, s) dR
\end{aligned}
$$

which implies that by offering repayment $r_s(R)$ the entrepreneur enjoys higher expected wage with low effort, and hence incentives are harder to provide given that both contracts pay the same expected wage when exerting effort. Since managerial incentive constraint must bind at the optimum, this means for any repayment scheme $r_s(R)$ we can always find a unique debt contract that (weakly) dominates the original one. Therefore, the optimal contract is debt whose face value is conditional on the realization of the signal.

Step 2. It is clear from the incentive constraint (5) that q_1 is always 0, because any $q_1 > 0$ both tightens the incentive constraint and decreases the project NPV. Thus only q_0 can be possibly positive. And if the solution is interior, the optimal q_0 is jointly determined by the first-order conditions in the following subsection.

A.2 Proof of Result 1.

The following notation is used for the truncated expectations. For any density function f (with subscripts denoting type and state), define the functions:

$$
I_f(D) = \int_D^{\infty} (\omega - D) f(\omega)\, d\omega, \qquad J_f(D) = \int_0^{D} \omega f(\omega)\, d\omega + D(1 - F_f(D)),
$$

where F_f is the cumulative distribution function corresponding to f, and $S_f(D) = 1 - F_f(D)$ is the survival function.

Let $\mathcal{L}$ be the Lagrangian function for the maximization problem, with λ and μ as the multipliers for the first and second constraints, respectively.

First-Order Conditions with Signal For initial wealth constrained entrepreneurs, they acquire interim performance signal. The first-order necessary conditions for an interior optimum with respect to k, D_0, D_1, and q_0 are as follows.

First-Order Condition for k:

$$\begin{aligned}0 = (1+\mu)\Big[\alpha k^{\alpha-1}\Big(g_H((1-\gamma)^\alpha q_0 I_{H,A}(D_0) + (1-q_0)I_{H,N}(D_0)) + (1-g_H)I_{H,N}(D_1)\Big) - g_H q_0 \chi\Big] - \psi \\ + \lambda\Big[\alpha k^{\alpha-1}\Big(g_H q_0 (1-\gamma)^\alpha J_{H,A}(D_0) + g_H(1-q_0)J_{H,N}(D_0) + (1-g_H)J_{H,N}(D_1)\Big) - (1+r)\Big] \\ - \mu\Big[\alpha k^{\alpha-1}\Big(g_L((1-\gamma)^\alpha q_0 I_{L,A}(D_0) + (1-q_0)I_{L,N}(D_0)) + (1-g_L)I_{L,N}(D_1)\Big) - g_L q_0 \chi + B\Big].\end{aligned} \tag{A.2.1}$$

First-Order Condition for D_0:

$$\begin{aligned}0 = g_H(\lambda - (1+\mu))\Big[(1-\gamma)^\alpha q_0(1-F_{H,A}(D_0)) + (1-q_0)(1-F_{H,N}(D_0))\Big] \\ + \mu g_L\Big[(1-\gamma)^\alpha q_0(1-F_{L,A}(D_0)) + (1-q_0)(1-F_{L,N}(D_0))\Big].\end{aligned} \tag{A.2.2}$$

First-Order Condition for D_1:

$$0 = (1-g_H)(1-F_{H,N}(D_1))(\lambda - (1+\mu)) + \mu(1-g_L)(1-F_{L,N}(D_1)). \tag{A.2.3}$$

First-Order Condition for q_0:

$$\begin{aligned}0 = (1+\mu)g_H\Big[k^\alpha((1-\gamma)^\alpha I_{H,A}(D_0) - I_{H,N}(D_0)) - \chi k\Big] + \lambda g_H k^\alpha\Big[(1-\gamma)^\alpha J_{H,A}(D_0) - J_{H,N}(D_0)\Big] \\ - \mu g_L\Big[k^\alpha((1-\gamma)^\alpha I_{L,A}(D_0) - I_{L,N}(D_0)) - \chi k\Big].\end{aligned} \tag{A.2.4}$$

These conditions hold at an interior optimum, together with the complementary slackness conditions $\lambda \geq 0$ and $\mu \geq 0$.

First-Order Conditions without Signal For entrepreneurs with sufficient, they do not acquire interim performance signal. The first-order necessary conditions for an interior optimum with respect to k, D are as follows.

First-Order Condition for k:

$$0 = (1+\mu)\alpha k^\alpha I_{H,N}(D) + \lambda[\alpha k^\alpha J_{H,N}(D) - (1+r)] - \mu(\alpha k^\alpha I_{L,N}(D) + B). \tag{A.2.5}$$

First-Order Condition for D:

$$\frac{\mu}{1+\mu-\lambda} = \frac{1-F_{H,N}(D)}{1-F_{L,N}(D)}. \tag{A.2.6}$$

Similarly, these conditions hold at an interior optimum, together with the complementary slackness conditions $\lambda \geq 0$ and $\mu \geq 0$.

B Appendix: Numerical Solution

B.1 Algorithm to solve the optimal contract

This is how we solve the policy function for a particular firm with initial wealth N:

Step 1. Given k and q_0, we solve the entrepreneur's wage minimization problem subject to the incentive compatibility constraint:

$$\min_{D_0,D_1} \nu \left[\int_{D_0}^{\infty} (\omega - D_0) \cdot k^{\alpha} \cdot ((1-\gamma)^{\alpha} q_0 f_{H,A}(\omega) + (1-q_0) f_{H,N}(\omega)) d\omega - q_0 \chi k^{\alpha} \right] + (1-\nu) \left[\int_{D_1}^{\infty} (\omega - D_1) \cdot k^{\alpha} \cdot f_{H,N}(\omega) d\omega \right]$$

s.t.

$$\begin{aligned} &\nu \left[\int_{D_0}^{\infty} (\omega - D_0) \cdot k^{\alpha} \cdot ((1-\gamma)^{\alpha} q_0 f_{H,A}(\omega) + (1-q_0) f_{H,N}(\omega)) d\omega - q_0 \chi k^{\alpha} \right] \\ &+ (1-\nu) \left[\int_{D_1}^{\infty} (\omega - D_1) \cdot k^{\alpha} \cdot f_{H,N}(\omega) d\omega \right] \geq \\ &(\nu+\delta) \left[\int_{D_0}^{\infty} (\omega - D_0) \cdot k^{\alpha} \cdot ((1-\gamma)^{\alpha} q_0 f_{L,A}(\omega) + (1-q_0) f_{L,N}(\omega)) d\omega - q_0 \chi k^{\alpha} \right] \\ &+ (1-\nu-\delta) \left[\int_{D_1}^{\infty} (\omega - D_1) \cdot k^{\alpha} \cdot f_{L,N}(\omega) d\omega \right] + Bk \end{aligned}$$

Let the Lagrangian multiplier of (IC) be μ. The first-order conditions of D_0, D_1 are as follows:

$$LR_0(D) = \frac{\nu[q_0 \cdot (1-\gamma)^{\alpha} \cdot (1 - F_{H,A}(D)) + (1-q_0)(1 - F_{H,N}(D))]}{(\nu+\delta)[q_0 \cdot (1-\gamma)^{\alpha} \cdot (1 - F_{L,A}(D)) + (1-q_0)(1 - F_{L,N}(D))]} \tag{B.1.1}$$

$$D_0 = \begin{cases} 0, & \text{if } LR_0(0) > \dfrac{\mu}{\mu - 1} \\ LR_0^{-1}(\dfrac{\mu}{\mu-1}), & \text{if } LR_0(0) \leq \dfrac{\mu}{\mu-1} \end{cases} \tag{B.1.2}$$

and

$$LR_1(D) = \frac{(1-\nu)(1 - F_{H,N}(D))}{(1-\nu-\delta)(1 - F_{L,N}(D))} \tag{B.1.3}$$

$$D_1 = \begin{cases} 0, & \text{if } LR_1(0) > \dfrac{\mu}{\mu - 1} \\ LR_1^{-1}(\dfrac{\mu}{\mu-1}), & \text{if } LR_1(0) \leq \dfrac{\mu}{\mu-1} \end{cases} \tag{B.1.4}$$

and that of μ is the binding (IC).

Step 2. With the solved D_0 and D_1, we examine the (PC)

$$\begin{aligned}
&\nu \cdot q_0 \cdot \left[\int_0^{D_0} \omega f_{H,A}(\omega) d\omega + D_0(1 - F_{H,A}(D_0)) \right] \cdot ((1-\gamma)k)^\alpha \\
&+ \nu \cdot (1 - q_0) \left[\int_0^{D_0} \omega f_{H,N}(\omega) d\omega + D_0(1 - F_{H,N}(D_0)) \right] \cdot k^\alpha \\
&+ (1 - \nu) \left[\int_0^{D_1} \omega f_{H,N}(\omega) d\omega + D_1(1 - F_{H,N}(D_1)) \right] \cdot k^\alpha \geq (1 + r)(k - N)
\end{aligned}$$

and check whether it holds under given k and q_0. If it holds, we keep k and lower q_0 for one grid until the (PC) no longer holds, or q_0 reaches its lower bound 0, then we find the policy function $q_0(k)$ as the lowest value that makes the (PC) hold. If it does not hold, we keep k and increase q_0 until (PC) holds, and if (PC) does not hold even when q_0 reaches the upper bound, then we say the current k is too large to finance for the given initial wealth N. Overall this part has found the policy function q_0, D_0 and D_1 as a function of k.

Step 3. Now we go through all $k \in [\underline{k}, k^{fb}]$ to calculate the entrepreneur's expected payoff (objective)

$$\begin{aligned}
V(k) =& \nu \left[\int_{D_0}^{\infty} (\omega - D_0) \cdot k^\alpha \cdot ((1-\gamma)^\alpha q_0 f_{H,A}(\omega) + (1 - q_0) f_{H,N}(\omega)) d\omega - q_0 \chi k^\alpha \right] \\
&+ (1 - \nu) \left[\int_{D_1}^{\infty} (\omega - D_1) \cdot k^\alpha \cdot f_{H,N}(\omega) d\omega \right]
\end{aligned}$$

and $k^{sb} = \arg\max_k V(k)$, and the corresponding q_0, D_0 and D_1 are hence determined.

C Appendix: Variable Definitions

The following financial variables are constructed from quarterly Compustat data:

Total assets: atq
Average assets: (Total assets + Lagged total assets) / 2
Market-to-book ratio: Market value / Total assets, where

- Market value = Market value of equity − Book value of equity + Total assets
- Market value of equity = prccq × cshoq
- Book value of equity = Total assets − ltq + txditcq

Total debt: dlcq + dlttq
Leverage ratio: Total debt / Total assets
Net worth to assets ratio (inside equity): seqq / Total assets
Current ratio: actq / lctq
PPE scaled by assets: ppentq / Total assets
Cash scaled by assets: cheq / Total assets
Shareholder payout: prstkcq + dvq
Operating income scaled by average assets: oibdpq / Average assets
Interest expense scaled by average assets: xintq / Average assets
Capital expenditures quarterly: capxy (adjusted for fiscal quarter accumulation)
Cash acquisitions quarterly: aqcy (adjusted for fiscal quarter accumulation)
Capital expenditures scaled by average assets: Capital expenditures quarterly / Average assets
Cash acquisitions scaled by average assets: Cash acquisitions quarterly / Average assets
Net debt issuance: (Total debt − Total lagged debt) / Lagged total assets
Sales: saleq
Operating costs: Sales − Operating income
Sales scaled by average assets: Sales / Average assets
Operating costs scaled by average assets: Operating costs / Average assets

D Appendix: Model Comparative Statics

I consider two groups of comparative statics of N^* and q_0 with respect to the relevant of the eleven parameters: the curvature of the profit function, α, the expectation of idiosyncratic productivity under high effort and no action, $\mu_\omega := E_{H,N}[\omega]$, the log volatility of idiosyncratic volatility, σ_ω, the improvement in the first moment of productivity, $\varphi := E_H[\omega] - E_L[\omega]$, the private benefit of low effort, B, the reduction in capital investment by interim action, γ, the improvement in the first moment of productivity by interim action, $\tau := E_A[\omega] - E_N[\omega]$, the managerial cost by interim action, χ, the cost of performance signal acquisition, ψ, the probability of nominal covenant violation, $\nu := G_H(0)$, and the performance signal informativeness, $\delta := G_L(0) - G_H(0)$.

Comparative Statics of Covenant Coverage Threshold. The first set of results concerns the cost of signal acquisition and covenant inclusion. The covenant coverage threshold decreases with this cost. The intuition is straightforward: as it becomes more costly to acquire the signal and write covenant-based contracts, fewer firms find it optimal to do so.

The second set of results studies the moral hazard parameters. The covenant coverage threshold increases with the private benefit of low effort and decreases with the productivity improvement under high effort. That is, it is positively related to the severity of the moral hazard friction. When agency problems are more pronounced, firms require additional mechanisms to enhance pledgeable incom, which is achieved by acquiring an additional signal and writing performance-sensitive contracts with covenants, which transfer (partial) control rights to the lender upon violation. As a result, a larger fraction of firms adopts complex contracts with financial covenants.

The third set of results examines technology-related parameters. The covenant coverage threshold increases with the curvature of the profit function. The intuition is that a higher curvature makes the profit function closer to linear, thereby increasing the relative gains from higher moral hazard rents and greater pledgeable income while leaving the associated costs unchanged. As a result, signal acquisition and covenant inclusion become more attractive. The threshold also increases with both the expectation and the log volatility of idiosyncratic productivity. The intuition is similar. A higher expected productivity raises the benefits of performance-sensitive contracts by increasing both moral hazard rents and pledgeable income. Likewise, greater volatility improves the firm's upside potential: as residual claimants, entrepreneurs benefit disproportionately from favorable realizations in the right tail. This improves the value of conditioning on additional effort information, so that more firms tend to acquire the signal and adopt

performance-sensitive contracts with covenants.

Finally, the covenant coverage threshold does not respond to parameters governing the signal structure or the consequences of interim action. This result highlights a clear separation between the extensive and intensive margins. The intuition is that only a subset of firms that include covenants will ever experience a violation and subsequent creditor intervention, while some others are granted a waiver. As a result, parameters that affect the signal information structure or the consequences of intervention influence only the intensive margin, the conditional probability of intervention, while leaving the extensive margin of covenant coverage unchanged. This separation provides a useful identification of distinct economic mechanisms operating through covenant coverage versus covenant enforcement.

Comparative Statics of Creditor Intervention. I now turn to the properties of the conditional probability of creditor intervention. The first set of results concerns the moral hazard parameters. The probability of intervention increases with the magnitude of the private benefit and decreases with the productivity improvement with high effort. The underlying intuition is straightforward: when the moral hazard friction is more severe, either because the temptation to shirk is greater or because the effort improvement is smaller, the interim action must be taken more frequently to maintain sufficient managerial discipline. In this sense, the endogenous probability of intervention serves as an instrument through which creditors tighten incentive provision when agency frictions are more acute.

The second set of results pertains to the idiosyncratic productivity distribution. The probability of intervention increases with both the mean and the log volatility of idiosyncratic productivity. As either parameter rises, the entrepreneur faces a higher likelihood of drawing a favorable productivity realization, which, holding the compensation schedule fixed, raises the relative attractiveness of low effort for the entrepreneur as the residual claimant. To preserve incentive compatibility, creditors respond by intervening more aggressively. Similarly, the probability of intervention increases with the curvature parameter of the profit function. A higher curvature value brings the profit function closer to linear, amplifying the sensitivity of realized profits to productivity shocks. Consequently, the relative benefit of the interim action grows more rapidly than its cost, making intervention more attractive at the margin.

The third set of results concerns the information structure of signal. The probability of intervention decreases with signal informativeness. When the signal more precisely reveals the entrepreneur's effort choice, the agency friction is better mitigated through the contractual terms alone, reducing the lender's need to rely on the costly interim ac-

tion. In addition, an increase in the nominal rate of covenant violation, which lowers the probability of a low signal, also reduces the probability of intervention. Although covenant violations become less frequent, the marginal benefit of intervention conditional on a violation rises disproportionately relative to its cost, rendering the action more attractive whenever it is triggered.

The fourth set of results examines the consequences of the interim action itself. The probability of intervention decreases with the magnitude of capital investment loss, increases with the productivity enhancement induced by the action, and decreases with the managerial cost imposed on the entrepreneur. These results admit a unified interpretation: any parameter that raises the net marginal benefit of intervention, such as a larger productivity enhancement, increases its equilibrium likelihood; while any parameter that raises its net marginal cost, such as greater capital destruction or a higher managerial burden, suppresses lenders' willingness to intervene. Since the interim action always carries a negative net present value, the comparative statics reflect the interplay between the action's disciplinary value and its direct cost.

E Appendix: Characteristics of Covenant Violations

Table 17 reports summary statistics on the incidence of financial covenant violations in our sample. Covenant violations are widespread: 40.3 percent of firms report a violation at least once over the sample period, 6.3 percent of firm-quarter observations are in violation in a given quarter, and 1.3 percent correspond to new violations. Violations occur across all industries and size groups, though prevalence varies. They are most common in wholesale and retail trade (around 50 percent) and least common in the residual "other" category (30.8 percent). The relationship with firm size is non-monotonic: violation rates are highest among the smallest firms (32.7 percent), fall to a trough of below 20 percent among mid-sized firms ($2.5–$5 billion), and rise again among the largest firms (29.8 percent).

Violations are most sharply differentiated by net worth. The violation rate falls monotonically from 34.9 percent in the bottom decile of net worth-to-assets to just 7.2 percent in the top decile, a nearly five-fold decline. This pattern is consistent with the model's prediction that a firm's internal financing capacity N governs the terms of the financing contract: firms with low net worth must cede a greater share of control rights to creditors in exchange for relaxing incentives, and thus raising pledgeable income and investment scale. As net worth rises, entrepreneurs require less external discipline to sustain the same contract, control is given up less readily, and covenant violations become correspondingly less frequent. The strength and monotonicity of this relationship in the data lend direct support to balance sheet strength, rather than size or industry, as the primary empirical counterpart to the state variable driving cross-sectional contracting outcomes in the model.Taken together, these patterns indicate that covenant violations are not confined to a narrow set of distressed firms, but instead arise across a broad range of industries and firm sizes, with a clear concentration among financially weaker firms.

Table 18 characterizes firms at the time of a new covenant violation. Panel A reports the distribution of firm characteristics for violators in levels, while Panel B reports their percentile rank relative to same industry-quarter peers.

Violators are not extreme in levels: median firm size, profitability, and market valuation are broadly comparable to the full sample, though balance sheets are weaker—median net worth-to-assets is 0.41 versus 0.50 in the full sample, and median leverage is 0.29 versus 0.19. Performance changes matter more than performance levels: the median change in sales growth is close to zero, but the distribution is skewed toward negative realizations, indicating that violations tend to follow deteriorating conditions rather than persistently poor ones.

Table 17: Frequency of Financial Covenant Violations

	Violator Percentage
Overall	
Fraction of firms ever reporting covenant violation	40.3%
Fraction of firm-quarter observations with covenant violation	6.3%
Fraction of firm-quarter observations with new covenant violation	1.3%
By industry	
Agriculture, minerals, construction	39.7%
Manufacturing	42.3%
Transportation and utilities	37.1%
Wholesale trade	50.8%
Retail trade	48.1%
Services	38.6%
Other	30.8%
By size (book assets)	
< \$100M	32.7%
\$100M–\$250M	24.0%
\$250M–\$500M	21.7%
\$500M–\$1B	21.7%
\$1B–\$2.5B	23.8%
\$2.5B–\$5B	19.9%
> \$5B	29.8%
By net worth (book equity-to-assets)	
Bottom 10%	34.9%
10–30%	32.1%
30–70%	27.9%
70–90%	14.7%
Top 10%	7.2%

Notes: This table reports the percentage of firms that report at least one financial covenant violation during the sample period. A firm is classified as a violator if it reports a violation in any quarter. A new violation is defined as a violation preceded by four quarters without violations. Industry classifications are based on SIC codes. Firm size is measured using total assets (in millions of USD).

Panel B confirms that these gaps are systematic rather than incidental to the full-sample comparison. Relative to industry-quarter peers, violators rank below median in profitability (31st percentile), liquidity (34th), market valuation (35th), and net worth (36th), and above median in leverage (65th) and operating costs relative to assets (62nd). These deviations are moderate rather than extreme in that violators cluster in the lower-middle, not the tail, of their industry distribution, which suggests that covenant violations arise among firms experiencing relative underperformance and balance sheet strain, rather than among firms in acute financial distress.

Table 18: Which Firms Violate Covenants?

Panel A: Distribution of Variables for New Violators

	N	10th	25th	50th	75th	90th	All Firms Median
Assets ($M)	4709	19.1	42.4	130	463	1712	259
Change in Ln(Sales)	4673	-0.300	-0.120	-0.006	0.093	0.246	0.022
Operating cash flow / assets	4388	-0.076	-0.021	0.008	0.026	0.043	0.024
Sales / assets	4709	0.079	0.159	0.256	0.391	0.568	0.216
Operating costs / assets	4388	0.091	0.167	0.267	0.400	0.582	0.207
Net worth / assets	4709	0.017	0.234	0.413	0.578	0.718	0.504
Leverage ratio	4699	0.029	0.136	0.290	0.461	0.663	0.188
Current ratio	4617	0.602	1.020	1.530	2.350	3.530	2.000
Market-to-book ratio	4709	0.765	0.931	1.190	1.680	2.630	1.510
Payout	4690	0.000	0.000	0.000	0.069	2.770	0.000

Panel B: Within Industry-Quarter Rank of New Violators

	N	10th	25th	50th	75th	90th	All Firms Median
Assets ($M)	4709	0.097	0.203	0.396	0.628	0.811	0.500
Change in Ln(Sales)	4673	0.076	0.181	0.409	0.711	0.890	0.500
Operating cash flow / assets	4388	0.059	0.143	0.313	0.550	0.759	0.500
Sales / assets	4709	0.133	0.311	0.555	0.799	0.921	0.500
Operating costs / assets	4388	0.155	0.348	0.615	0.830	0.933	0.500
Net worth / assets	4709	0.065	0.167	0.360	0.586	0.773	0.500
Leverage ratio	4699	0.232	0.442	0.652	0.845	0.941	0.500
Current ratio	4617	0.054	0.146	0.336	0.584	0.792	0.500
Market-to-book ratio	4709	0.068	0.167	0.350	0.603	0.810	0.500
Payout	4690	0.000	0.005	0.019	0.565	0.799	0.020

Notes: Panel A reports the distribution of firm characteristics for new covenant violators at the time of violation. The column "All Firms Median" reports the median across the full sample. Panel B reports within industry-quarter percentile ranks. A value of 0.5 corresponds to the industry-quarter median.

F Appendix: Private-equity Sponsorship in Syndicated Loans

This appendix documents the prevalence of private-equity (PE) sponsorship among syndicated borrowers over the sample period and describes the construction of the firm-quarter PE indicator used in Section 7.3.2.

Variable construction. A DealScan tranche is classified as PE-sponsored when the `Sponsored` field equals `Yes`. For each tranche, I use its active and maturity dates to identify the calendar quarters during which it remains outstanding. I then aggregate across active tranches within each firm-quarter: a firm is classified as having active syndicated debt in quarter t if it has at least one outstanding tranche, and as having PE exposure if at least one of those tranches is PE-sponsored. The resulting indicator is

$$PE_{it} = \mathbf{1}\{\text{firm } i \text{ has at least one active PE-sponsored tranche in quarter } t\},$$

with the PE share calculated among firm-quarters with active syndicated loan.

Time-series pattern. Figure 6 plots the unconditional annual shares of firms with PE exposure, any covenant violation, and a new covenant violation in the matched sample. PE exposure rises steadily over the sample period, increasing from approximately 1.2 percent of firms in 1996 to 8.2 percent by 2009. It remains relatively stable thereafter, fluctuating between roughly 7 and 9 percent through 2019. Overall, the average PE exposure is substantially higher in the post-2010 period than in the pre-2010 period, averaging 8.1 percent versus 5.0 percent, respectively.

The covenant-violation series move in the opposite direction. The share of firms experiencing at least one covenant violation is between roughly 10 percent and 16 percent during the late 1990s and early 2000s, but falls to approximately 4–6 percent after 2010. The share experiencing a new violation follows a similar pattern, declining from around 4–7 percent in the earlier years to roughly 1–2 percent in the later sample. The figure therefore shows pronounced negative comovement between PE exposure and covenant-violation incidence over time. These patterns are illustrative and are intended to characterize the changing composition and covenant outcomes of firms over the sample period.

Naive Regression To provide a simple descriptive comparison of covenant-violation incidence across PE-sponsored and non-PE-sponsored borrowers, I estimate linear prob-

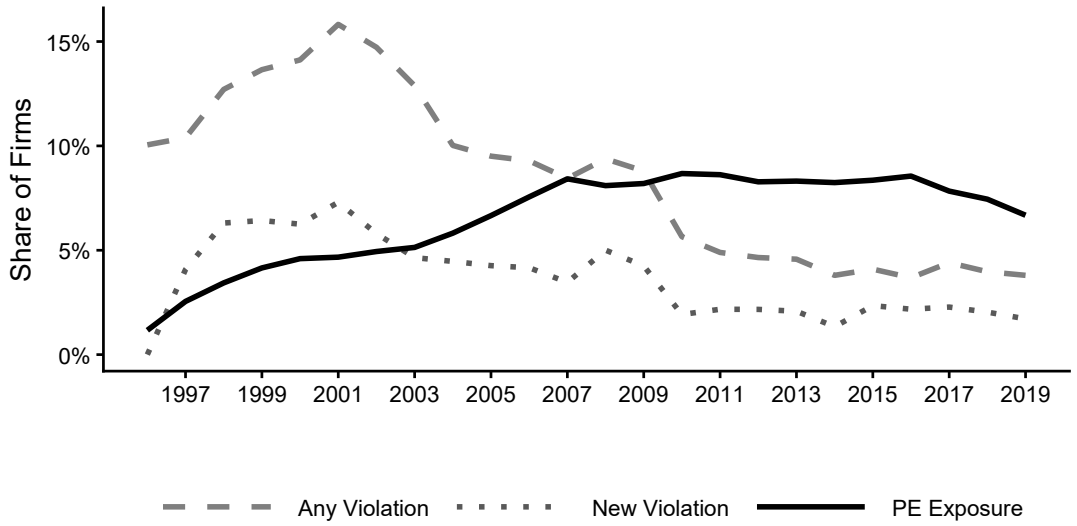


Figure 6: Private-Equity Exposure and Covenant Violations

ability models at the firm-quarter level. Specifically, I estimate

$$Violation_{it} = \alpha + \beta\, PE_{it} + \gamma_t + \varepsilon_{it},$$

where PE_{it} equals one if firm i has at least one active PE-sponsored tranche in quarter t. The sample is restricted to firm-quarters with at least one active syndicated loan, so that the comparison is between PE-sponsored and non-PE-sponsored syndicated borrowers rather than between borrowers and firms without syndicated debt. I consider two binary outcomes: an indicator for experiencing any covenant violation during the quarter and an indicator for experiencing a new covenant violation. All specifications include quarter fixed effects to absorb common variation in credit conditions and covenant-violation incidence over time, and standard errors are clustered at the firm level.

Table 19 reports the results. Conditional on quarter fixed effects, PE-sponsored firm-quarters are associated with a 0.9 percentage-point lower probability of experiencing any covenant violation and a 0.2 percentage-point lower probability of experiencing a new violation. Both associations are statistically significant at conventional levels. These estimates are descriptive and are not intended to identify a causal effect of PE sponsorship. Rather, they show that the negative comovement between PE exposure and covenant-violation incidence documented in Figure 6 remains present after absorbing common quarter-level variation.

To provide a simple descriptive comparison of creditor intervention upon covenant violations across PE-sponsored and non-PE-sponsored borrowers, I estimate linear prob-

Table 19: Private-Equity Sponsorship and Covenant Violations

	(1) Any Violation	(2) New Violation
PE-sponsored	-0.009^{*}	-0.002^{**}
	(0.004)	(0.0009)
Quarter FE	Yes	Yes
Observations	156,996	156,996
R^2	0.0671	0.0157

Notes: The unit of observation is the firm-quarter, restricted to firms with active syndicated loans. *PE-sponsored* equals one if the firm has an active PE-sponsored tranche. Columns (1) and (2) report linear probability models for any and new covenant violations, respectively. All specifications include quarter fixed effects; standard errors are clustered by firm. Coefficients are in percentage points.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

ability models at the violation-event level. Specifically, I estimate

$$\mathit{Intervention}_{it} = \alpha + \beta\, PE_{it}^{(k)} + \gamma_t + \varepsilon_{it},$$

where $\mathit{Intervention}_{it}$ equals one if the lender intervenes following the covenant violation, and $PE_{it}^{(k)}$ denotes the PE-exposure measure used in specification k. I consider PE exposure in the preceding quarter, the violation quarter, and any of the preceding four quarters. The sample consists of firm-quarters in which a covenant violation occurs. All specifications include quarter fixed effects to absorb common time variation, and standard errors are clustered at the firm level.

Table 20: Private-Equity Sponsorship and Lender Intervention

	(1) $t-1$	(2) t	(3) Prior 4 Quarters
PE exposure	0.183^{***}	0.176^{***}	0.181^{***}
	(0.040)	(0.039)	(0.038)
Quarter FE	Yes	Yes	Yes
Observations	2,163	2,171	2,171
R^2	0.109	0.108	0.109

Notes: The unit of observation is the covenant-violation event. *PE exposure* measures whether the firm has an active PE-sponsored tranche in the preceding quarter, the violation quarter, or any of the preceding four quarters, respectively. All specifications include quarter fixed effects; standard errors are clustered by firm. Coefficients are in percentage points.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 20 reports the results. PE exposure is positively associated with lender intervention across all three timing definitions, with estimated coefficients ranging from 0.176 to 0.183, corresponding to approximately 18 percentage points. The estimates

are statistically significant in all specifications. Overall, the results document a positive relationship between the rise in PE sponsorship and the higher incidence of creditor intervention following covenant violations.

G Appendix: Empirical Design and Identification

G.1 Investment–Cash Flow Sensitivity: Quasi-experiment Details

This appendix provides a complete description of the two-stage quasi-experimental strategy used to estimate investment–cash flow sensitivity in Section 6.3.

Sample construction. The estimation sample is a firm-annual panel drawn from the Compustat Annual Fundamentals and Segments databases over 2010–2019, spanning five years before and after the 2015–16 oil price collapse. Oil-dependent firms are defined as those for which at least 25 percent of pre-shock cash flow originates from segments classified under oil and gas extraction (SIC 13), ensuring meaningful exposure to the oil price shock while retaining diversified non-oil operations. To be included, a firm must satisfy three criteria: at least two pre-shock annual observations, at least one identifiable non-oil segment, and non-negativity of lagged total assets. Non-oil segments are conservatively defined to exclude industries with direct exposure to petroleum markets or its substitutes, including petroleum refining (SIC 29), pipelines (SIC 46), and energy utilities (SIC 49). The resulting firm-level panel comprises 12,864 firm-year observations, and the segment-level panel of non-oil segments contains 74,912 observations.

The oil price shock. The 2015–16 oil price collapse provides a quasi-experimental shock to firm-level cash flow that is plausibly exogenous to the investment opportunities of non-oil business segments. Between mid-2014 and early 2016, West Texas Intermediate crude fell from approximately $105 to $27 per barrel, a decline of nearly 75 percent driven by an unexpected surge in North American shale production and OPEC's decision not to curtail output. For non-oil divisions of multi-segment firms, this shock reduced the cash flow and collateral value of the parent's oil segment without directly affecting segment-level productivity or demand conditions. The variable Post_t is therefore defined as an indicator equal to one from 2015 onward, and the treatment indicator Oil Firm_j is fixed at its pre-shock value to avoid endogenous reclassification.

First stage: firm-level controls. The first stage identifies the causal effect of the oil price shock on firm-level cash flow. The key challenge is that oil-dependent firms may differ from non-oil firms along dimensions that independently predict cash flow dynamics — for instance, oil firms tend to be more capital intensive and more leveraged. A naive comparison of cash flow changes between oil and non-oil firms after 2015 would therefore conflate the effect of the shock with pre-existing differences in firm characteristics.

The lagged firm controls $\mathbf{X}_{j,t-1}$ absorb time-varying firm characteristics that may be correlated with both oil firm status and future cash flow. Including Tobin's Q is particularly important: without it, any post-shock divergence in investment opportunities between oil and non-oil firms could contaminate the cash flow estimate, because firms with deteriorating investment opportunities mechanically generate lower cash flow regardless of the financing channel. By conditioning on Q, the first stage isolates the cash flow channel from the investment opportunity channel, ensuring that $\hat{\beta}$ captures a financing shock rather than a productivity shock. Lagged leverage absorbs differences in debt capacity that predict cash flow through interest obligations. Lagged sales growth and the cash flow ratio absorb firm-level momentum in operating performance that would otherwise generate differential post-shock trends between oil and non-oil firms independent of the price shock itself. Log total assets controls for the scale of operations, which determines the absolute magnitude of cash flow fluctuations and ensures comparability across firms of different sizes.

First stage: fixed effects. Firm fixed effects θ_j absorb all time-invariant determinants of cash flow, including industry classification, organizational structure, and average capital intensity, ensuring that $\hat{\beta}$ is identified from within-firm variation over time rather than cross-sectional differences between oil and non-oil firms. Year fixed effects τ_t absorb aggregate macroeconomic shocks common to all firms in a given year, including changes in interest rates, aggregate demand, and credit market conditions that affect all firms simultaneously and could otherwise generate spurious differential trends between the two groups. Together, the two-way fixed effects structure means identification comes from the differential deviation of oil-dependent firms from their own pre-shock cash flow trajectory, relative to the contemporaneous deviation of non-oil firms from theirs – a within-firm, within-year comparison that removes both permanent firm heterogeneity and common aggregate fluctuations.

Instrument construction and the exclusion restriction. The predicted cash flow shock retains only the component of cash flow variation attributable to the interaction $\text{Oil Firm}_j \times \text{Post}_t$, explicitly excluding contributions from firm controls, firm fixed effects, and year fixed effects. This isolation is the key to satisfying the exclusion restriction in the second stage. If the full fitted value from equation (11) were used as the instrument, it would incorporate variation driven by lagged leverage, Tobin's Q, and other firm controls that may independently predict non-oil segment investment through channels unrelated to internal capital reallocation. By retaining only $\hat{\beta} \cdot (\text{Oil Firm}_j \times \text{Post}_t)$, the instrument isolates cash flow variation driven solely by the firm's pre-determined exposure to the

oil sector interacted with the timing of the aggregate price collapse — neither of which is plausibly determined by non-oil segment investment opportunities.

Second stage: segment-level controls. The second stage faces the challenge that non-oil segment investment may respond to the oil shock through channels other than internal capital reallocation. Three confounds are most salient, each addressed by a specific element of the control vector $\mathbf{Z}_{i,j,t}$.

The segment's revenue share within the parent firm controls for the mechanical relationship between segment size and capital access. Larger segments may receive preferential treatment in internal allocation independent of the shock, so without this control π would reflect a size-driven allocation rule rather than the causal response to the cash flow shortfall.

The number of segments operated by the parent firm controls for the complexity of the internal capital market. Firms with more segments face a more severe headquarters allocation problem and may respond differently to cash flow shocks — either spreading cuts thinly across all divisions or concentrating them in peripheral ones. Conditioning on this variable ensures comparability of the allocation response across firms with different internal capital market structures.

Lagged segment sales growth absorbs segment-level demand dynamics that may be correlated with the timing of the oil shock through industry input-output linkages. Without this control, segments in industries that supply oil-related inputs might show investment declines that reflect deteriorating product demand rather than internal capital reallocation, biasing π away from zero and overstating the severity of the financing friction.

Second stage: fixed effects and clustering. Segment fixed effects η_i absorb time-invariant segment characteristics, including industry classification, average capital intensity, and baseline profitability that could generate spurious cross-sectional correlation between instrumented cash flow and investment levels. Identification of π therefore comes entirely from within-segment variation over time in response to the instrumented cash flow shock, not from comparing investment rates across segments with different structural characteristics. Year fixed effects τ_t absorb economy-wide capital expenditure cycles and aggregate financing conditions that coincide with the oil price shock period and affect all segments simultaneously, regardless of their parent firm's oil exposure.

Standard errors are clustered at the parent-firm level rather than the segment level. Because multiple segments belong to the same parent firm, segment-level residuals are mechanically correlated within firms, both through shared exposure to the instru-

mented cash flow shock and through the headquarters allocation decision that jointly determines investment across all divisions. Clustering at the firm level accounts for this within-firm dependence and produces conservative inference that does not assume independence across segments of the same parent.

Identification and the link to the structural parameter. The parameter π is identified from within-firm, within-segment variation in investment attributable to the shock-driven component of firm-level cash flow, after removing segment fixed effects, year fixed effects, and time-varying segment controls. Restricting the sample to firms observed in both the pre- and post-shock periods ensures that identification comes from the dynamic response of continuing firms rather than compositional changes in the segment population, which could otherwise conflate selection into the sample with genuine investment sensitivity.

Under the exclusion restriction, π measures the extent to which a shock-driven reduction in firm-level cash flow is transmitted to non-oil segment investment, i.e., the degree to which internal capital cannot be replaced by external financing at the same cost. In the structural model, this sensitivity is a direct function of the agency cost parameter governing the tightness of the borrowing constraint: a more negative estimate of π implies a larger wedge between the cost of internal and external funds, and maps to a higher value of this parameter in the structural estimation.

G.2 Covenant Violation and Corporate Policies: Quasi-RDD Details

This appendix provides a complete description of the quasi-discontinuity specification in equation (10).

Outcome variables. The left-hand side variable $y_{i,t+h} - y_{i,t}$ is the h-quarter change in the outcome of interest for firm i measured from quarter t. I estimate the specification separately for $h \in \{1, 2, 4\}$ to characterize both the immediate and medium-run responses to a violation. Outcomes include log capital expenditures scaled by average assets, log PPE, log sales, log operating costs, cash acquisitions scaled by average assets, and operating income scaled by average assets.

Violation indicator. $\text{Violation}_{i,t}$ is an indicator equal to one for a *new* financial covenant violation, defined as a violation by a firm that has not breached any financial covenant in the preceding four quarters. This restriction isolates the initial creditor response and avoids confounding repeated violations with ongoing renegotiation dynamics.

Covenant controls. $\mathbf{X}_{i,t}$ is the vector of six financial ratios most commonly written into covenant agreements: the ratio of operating cash flow to lagged total assets; the leverage ratio (total debt to total assets); the ratio of interest expense to lagged total assets; the ratio of net worth to total assets; the current ratio (current assets divided by current liabilities); and the market-to-book ratio. All six variables are included linearly, and $h(\mathbf{X}_{i,t})$ collects their squared and cubic terms, yielding 18 polynomial controls in total. These terms absorb the nonlinear relationship between the firm's financial position and subsequent outcomes, so that the violation indicator identifies only the discontinuous component of this relationship at the covenant threshold. $\mathbf{X}_{i,t-4}$ includes the four-quarter lag of the same six variables, entered linearly, to control for the firm's financial trajectory over the preceding year and remove any pre-violation trend that may predict future outcomes independently of the violation event itself.

Firm-level controls. $\mathbf{Z}_{i,t}$ includes the contemporaneous level and first difference of log total assets and of the PPE-to-assets ratio. These four variables absorb variation in firm size, size growth, capital intensity, and changes in capital intensity that may be correlated with both violation propensity and outcome dynamics but are not themselves covenant variables.

Fixed effects. α_j denotes a set of 38 SIC-based industry dummies, which absorb permanent cross-industry differences in investment rates, profitability, and financial structure. δ_t denotes calendar-quarter dummies, which absorb aggregate macroeconomic fluctuations common to all firms in a given quarter, including business cycle variation in credit conditions that generates mechanical correlation between violation frequency and outcomes. ϕ_f denotes fiscal-quarter dummies, which remove seasonal patterns in financial reporting and covenant measurement that vary with a firm's fiscal calendar. Together, these fixed effects ensure that identification comes from within-industry, within-quarter comparisons among firms at similar points in the fiscal calendar.

Identification and the link to the structural parameter. The quasi-discontinuity design identifies β from variation in violation status among firms that are observationally similar along all dimensions controlled for on the right-hand side. After absorbing the smooth polynomial functions of the six covenant ratios, their four-quarter lags, firm size and capital intensity, and the three sets of fixed effects, the residual variation in whether a firm crosses a covenant threshold in a given quarter is plausibly as good as random. The identifying assumption is that firms do not precisely manipulate their financial ratios to sort around unobserved, heterogeneous covenant thresholds, an as-

sumption supported by the evidence in Nini et al. [2012].

Event study. Figure 7 plots the mean and median values of key investment and size variables over the event window spanning four quarters before to four quarters after the onset of a new financial covenant violation. A new violation is defined as one that is not preceded by a breach in the previous four quarters, so that event time zero marks the beginning of a new violation episode. The figure shows a pronounced decline in investment and a subsequent slowdown in firm growth following the violation.

Capital expenditures decline steadily over the event window, falling from 1.85 percent of assets four quarters before the violation to 1.54 percent in the violation quarter and 1.18 percent four quarters afterward. Cash acquisitions contract even more sharply, declining from roughly 1.0 percent of assets before the violation to 0.77 percent in the violation quarter and below 0.4 percent within the following year. The median remains at zero throughout, reflecting the infrequent nature of acquisition activity.

Firm size exhibits a similar pattern. Log assets increase steadily before the violation, peak around the violation quarter, and then decline gradually thereafter. Likewise, log PPE continues to rise through the violation quarter, peaks one quarter later, and subsequently trends downward, indicating a slowdown in capital accumulation. Taken together, these patterns suggest that covenant violations are followed by sustained reductions in investment and a gradual slowdown in firm growth, consistent with an increase in creditor control rights following the breach.

Figure 8 plots the mean and median values of accounting-based performance measures from four quarters before to four quarters after the onset of a new covenant violation. A new violation is defined as one that is not preceded by a breach in the previous four quarters, so that event time zero marks the quarter in which the violation is first recorded. The figure shows a pronounced deterioration in operating performance leading up to the violation, followed by a significant recovery.

Operating income, scaled by average assets, declines steadily before the violation, falling from 1.15 percent (mean) and 2.52 percent (median) four quarters prior to -1.03 percent and 0.83 percent, respectively, at the violation quarter. Following the violation, profitability improves steadily: the mean rises to 0.19 percent and the median to 1.51 percent four quarters later. This post-violation recovery is driven primarily by a moderation in operating costs rather than a rebound in sales: log sales remain broadly stable throughout the event window, while log operating costs rise steadily into the violation quarter, where they peak, and decline in the following quarters. Overall, these patterns suggest that the deterioration in profitability around covenant violations is driven by a temporary buildup in operating costs, and that the subsequent recovery in profitability

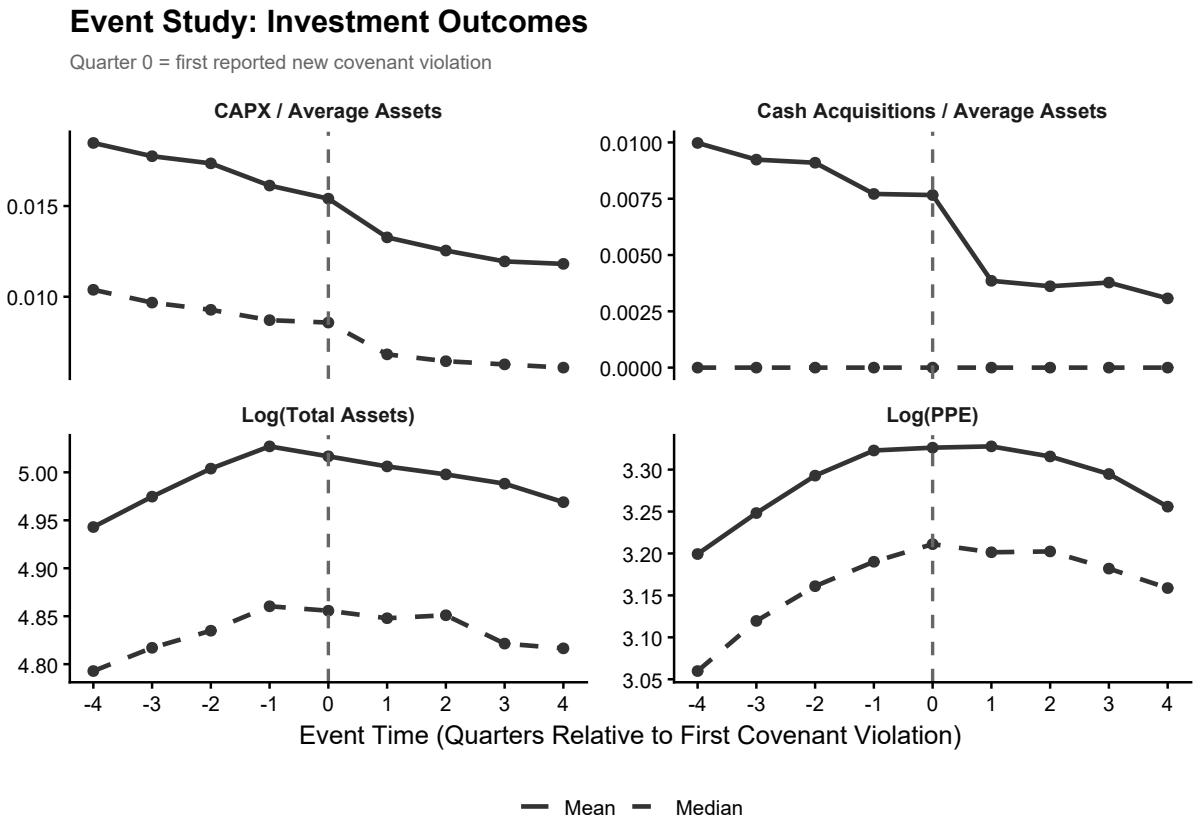


Figure 7: Event Study of Investment around Financial Covenant Violations. This figure presents mean and median values of investment-related variables around the onset of a new financial covenant violation. A new violation is defined as a violation by a firm that has not experienced a violation in the preceding four quarters. Event time 0 denotes the quarter in which the violation is first reported, implying that the underlying breach occurs between quarters -1 and 0.

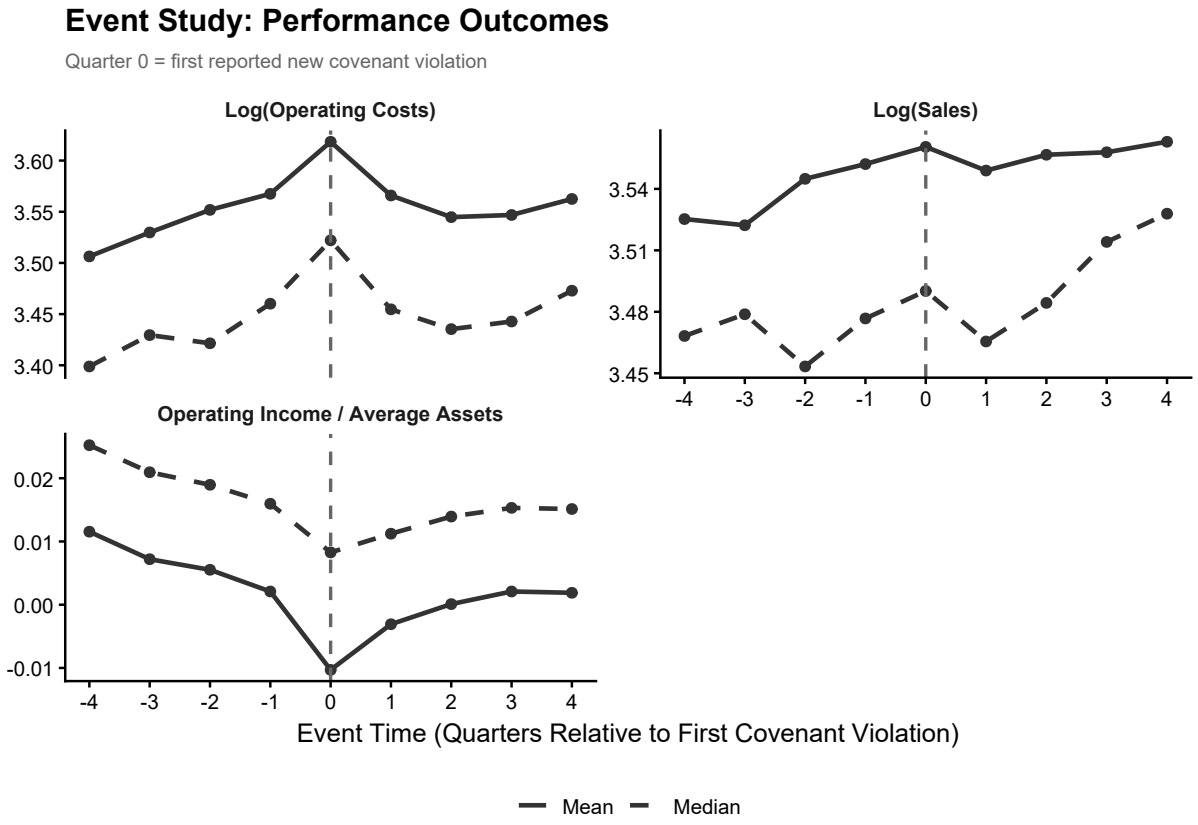


Figure 8: Event Study of Operating Performance around Financial Covenant Violations. This figure presents mean and median values of firm operating performance around the onset of a new financial covenant violation. A new violation is defined as a violation by a firm that has not experienced a violation in the preceding four quarters. Event time 0 denotes the quarter in which the violation is first reported, implying that the underlying breach occurs between quarters -1 and 0.

reflects the unwinding of these cost pressures rather than any improvement in sales.

H Appendix: Structural Estimation

H.1 Model Moments

For each simulated firm and parameter vector Θ, the model generates equilibrium investment intensity k, debt face value (promised repayment), loan spreads, covenant choices, and intervention policies. Loan spreads are defined as expected repayment per unit of external financing net of the risk-free rate:

$$\textit{spread} = \frac{E[D]}{k - N} - (1 + r),$$

where

$$E[D] = \begin{cases} \nu D_0 + (1 - \nu) D_1, & \text{complex debt,} \\ D, & \text{simple debt.} \end{cases}$$

The (unconditional) probability of default is

$$\Pr(\textit{default}) = \begin{cases} \nu \left[q_0 F_{H,A}(D_0) + (1 - q_0) F_{H,N}(D_0) \right] + (1 - \nu) F_{H,N}(D_1), & \text{complex debt,} \\ F_{H,N}(D), & \text{simple debt.} \end{cases}$$

and correspondingly, the conditional probability of default upon covenant violation is

$$\Pr(\textit{default}) \mid \text{violation} = q_0 F_{H,A}(D_0) + (1 - q_0) F_{H,N}(D_0)$$

The following twelve moments are calculated from the simulated cross-section of firms.

Elasticity of loan spread to internal financing capacity:

$$\frac{\text{Cov}(\log \textit{spread}, \log N)}{\text{Var}(\log N)}.$$

Elasticity of loan spread to external financing intensity:

$$\frac{\text{Cov}(\log \textit{spread}, \log\left(1 + \frac{k-N}{N}\right))}{\text{Var}(\log\left(1 + \frac{k-N}{N}\right))}.$$

Cross-sectional variance of external financing intensity:

$$\text{Var}\left[\log\left(1 + \frac{k - N}{N}\right)\right].$$

Mean external financing intensity:

$$\mathbb{E}\left[\log\left(1+\frac{k-N}{N}\right)\right].$$

External financing sensitivity to internal capital:

$$\frac{\mathrm{Cov}(k-N,N)}{\mathrm{Var}(N)}.$$

Mean probability of default:

$$\mathbb{E}[\Pr(\textit{default})].$$

Mean probability of default upon covenant violation:

$$\mathbb{E}[\Pr(\textit{default}) \mid \text{violation}].$$

Fraction of self-financing firms:

$$1-\Gamma(N^*).$$

Unconditional covenant violation rate:

$$\Gamma(N^*)\nu.$$

Mean probability of creditor intervention conditional on violation:

$$\mathbb{E}[q_0(N) \mid N \leq N^*].$$

Mean treatment effect of intervention on operating income:

$$\mathbb{E}[q_0(N)\Delta y(N) \mid N \leq N^*],$$

$$\Delta y(N) = y^I(N) - y^W(N),$$

where

$$y^I(N) = (\mu_\omega + \tau)\left[(1-\gamma)k(N)\right]^\alpha$$

denotes the expected operating output following creditor intervention, and

$$y^W(N) = \mu_\omega k(N)^\alpha$$

denotes the expected operating output under waiver. Therefore,

$$\Delta y(N) = (\mu_\omega + \tau)\left[(1-\gamma)k(N)\right]^\alpha - \mu_\omega k(N)^\alpha.$$

Because the model assumes a continuum of firms at each net-worth level, idiosyncratic productivity shocks are integrated out by the law of large numbers, so $\Delta y(N)$ depends only on the conditional mean productivity under each contractual regime. Since the covenant violation probability ν is constant across covenant firms, conditioning on violating firms is equivalent to conditioning on firms with financial covenants ($N \leq N^*$).

Semi-elasticity of intervention to internal financing capacity:

$$\frac{\text{Cov}\left(q_0(N), \log N \mid N \leq N^*\right)}{\text{Var}\left(\log N \mid N \leq N^*\right)}.$$

where $q_0(N)$ denotes the equilibrium probability of creditor intervention following a covenant violation for a firm with internal financing capacity N. This moment captures the cross-sectional relationship between creditor control rights and borrower financial conditions conditional on covenant violation. A negative value indicates that creditor intervention is more likely among firms with lower internal financing capacity.

H.2 Empirical Moments

The empirical counterparts are constructed from the matched Compustat–DealScan sample together with the covenant violation event data. Unless otherwise stated, all moments are computed from the pooled firm-year cross section over the sample period.

Elasticity of loan spread to internal financing capacity:

$$\frac{\text{Cov}(\log S_i, \log N_i)}{\text{Var}(\log N_i)}.$$

Elasticity of loan spread to external financing intensity:

$$\frac{\text{Cov}(\log S_i, \log\left(1 + \frac{Debt_i}{N_i}\right))}{\text{Var}(\log\left(1 + \frac{Debt_i}{N_i}\right))}.$$

Cross-sectional variance of external financing intensity:

$$\text{Var}\left[\log\left(1 + \frac{Debt_i}{N_i}\right)\right].$$

Mean external financing intensity:

$$\mathbb{E}\left[\log\left(1+\frac{Debt_i}{N_i}\right)\right].$$

Investment-internal capital sensitivity: the regression estimate of

$$\frac{\text{Investment}_{i,j,t}}{\text{Total Asset}_{j,t-1}} = \delta + \pi \frac{\widehat{\text{Cash Flow}}^{\text{shock}}_{j,t-1}}{\text{Total Asset}_{j,t-1}} + \phi Z_{i,j,t} + \eta_i + \tau_t + \varepsilon_{i,j,t}.$$

Mean probability of default:

$$\mathbb{E}[D_i],$$

where D_i is an indicator for default.

Mean probability of default:

$$\mathbb{E}[D_i \mid \text{violation}].$$

Fraction of self-financing firms:

$$\mathbb{E}[\text{Having no outstanding syndicated loan}_i].$$

Unconditional (all) financial covenant violation rate:

$$\mathbb{E}[\text{violation}_i].$$

Mean probability of creditor intervention conditional on violation:

$$\mathbb{E}[\text{Intervention}_i \mid \text{violation}].$$

Mean treatment effect of intervention on operating performance: the regression beta estimate of

$$y_{i,t+4} - y_{i,t} = \beta\, \mathit{Violation}_{i,t} + \theta' \mathbf{X}_{i,t} + \kappa' h(\mathbf{X}_{i,t}) + \lambda' \mathbf{X}_{i,t-4} + \gamma' \mathbf{Z}_{i,t} + \alpha_j + \delta_t + \phi_f + \varepsilon_{i,t}.$$

where $y_{i,t+4} - y_{i,t}$ denotes the four-quarter change in operating performance measured by operating income scaled by average assets.

Semi-elasticity of intervention to internal financing capacity:

$$\frac{\text{Cov}(\text{Intervention}_i, \log N_i \mid \text{Violation})}{\text{Var}(\log N_i \mid \text{Violation})}.$$

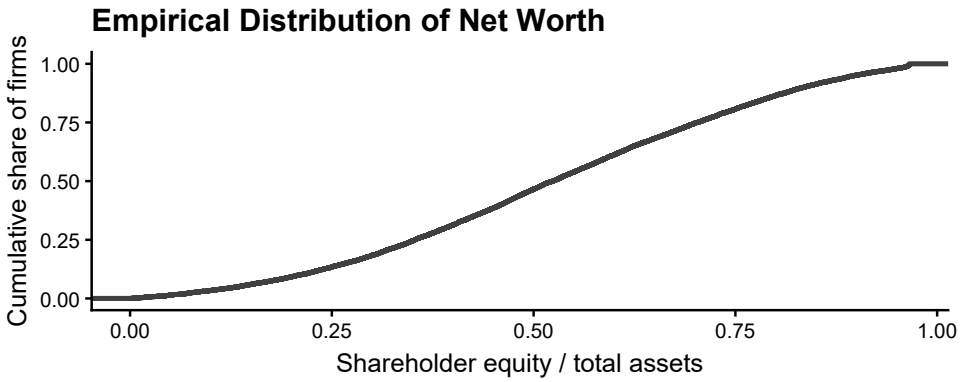


Figure 9: Empirical cumulative distribution of cross-sectional firms' net worth.

H.3 Distribution of Net Worth

Figure 9 shows the empirical distribution of the shareholder's equity-to-total-assets ratio across firms. In the estimation process, I draw repeatedly from this empirical distribution and use the resulting values to represent firms' net worth, or internal capital in the model, thereby generating a simulated cross-sectional distribution of firms.