

SUPPLEMENTARY APPENDIX: ANATOMY OF CORPORATE BORROWING CONSTRAINTS

Chen Lian¹ and Yueran Ma²

¹Massachusetts Institute of Technology

²University of Chicago Booth School of Business

IA1 Other Types of Financial Covenants

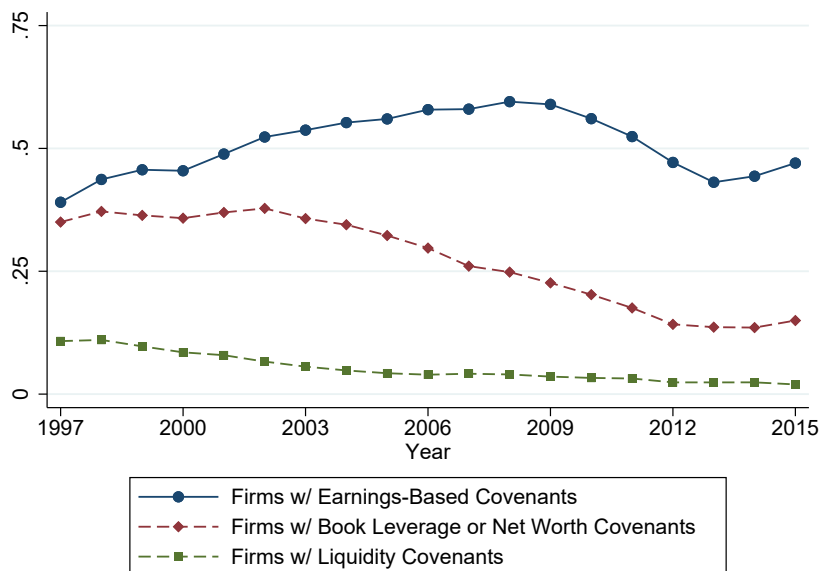
As mentioned in Section 2.2, other types of financial covenants have two main forms. One type specifies an upper bound on book leverage, or analogously a lower bound on book equity (book net worth). As book equity is closely related to the accumulation of past earnings, this can be broadly viewed as a variant of EBCs. The popularity of this type of covenant has declined in the past twenty years for several reasons. Demerjian (2011) postulates the decline is affected by shifts in accounting standards that gave firms more discretion in estimating the value of assets and liabilities on their balance sheets. In addition, institutional investors became increasingly more important in corporate loans, who place less emphasis on balance sheet-based metrics relative to earnings-based metrics. Currently the prevalence of the book leverage/net worth covenants is less than a third of the prevalence of earnings-based covenants, and violations are uncommon.

The other type of financial covenant focuses on liquidity conditions, and specifies limits on the ratio of current assets to current liabilities. The prevalence of this type of financial covenant is relatively low.

Figure IA1 plots the fraction of large firms with earnings-based covenants, book leverage/net worth covenants, and liquidity covenants, based on covenant information from DealScan loans.

Figure IA1: Other Forms of Financial Covenants

This figure shows the prevalence of different types of financial covenants among large US non-financial firms (assets above Compustat median). The solid line with circles shows the fraction of firms with earnings-based covenants. The dashed line with diamonds shows the fraction of firms with book leverage or book net worth covenants. The dashed line with squares shows the fraction of firms with liquidity covenants (limits on current assets relative to current liabilities). The covenants data are based on DealScan loans.



IA2 Contracting Bases of Earnings-Based Covenants

Below we illustrate the contracting functions of earnings-based covenants in cash flow-based lending.

In the simplest case where the borrower's cash flows are completely exogenous, the lender can just determine debt capacity at issuance based on expected cash flows. The lender does not need to constantly monitor each period's cash flows/earnings and restrict debt capacity. To understand why creditors closely monitor cash flows/earnings in each period, we consider two types of frictions that can give rise to earnings-based covenants.

IA2.1 Summary of Mechanisms

Earnings-Based Covenant and Incentive Provision

The first explanation is based on the role of financial covenants as an incentive scheme. We study a setting in the spirit of [Innes \(1990\)](#). In this setting, cash flows are verifiable and contractible, consistent with the institutional background of cash flow-based lending discussed above. However, the borrower needs to make an effort choice, and the effort is unobservable and not contractible. Effort is costly and the borrower may want to shirk (moral hazard), so financial contracts are designed to provide incentives for high effort.

In a standard debt contract, there is one breakpoint (default threshold) that serves two functions: satisfying the creditor’s participation constraint (break-even condition) and incentivizing the borrower to exert effort (default is costly to the borrower). Adding a covenant allows the creditor to specify a separate threshold, covenant violation, for incentive provision. Covenant violation imposes costs to the borrower, such as punishment fees or significant non-monetary costs (time spent dealing with creditors, restrictions on corporate policies, management being replaced, etc.), and incentivizes the borrower to work hard to avoid violation. By allowing the contract to decouple the incentive effect from the breakeven condition, the covenant can decrease the cost of incentivizing the borrower (helps satisfy the borrower’s incentive compatibility constraint). The formal model is shown below in Section [IA2.2](#).

Earnings-Based Covenant as Contingent Transfer of Control Rights

The second explanation views covenant violation as a signal that default on debt payment may become possible, and the creditor should consider stepping in to take actions. Specifically, when earnings are above the threshold specified by the covenant, default is remote; creditors can rest assured and do not need to pay much attention. When earnings fall below the covenant threshold, there are warning signs that the borrower’s ability to pay back the debt could be in question and creditors may suffer losses. In this case, creditors may want to step in and take some otherwise costly actions to improve firm performance. Because creditors enjoy most of the benefits from such actions (such actions only improve firm performance in bad states), the borrower/firm shareholders cannot commit to it. As a result, financial covenants are placed in debt contracts as an early warning sign, and they can trigger partial transfers of control rights to creditors. This view builds along the idea of contingent control rights ([Aghion and Bolton, 1992](#)) and the evidence on control right transfers following covenant violations ([Chava and Roberts, 2008](#); [Roberts and Sufi, 2009](#)). The formal model is shown below in [S IA2.3](#).

Why Covenants based on Earnings/EBITDA?

Finally, we discuss why financial covenants in cash flow-based lending emphasize current earnings as a key metric to serve the contracting functions discussed above (incentive provision or contingent transfer of control rights). The evaluation metric needs to have several properties. First, it needs to be informative about firm performance, which is central to both of the rationales we considered. Firm performance shows the manager’s effort. It also signals the necessity for creditor interventions (the borrower’s financial performance/cash flow value is especially important to creditor payoffs in cash flow-based lending). Second, the metric needs to be easy to observe and measure, so that it can be assessed on a frequent basis, and borrowers and lenders do not dispute its value.

In the US, with an accounting system that is reliable and well-designed to reflect the economic activities of the firm, earnings are informative and serve as a central measure of performance. Moreover, among various possible measures of earnings, creditors place most weight on EBITDA to reflect the performance and cash flow generation ability of

the firm’s core business.¹ Financial covenants also focus on current/recent earnings which are readily observable based on financial statements, rather than future earnings which are unobservable and not easily contractible.²

IA2.2 Model 1: Incentive Provision

Below we provide a model that illustrates the role of financial covenants for incentive provision.

The model has two stages, $t = 1, 2$. In stage $t = 1$, the risk neutral borrower needs to borrow $B > 0$ dollars from the risk neutral creditor to continue operations. If operations continue, the borrower needs to make an unobservable effort choice, $e \in \{e^L, e^H\}$, generating cost $g(e)$ to the borrower. In stage $t = 2$, the borrower generates observable and verifiable earnings/cash flows R with p.d.f. $f_e(R)$ and c.d.f. $F_e(R)$, where $e \in \{e^L, e^H\}$, and needs to repay debt obligations. We assume a competitive lending market, so the optimal contract maximizes the borrower’s payoff, subject to the creditor’s participation constraint (IR-C) and the borrower’s incentive compatibility constraint of not shirking (IC-B).³ For simplicity, we assume the gross interest rate to be 1.

We focus on whether adding an earnings-based covenants to an otherwise standard debt contract⁴ can improve the borrower’s payoff. The face value of debt is denoted by $D > 0$. On top of it, an earnings-based covenants with threshold $C \geq D$ can be added. When the covenant is violated, the borrower faces a “technical default,” and bears a non-monetary cost of $\bar{A} > 0$ (which may come from creditor interventions, time costs of dealing with creditors, career costs, etc.). When $C = D$, the contract degenerates to a standard debt contract, and the borrower only incurs the non-monetary cost if he misses debt payment.⁵

In this environment, the optimal debt contract (with covenants) solves the following

¹For instance, taxes and interests are excluded because they can be affected by different capital structures different firms have. The exclusion makes EBITDA more comparable across firms.

²One may wonder whether financial covenants can use other measures. We discuss several alternatives and why they are not applied in cash flow-based lending. First, relative to earnings, the value of physical assets can be driven by many factors and is less informative about the borrower’s performance. It can also be difficult to measure on a frequent basis, especially when assets are specialized and illiquid. Second, statistical measures of distance/probability to default can be relevant, but they are difficult to assess. Debtors and creditors can dispute about the computation, making it harder to contract on. Finally, financial covenants also do not use metrics such as stock prices, which can fluctuate due to non-fundamental reasons. In addition, investors can deliberately influence stock prices to trigger or avoid covenant violations, which can significantly complicate the situation.

³We assume the cost of not continuing operations to the borrower is very high, so the borrower’s participation constraint always holds.

⁴Innes (1990) shows that a debt-like contract is optimal in this environment, as it provides best incentives for the borrower to work. That is why we focus on debt contracts here. We discuss the relationship with the particular contract Innes (1990) considered in footnote 7.

⁵For simplicity, in the current environment, the non-monetary cost \bar{A} to the borrower when the covenant is violated (i.e. $D \leq R < C$) and such cost when the borrower misses debt payment (i.e. $R < D$) is the same. The key result, Proposition A1, extends to settings where the non-monetary costs at these two events are different. Moreover, Proposition A1 also holds when there is additional monetary cost of the payment default (e.g. monetary cost associated with bankruptcy).

constrained maximization problem:

$$U^* = \sup_{C,D} \int (\max\{R - D, 0\} - \bar{A}1_{\{R < C\}}) f_{e^H}(R) dR - g(e^H) \equiv \sup_{C,D} U^B(C, D), \quad (1)$$

$$\text{s.t. } IC - B : \int (\max\{R - D, 0\} - \bar{A}1_{\{R < C\}}) f_{e^H}(R) dR - g(e^H) \geq \int (\max\{R - D, 0\} - \bar{A}1_{\{R < C\}}) f_{e^L}(R) dR - g(e^L), \quad (2)$$

$$IR - C : \int \min\{R, D\} f_{e^H}(R) dR \geq B, \quad (3)$$

$$C \geq D, \quad (4)$$

Condition (1) specifies the payoff to the borrower. It consists of three components. First, $\max\{R - D, 0\}$ is the monetary payoff to the borrower when the realized earnings/cash flows is R . Second, the borrower incurs a non-monetary cost \bar{A} when the covenant is violated or debt payment is missed. Third, the borrower incurs a cost of $g(e^H)$ by exerting high efforts. Condition (2) specifies the borrower's incentive compatibility constraint of not shirking (IC-B): the borrower's utility is higher under e^H than e^L .⁶ Condition (3) specifies the expected payoff to the creditor is weakly higher than the amount lent to the borrower, B , so the creditor has incentive to participate (IC-R). Condition (4) requires the covenant violation cutoff to be weakly higher than the debt face value/payment default threshold.

Under the standard debt contract, $C = D$: the incentive effects provided by the non-monetary costs are determined by the face value of debt D (under the standard debt contract, the utility difference between high and low levels of effort, which comes from the non-monetary cost, is $\int -\bar{A}1_{\{R < D\}} f_{e^H}(R) dR - (\int -\bar{A}1_{\{R < D\}} f_{e^L}(R) dR) = \bar{A}(F_{e^H}(D) - F_{e^L}(D))$). Adding an earnings-based covenant, $C > D$, allows the contract to decouple debt payment, D , and incentive effects (the utility difference between high and low efforts coming from the non-monetary cost is now given by $\int -\bar{A}1_{\{R < C\}} f_{e^H}(R) dR - (\int -\bar{A}1_{\{R < C\}} f_{e^L}(R) dR) = \bar{A}(F_{e^H}(C) - F_{e^L}(C))$). The introduction of earnings based covenants helps to provide more effective incentives for the borrower to exert high effort, and helps to achieve the constrained optimum. We formalize this intuition in Proposition A1.⁷ We state a few standard (technical) assumptions first.

⁶This raises the question of why the optimal contract wants to implement high effort e^H , instead of shirking e^L . We assume $\int R f_{e^L}(R) dR < B$. As a result, the expected payoff generated by shirking is not enough to compensate the creditor. A contract implementing e^L cannot satisfy creditor's participation constraint.

⁷Innes (1990) considers two types of contracts: a "live or die" contract and a standard debt contract. The "live or die" contract features a discrete jump in the borrower's payoff if he does not default on debt payment, similar to the effect of $\bar{A} > 0$ here. This is the optimal contract without any restriction on the contract space. However, a contract with discrete jumps may create incentives for the borrower to get a few extra dollars and avoid the jump. The debt contract Innes (1990) considers avoids such the discrete jump of the borrower's payoff (this requires $\bar{A} = 0$ in our notation), and provides a smooth payoff scheme. In our view, as widely documented in the empirical literature on debt covenants, the event of covenant violation indeed incurs significant costs to the borrower, and borrowers try to avoid such violations. However, this cost should not be a free variable that can be chosen by the contract as in the "live or death" contract. As a result, we choose a fixed cost $\bar{A} > 0$ and explores its implications for optimal contract design.

Assumption A1 (Full and Non-Moving Support). *The p.d.f of R satisfies:*

$$f_{e^L}(R), f_{e^H}(R) > 0, \forall R \in [R_{\min}, R_{\max}];$$

$$f_{e^L}(R) = f_{e^H}(R) = 0, \forall R \notin [R_{\min}, R_{\max}].$$

Assumption A2 (Monotone Likelihood Ratio Property (MLRP)). *The likelihood ratio $L(R) = \frac{f_{e^H}(R)}{f_{e^L}(R)}$ is increasing in $R \in [R_{\min}, R_{\max}]$.*

Assumptions **A1** and **A2** are standard regularity assumptions to make the problem well behaved. By Assumption **A2**, there exists \bar{R} , such that

$$\begin{cases} L(R) = \frac{f_{e^H}(R)}{f_{e^L}(R)} < 1 & R < \bar{R} \\ L(R) = \frac{f_{e^H}(R)}{f_{e^L}(R)} \geq 1 & R \geq \bar{R}. \end{cases}$$

Now we state the assumption under which at least one contract will satisfy the constraints in conditions (2), (3) and (4), so the problem in (1) is well defined.

Assumption A3. *[Existence]*

i) Under high efforts, the borrower generates enough output to repay the creditor:

$$\int R f_{e^H}(R) dR > B.$$

As a result, there exists a $\bar{D} \in [0, R_{\max})$ that uniquely pins down the creditor's break-even condition,

$$\int \min \{R, \bar{D}\} f_{e^H}(R) dR = B, \quad (5)$$

thus condition (3) holds with equality.

ii) Under contract $(C, D) = (\max \{\bar{D}, \bar{R}\}, \bar{D})$, the borrower's IC condition gets satisfied.⁸

$$\begin{aligned} & \int \left(\max \{R - \bar{D}, 0\} - \bar{A}1_{\{R < \max \{\bar{D}, \bar{R}\}\}} \right) f_{e^H}(R) dR - g(e^H) \geq \\ & \int \left(\max \{R - \bar{D}, 0\} - \bar{A}1_{\{R < \max \{\bar{D}, \bar{R}\}\}} \right) f_{e^L}(R) dR - g(e^L). \end{aligned} \quad (6)$$

We will now be able to formalize the previous intuition about why earnings-based covenants are helpful, and state Proposition **A1**.

Proposition A1. *Under Assumptions **A1**, **A2** and **A3**, we establish:*

(i) The set of contracts that satisfy all of the constraints (2) - (4) are non-empty. Moreover, there exists a contract (C^, D^*) that achieves the supremum U^* defined in condition (1).*

⁸In fact, we can prove that, if condition (6) is violated, the borrower's IC condition is not satisfied under any contract. In this sense, contract $(C, D) = (\max \{\bar{D}, \bar{R}\}, \bar{D})$ is the "best" contract in terms of helping to achieve the borrower's IC constraint.

(ii) In any optimal contract, the face value of debt always pins down the creditor's break-even condition. That is, $D^* = \bar{D}$, where \bar{D} is defined in (5).

(iii) Suppose that the borrower's IC constraint is not satisfied under a simple debt contract with face value \bar{D} ,

$$\int \left(\max \{R - \bar{D}, 0\} - \bar{A}1_{\{R < \bar{D}\}} \right) f_{e^H}(R) dR - g(e^H) < \int \left(\max \{R - \bar{D}, 0\} - \bar{A}1_{\{R < \bar{D}\}} \right) f_{e^L}(R) dR - g(e^L). \quad (7)$$

In any optimal contract, the cutoff of covenant violation is strictly higher than the face value of debt.

$$C^* > D^*. \quad (8)$$

Part (i) of the Proposition proves the existence of the optimum under the previous assumptions. Part (ii) shows that once the option of adding a financial covenant is available, the face value of debt is *always* pinned down by the creditor's break-even condition. In this sense, the introduction of financial covenant decouples the face value of debt/debt payment, D , and incentive effects. Part (iii) shows, as long as a simple debt contract with face value $D = \bar{D}$ is not enough to incentivize the borrower to put high efforts⁹, the optimal contract *always* features a higher cutoff for covenant violation than the face value of debt.

The role of covenants as an incentive scheme also provides a rationale about why EBITDA is chosen as the key earnings measure used in practice. Among financial variables, it is among the most informative ones about firm performance (e.g. excluding windfalls etc.) and thus managers' efforts. Moreover, this metric is easy to observe and measure. It can be assessed on a frequent basis, and borrowers and lenders do not constantly dispute its value.

IA2.3 Model 2: Contingent Transfer of Control Rights

Now we present a model formulating the role of financial covenants for contingent transfer of control rights.

The model has three stages, $t = 1, 1.5, 2$. The gross interest rate is normalized to be 1 throughout.

In stage $t = 1$, the risk neutral borrower needs to borrow $B > 0$ dollars from the risk neutral creditor to continue operations.¹⁰ Different from the first explanation in Section IA2.2, there is no ex ante effort choice. We thus emphasize that the second explanation does not depend on the role of earnings-based covenants as an incentive scheme.¹¹ Instead,

⁹This is what condition (7) means. If it does not hold, then the friction due to ex ante moral hazard does not matter for the contract design, and we go back to the first best (the problem is uninteresting in this case).

¹⁰Similar to the model above, we assume the cost of not continuing operations to the borrower is very high, so the borrower's participation constraint always holds.

¹¹As we will see, the crucial friction in the first explanation is the borrower's unobservable ex ante efforts

the earnings/cash flows generated at stage $t = 2$, $R(x)$, is a function of the exogenous state of the world, $x \in [x_{\min}, x_{\max}]$, in stage 2. Without loss of generality, we assume $R(x)$ is increasing in x .¹²

In the intermediate stage $t = 1.5$, an observable state of nature $s \in [s_{\min}, s_{\max}]$ is revealed, which serves as a “signal” about x . When s is low (high), it means low (high) x is more likely. In particular, let $F_s(x)$ denote the distribution (c.d.f.) of x conditional on s . We assume, if $s > s'$,

$$F_s(x) \text{ first order stochastic dominates } F_{s'}(x). \quad (9)$$

As a result,

$$E[R(x) | s] \text{ is increasing in } s.$$

In this intermediate stage, an additional action can be taken, which generates additional observable and verifiable earnings/cash flows $Y(x)$ in stage $t = 2$. Such actions are only efficient when x is bad. In particular, $Y(x)$ is decreasing in x (We still maintain that $Y(x) + R(x)$ is increasing in x .) Moreover, there is a cutoff $\bar{x} \in (x_{\min}, x_{\max})$, such that

$$\begin{cases} Y(x) > 0 & \text{if } x < \bar{x} \\ Y(x) \leq 0 & \text{if } x \geq \bar{x} \end{cases}. \quad (10)$$

Such an action can be thought as an “emergency plan” that is otherwise costly in the good states of the world.

In stage $t = 2$, the state of nature x , is revealed, and the borrower generates observable and verifiable earnings/cash flows $R(x)$. If the “emergency plan” project is taken, an additional observable and verifiable earnings/cash flows $Y(x)$ is generated. The borrower needs to repay his debt obligations, with face value D , in stage 2. As before, we assume a competitive lending market, so the optimal contract maximizes the borrower’s payoff, subject to the creditor’s participation constraint (IR-C).

Let us first consider the first best, where the “emergency plan” project is taken if and only if $s \leq \bar{s}$, where \bar{s} is the cutoff such that¹³

$$\begin{cases} E[Y(x) | s] > 0 & \text{if } s < \bar{s} \\ E[Y(x) | s] \leq 0 & \text{if } s \geq \bar{s} \end{cases}.$$

Under first best, the creditor’s realized payoff is $\min\{D, R(x) + Y(x) 1_{s < \bar{s}}\}$. To satisfy the creditor’s participation constraint (IR), it must be the case that $E[\min\{D, R(x) + Y(x) 1_{s < \bar{s}}\}] \geq B$. A competitive lending market then pins down $D = D^*$ by letting the previous condition hold with equality. The borrower’s realized utility is then given by $\max\{R(x) + Y(x) 1_{s < \bar{s}} - D^*, 0\}$.

choice. The crucial friction in the second explanation is that the borrower cannot commit to some ex post actions that are beneficial in the bad states.

¹²We also assume $E[R(x)] > B$, so there is enough output to compensate the borrower.

¹³The existence of such cutoff comes from conditions (9) and (10).

How can the first best can be implemented? A standard debt contract in which the borrower always has control rights in the intermediate stage $t = 1.5$ may not do the job. This is because the “emergency plan” is beneficial in bad states of the world, but is otherwise costly in good states of the world; the creditor enjoys the majority of benefits from such an action, and the borrower may not be able to commit to implementing it even when s is revealed revealed in the intermediate stage.¹⁴ For example, we have:

Proposition A2. *Assume $R(x_{\min}) \leq D \leq R(x_{\max})$, so there exists a unique x_D such that $R(x_D) = D$.¹⁵ As long as $Y(x_D) \leq 0$, for all s ,*

$$E[\max\{R(x) + Y(x) - D, 0\} | s] \leq E[\max\{R(x) - D, 0\} | s]. \quad (11)$$

Moreover, if for a given s , there is a positive measure of x under F_s such that

$$\max\{R(x) + Y(x) - D, 0\} < \max\{R(x) - D, 0\},$$

The condition $Y(x_D) \leq 0$ means that, in the state of world where the borrower starts to receive payment, the “emergency plan” project is already inefficient.¹⁶ In this case, the borrower weakly prefers not to implement the “emergency plan” in *any* state of the world in the intermediate stage. Moreover, if for a given intermediate state s , there is a positive measure of final states x such that taking the “emergency plan” project is strictly worse off for the borrower, then the borrower will strictly prefer not to implement such “emergency plan” in state s . This explains why the optimal contract needs to feature a covenant that *transfers the control rights* to the creditor in certain states of the world.

Now we show that a financial contract specifying a contingent transfer of control rights from the borrower to the creditor when $s < \bar{s}$ in the intermediate state can implement the first best. To be concrete, we have:¹⁷

Proposition A3. *For all $D > 0$ and $s < \bar{s}$,*

$$E[\min\{D, R(x) + Y(x)\} | s] \geq E[\min\{D, R(x)\} | s]. \quad (12)$$

This means the creditor always has incentives to implement the “emergency plan” when $s < \bar{s}$. As a result, the first best can be implemented by a standard debt contract with face value D^* and a covenant transferring the control rights to the creditor when $s < \bar{s}$.

As EBITDA is among the most informative financial variables about firm performance, it can serve as a helpful signal. In addition, this metric is easy to observe and measure, and can be assessed on a frequent basis. Accordingly, one can write a covenant that transfers

¹⁴Such frictions is akin to frictions studied in the “debt overhang” literature (Myers, 1977).

¹⁵Note that any debt face value $D \geq R(x_{\max})$ is equivalent to $D = R(x_{\max})$ in terms of payoffs, as $Y(x_{\max}) < 0$. So assume $D \leq R(x_{\max})$ is without loss of generality.

¹⁶Note that this does not mean there does not exist state \bar{s} in the intermediate stage such that the “emergency plan” is efficient for $s \leq \bar{s}$.

¹⁷The proposition can also be extended to the case with costs of bankruptcy, but such costs are not required.

control rights when EBITDA is too low, approximating the transfer of control rights in state $s < \bar{s}$ modeled in Proposition A3. Thus, earnings-based covenants can be thought as a mechanism for contingent transfers of control rights.

IA2.4 Proofs

Proof of Proposition A1.

i) Consider contract $(C, D) = (\max\{\bar{D}, \bar{R}\}, \bar{D})$. From condition (6), we know that the borrower's IC constraint, condition (2), is satisfied. From condition (5), we know that the creditor's IR constraint, condition (3), is satisfied. As a result, the set of contracts that satisfy all of constraints (2) - (4) is non-empty.

Moreover, by working with continuous random variables (we assume p.d.f. exists for $f_{e^L}(R)$ and $f_{e^H}(R)$), we know the borrower's utility as a function of C and D in condition 1 is continuous and bounded, and the set of (C, D) that satisfies constraints (2) - (4) is closed. As a result, the optimum of the following maximization problem exists. There exists a contract (C^*, D^*) that achieves the supreme U^* defined in condition 1.

ii) We will proceed by contradiction. Consider a constrained optimal contract (C^*, D^*) such that $U^* = U(C^*, D^*)$ and $D^* > \bar{D}$, where $\bar{D} \in [0, R_{\max})$ is defined in condition (5). We can construct an alternative contract $(C', D') = (C^*, \bar{D})$. Under this new contract, $U^B(C', D') > U^B(C^*, D^*)$. Let us consider whether the borrower's IC constraint is still satisfied under (C', D') . Let $h(D) \equiv \int \max\{R - D, 0\} (f_{e^H}(R) - f_{e^L}(R)) dR = \int_D^{R_{\max}} (R - D) (f_{e^H}(R) - f_{e^L}(R)) dR$. We have

$$\begin{cases} h'(D) = \left(\int_D^{R_{\max}} - (f_{e^H}(R) - f_{e^L}(R)) \right) dR = F_{e^H}(R) - F_{e^L}(R) \leq 0 & \text{if } D \in [0, R_{\max}) \\ h'(D) = 0 & \text{if } D > R_{\max}. \end{cases}$$

where we use the fact that under Assumption 5, F_{e^H} first order stochastically dominates F_{e^L} . As a result, we have $h(D^*) \leq h(\bar{D}) = h(D')$. This makes sure that the borrower's IC constraint is still satisfied under (C', D') . Moreover, conditions (3) and (4) are also satisfied under (C', D') . As a result, (C^*, D^*) achieves constrained optimum.

iii) Consider a constrained optimal contract (C^*, D^*) . From part (ii) of the Proposition, we know $D^* = \bar{D}$. From condition 7, we know if $C^* = D^* = \bar{D}$, the borrower's IC constraint will be violated. This proves $C^* > D^*$.

Proof of Proposition A3.

We prove Proposition A3 first, and then prove Proposition A2 next. As discussed in footnote 15, without loss of generality, we can assume $D \leq R(x_{\max})$. If $D \geq R(x_{\min})$, there exists a unique x_D such that $R(x_D) = D$. Consider two sub-cases:

a) $Y(x_D) \geq 0$. Because Y is decreasing, we have, for all $x \leq x_D$, $Y(x) \geq 0$. As a result,

$$\min\{D, R(x) + Y(x)\} \geq \min\{D, R(x)\} \quad \forall x \leq x_D. \quad (13)$$

For $x > x_D$, we assumed both $R(x)$ and $R(x) + Y(x)$ are increasing in x . As a result, $R(x) \geq R(x_D) = D$. $R(x) + Y(x) \geq R(x_D) + Y(x_D) \geq D$. Together, we have,

$$\min \{D, R(x) + Y(x)\} = \min \{D, R(x)\} = D \quad \forall x > x_D.$$

Together with condition (13), we prove $E[\min \{D, R(x) + Y(x)\} | s] \geq E[\min \{D, R(x)\} | s]$ for *any* s .

b) $Y(x_D) \leq 0$. Because Y is decreasing, for all $x > x_D$, we have $Y(x) \leq 0$. As a result,

$$\max \{R(x) + Y(x) - D, 0\} \leq \max \{R(x) - D, 0\} \quad \forall x > x_D.$$

For $x \leq x_D$, because both $R(x)$ and $R(x) + Y(x)$ are increasing in x , we have $R(x) + Y(x) \leq R(x_D) + Y(x_D) < D$. As a result,

$$\max \{R(x) + Y(x) - D, 0\} = \max \{R(x) - D, 0\} = 0 \quad \forall x \leq x_D.$$

Together, we have, for *any* s ,

$$E[\max \{R(x) + Y(x) - D, 0\} | s] \leq E[\max \{R(x) - D, 0\} | s]. \quad (14)$$

Note that, for $s < \bar{s}$, $E[Y(x) | s] = E[R(x) + Y(x) - D | s] - E[R(x) - D | s] > 0$. Moreover, $\max \{R(x) - D, 0\} + \min \{D, R(x)\} = R(x)$ and $\max \{R(x) + Y(x) - D, 0\} + \min \{D, R(x) + Y(x)\} = R(x) + Y(x)$. Together with condition (14), we have, for any $s < \bar{s}$,

$$E[\min \{D, R(x) + Y(x)\} | s] \geq E[\min \{D, R(x)\} | s].$$

Finally, we consider the case $D \leq R(x_{\min})$. Then, for all x , we have

$$\min \{D, R(x)\} = D \quad \text{and} \quad \min \{D, R(x) + Y(x)\} \geq D.$$

As a result, we have, for *any* s ,

$$E[\min \{D, R(x) + Y(x)\} | s] \geq E[\min \{D, R(x)\} | s].$$

This finishes the proof of Proposition A3.

Proof of Proposition A2.

As in the proof of Proposition A3, we have,

$$\max \{R(x) + Y(x) - D, 0\} \leq \max \{R(x) - D, 0\} \quad \forall x,$$

$$E[\max \{R(x) + Y(x) - D, 0\} | s] \leq E[\max \{R(x) - D, 0\} | s] \quad \forall s.$$

If for a given s , there is a positive measure of x under F_s such that

$$\max \{R(x) + Y(x) - D, 0\} < \max \{R(x) - D, 0\},$$

we have

$$E[\max \{R(x) + Y(x) - D, 0\} | s] < E[\max \{R(x) - D, 0\} | s].$$

IA3 Effects of Cash Flows in Classic Models of Corporate Borrowing

In this appendix, we further discuss several strands of literature on costly external financing, and their predictions about how cash flows influence corporate borrowing and investment. We clarify the differences between predictions based on EBCs and predictions in these models. As discussed in Section 3.1, in these other models, cash flows only affect corporate borrowing through the impact on internal funds; EBITDA does not have an independent role after controlling for internal funds. We summarize the detailed predictions below.

1. This paper

- Determinant of cost/capacity for external borrowing: Operating earnings.
- Formulation: $C(b, \pi)$; π is operating earnings (EBITDA).
- How cash flows influence borrowing and investment: Cash flows in the form of EBITDA relax borrowing constraints/decrease cost of external borrowing, and crowd in borrowing and investment. Holding EBITDA constant, cash receipts increase internal funds, but do not relax borrowing constraints/decrease cost of external borrowing. They boost investment but substitute out external borrowing.
- EBITDA plays an independent role controlling for internal funds.

2. [Froot, Scharfstein, and Stein \(1993\)](#), [Kaplan and Zingales \(1997\)](#)

- Determinant of cost/capacity for external borrowing: Exogenous (not dependent on financial variables).
- Formulation: $C(b)$.
- How cash flows influence borrowing and investment: Cash flows increase internal funds, but do not relax borrowing constraints/decrease cost of external borrowing. They boost investment but substitute out external borrowing.
- EBITDA does not play an independent role controlling for internal funds.

3. [Kiyotaki and Moore \(1997\)](#), [Bernanke, Gertler, and Gilchrist \(1999\)](#)

- Determinant of cost/capacity for external borrowing: Liquidation value of physical assets.
- Formulation: $C(b, qk)$. k is the amount of physical capital the firm owns, q is the liquidation value per unit of capital measured at the time of debt repayment.
- How cash flows influence borrowing and investment: Borrowing constraints/cost of external borrowing do not directly depend on cash flows. Higher cash flows may increase borrowing indirectly as they increase firms' internal funds ("net worth"), allow firms to acquire more physical assets, and relax firms' borrowing constraints/decreases cost of external financing.
- EBITDA does not play an independent role controlling for internal funds.

4. [Holmstrom and Tirole \(1997\)](#)

- Determinant of cost/capacity for external borrowing: Pledgeable income.
- Formulation: $C(b, P)$. P is the amount of pledgeable income a firm has.
- How cash flows influence borrowing and investment: Borrowing constraints/cost of external borrowing do not directly depend on cash flows. Higher cash flows may increase borrowing indirectly as they increase firms' internal funds ("net worth"), allow firms to acquire more projects, and therefore generate more pledgeable income and relax firms' borrowing constraints/decreases its cost of external financing.
- EBITDA does not play an independent role controlling for internal funds.

5. Net worth channel

- The concept "net worth channel" is used in both the third case and the fourth case. "Net worth" is defined as the firm's maximum amount of funds available that can be used to acquire new assets and projects ([Bernanke, Gertler, and Gilchrist, 1999](#)). This is equivalent to internal funds w in our framework.
- In the case of [Kiyotaki and Moore \(1997\)](#) and [Bernanke, Gertler, and Gilchrist \(1999\)](#), the net worth channel means that an increase in internal funds w allows firms to acquire more physical assets and relax its borrowing constraints. In the case of [Holmstrom and Tirole \(1997\)](#), the net worth channel means that an increase in internal funds w allows firms to acquire more projects, generate more pledgeable income and relax its borrowing constraints. The concept "net worth channel" can be consistent with both asset-based lending and cash flow-based lending.

- In the models above, the net worth channel is focused on the role of internal funds. All components of internal funds have the same positive impact on borrowing; EBITDA does not play an independent role after controlling for internal funds.

IA4 Additional Results

IA4.1 Are Financially More Constrained Firms More Sensitive to “Cash Flows”?

As discussed in Section 3.4, EBCs point to a new mechanism for investment cash flow sensitivity through earnings-based borrowing constraints. To the extent that cash flow sensitivity may depend on the form of borrowing constraint, this observation also sheds light on the debate about whether cash flow sensitivity should be higher among more financially constrained firms (Fazzari, Hubbard, and Petersen, 1988, 2000; Kaplan and Zingales, 1997, 2000). As we note, for small firms which are reasonably more constrained, there is one less channel of cash flow sensitivity, which could contribute to empirical findings that more “financially constrained” firms may not display higher cash flow sensitivity (especially when cash flows are measured based on earnings).

Table IA1 provides an illustration, and compares all large non-financial firms as a group with all small firms as a group. Panel A shows that among large firms, debt issuance increases significantly with EBITDA, driven by the large share of firms with EBCs. Among small firms, however, the coefficient on EBITDA is negative and significant when not controlling for net cash receipts OCF. The coefficient on EBITDA is about zero when OCF is added. Similarly, as shown in Section 3.3 and Table 5, small firms’ borrowing also does not respond significantly to changes in EBITDA due to the accounting natural experiment. The results suggest that, with the absence of EBCs, small firms may have one less source of cash flow sensitivity which operates through external borrowing.

Table IA1 Panel B presents results for capital expenditures. Columns (1) and (3) include EBITDA but not OCF, a specification similar to typical investment cash flow sensitivity regressions that measure “cash flows” using earnings. In this case, the coefficient on EBITDA is positive and significant for large firms, and insignificant for small firms. The interpretation of this result, however, is not necessarily that small firms are not sensitive to *internal funds*. Rather, it results from the absence of the EBC channel among small firms, as Panel A indicates. In Columns (2) and (4), we add OCF and its coefficient is positive in both groups, though smaller among small firms.¹⁸

¹⁸Capital expenditures capture spending on plant, property, and equipment, and the investment structure of large and small firms could be different. Small firms may invest more in labor and human capital or R&D, and less in traditional hard assets. Thus the empirical magnitude of the cash flow sensitivity of *capital expenditures* may also differ among these two groups for other reasons.

Table IA1: Debt Issuance and Investment Activities: Large vs. Small Firms

Firm-level annual panel regressions of debt issuance and investment activities on EBITDA:

$$Y_{it} = \alpha_i + \eta_t + \beta \text{EBITDA}_{it} + \kappa \text{OCF}_{it} + X'_{it} \gamma + \epsilon_{it}$$

The outcome variable is net long-term debt issuance in Panel A, and capital expenditures in Panel B. Control variables are the same as those in Table 3. Regression results are presented separately for all large firms (assets above Compustat median) and all small firms. Firm fixed effects and year fixed effects are included (R^2 does not include fixed effects). Sample period is 1996 to 2015. Standard errors are clustered by firm and time.

Panel A. Net LT Debt Issuance

	Large Firm		Small Firm	
	(1)	(2)	(3)	(4)
EBITDA	0.092*** (0.020)	0.173*** (0.023)	-0.019*** (0.007)	0.001 (0.009)
OCF		-0.141*** (0.022)		-0.033*** (0.011)
Q	0.007*** (0.002)	0.007*** (0.002)	0.004*** (0.001)	0.004*** (0.001)
Past 12m stock ret	0.001 (0.003)	0.000 (0.003)	0.002 (0.002)	0.002 (0.002)
L.Cash holding	-0.027 (0.020)	-0.026 (0.021)	-0.055*** (0.016)	-0.059*** (0.017)
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Obs	26,165	26,164	20,153	20,129
R^2	0.076	0.080	0.029	0.030

Standard errors in parentheses, clustered by firm and time

Panel B. CAPX Investment

	Large Firm		Small Firm	
	(1)	(2)	(3)	(4)
EBITDA	0.099*** (0.011)	0.078*** (0.012)	0.001 (0.004)	-0.002 (0.004)
OCF		0.038*** (0.008)		0.005 (0.004)
Q	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
Past 12m stock ret	0.005*** (0.002)	0.005*** (0.002)	0.004*** (0.001)	0.004*** (0.001)
L.Cash holding	0.013* (0.007)	0.014* (0.008)	0.005 (0.006)	0.006 (0.006)
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Obs	27,982	27,980	21,249	21,222
R^2	0.129	0.131	0.043	0.043

Standard errors in parentheses, clustered by firm and time

IA5 Robustness Checks

IA5.1 Response of Debt Issuance and Investment to EBITDA

Table IA2: Debt Issuance and Investment Activities:
Industry-Year Fixed Effects

Firm-level annual regressions of debt issuance and investment activities:

$$Y_{it} = \alpha_i + \eta_{kt} + \beta \text{EBITDA}_{it} + \kappa \text{OCF}_{it} + X'_{it} \gamma + \epsilon_{it}$$

In Panel A the outcome variable Y_{it} is net debt issuance; in Panel B, the outcome variable Y_{it} is investment activities. Y_{it} and the right hand side variables are the same as in Table 3 of the main text. Firm fixed effects (α_i) and industry-year fixed effects (η_{kt} , using two-digit SIC industry classification) are included (R^2 does not include fixed effects). Sample period is 1996 to 2015. The sample is restricted to large US non-financial firms that have earnings-based covenants in year t . Standard errors are clustered by firm and time.

Panel A. Debt Issuance

	Net LT Debt Iss.		Δ Book Debt		Δ Unsec. Debt		Δ Secured Debt	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EBITDA	0.246*** (0.032)	0.306*** (0.037)	0.381*** (0.040)	0.451*** (0.045)	0.244*** (0.041)	0.254*** (0.045)	0.120*** (0.031)	0.143*** (0.035)
OCF		-0.116*** (0.037)		-0.137*** (0.046)		-0.020 (0.033)		-0.046 (0.030)
Q	0.011** (0.005)	0.012** (0.005)	0.004 (0.005)	0.004 (0.005)	0.009** (0.004)	0.009** (0.004)	0.006 (0.005)	0.007 (0.005)
Past 12m stock ret	-0.003 (0.003)	-0.003 (0.003)	0.002 (0.003)	0.001 (0.003)	0.000 (0.003)	0.000 (0.003)	-0.007** (0.003)	-0.007** (0.003)
L.Cash holding	-0.033 (0.043)	-0.033 (0.043)	0.040 (0.048)	0.041 (0.049)	-0.139*** (0.042)	-0.139*** (0.042)	0.061 (0.048)	0.062 (0.048)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Obs	15,642	15,642	15,576	15,576	11,693	11,693	11,678	11,678
R^2	0.115	0.117	0.155	0.157	0.070	0.070	0.031	0.031

Standard errors in parentheses, clustered by firm and time

Panel B. Investment Activities

	CAPX		R&D	
	(1)	(2)	(3)	(4)
EBITDA	0.114*** (0.012)	0.089*** (0.012)	0.036*** (0.013)	0.040*** (0.014)
OCF		0.046*** (0.010)		-0.007 (0.013)
Q	0.010*** (0.002)	0.010*** (0.002)	0.004** (0.002)	0.004*** (0.002)
Past 12m stock ret	0.002 (0.002)	0.002 (0.002)	-0.003*** (0.001)	-0.003*** (0.001)
L.Cash holding	0.017 (0.011)	0.017 (0.011)	-0.004 (0.013)	-0.003 (0.013)
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y
Obs	16,907	16,907	8,588	8,586
R^2	0.135	0.138	0.106	0.107

Standard errors in parentheses, clustered by firm and time

Table IA3: Debt Issuance and Investment Activities:
Lagged Dependent Variable Specification

Firm-level annual regressions of debt issuance and investment activities:

$$Y_{it} = \eta_t + \beta \text{EBITDA}_{it} + \kappa \text{OCF}_{it} + X'_{it} \gamma + \xi Y_{it-1} + \epsilon_{it}$$

In Panel A the outcome variable Y_{it} is net debt issuance; in Panel B, the outcome variable Y_{it} is investment activities. Y_{it} and the right hand side variables are the same as in Table 3 of the main text. Lagged dependent variable Y_{it-1} is included. Sample period is 1996 to 2015. The sample is restricted to large US non-financial firms that have earnings-based covenants in year t . Standard errors are clustered by firm and time.

Panel A. Debt Issuance

	Net LT Debt Iss.		Δ Book Debt		Δ Unsec. Debt		Δ Secured Debt	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EBITDA	0.145*** (0.025)	0.204*** (0.031)	0.271*** (0.030)	0.348*** (0.040)	0.134*** (0.034)	0.129*** (0.038)	0.071*** (0.023)	0.110*** (0.028)
OCF		-0.108*** (0.036)		-0.143*** (0.041)		0.010 (0.023)		-0.077*** (0.027)
Q	0.010*** (0.004)	0.011*** (0.004)	0.006 (0.004)	0.007* (0.004)	0.009*** (0.003)	0.009*** (0.003)	0.001 (0.003)	0.001 (0.003)
Past 12m stock ret	0.009*** (0.003)	0.009*** (0.003)	0.018*** (0.005)	0.018*** (0.004)	0.012*** (0.003)	0.012*** (0.003)	-0.001 (0.005)	-0.001 (0.005)
L.Cash holding	0.008 (0.013)	0.011 (0.014)	0.036** (0.018)	0.040** (0.018)	-0.007 (0.023)	-0.008 (0.023)	0.022 (0.020)	0.025 (0.020)
LDV	0.027* (0.014)	0.026* (0.014)	0.041*** (0.015)	0.039*** (0.014)	-0.058** (0.026)	-0.058** (0.026)	-0.055*** (0.015)	-0.056*** (0.015)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Obs	15,425	15,425	16,044	16,044	10,959	10,959	10,935	10,935
R^2	0.034	0.036	0.054	0.057	0.039	0.039	0.017	0.018

Standard errors in parentheses, clustered by firm and time

Panel B. Investment Activities

	CAPX		R&D	
	(1)	(2)	(3)	(4)
EBITDA	0.165*** (0.013)	0.119*** (0.013)	0.055*** (0.021)	0.051*** (0.019)
OCF		0.081*** (0.010)		0.006 (0.013)
Q	0.001 (0.001)	0.000 (0.001)	0.005*** (0.002)	0.005*** (0.002)
Past 12m stock ret	0.011*** (0.002)	0.011*** (0.002)	-0.003*** (0.001)	-0.003*** (0.001)
L.Cash holding	0.006 (0.006)	0.005 (0.006)	0.045*** (0.012)	0.044*** (0.012)
LDV	0.554*** (0.034)	0.547*** (0.033)	0.564*** (0.084)	0.564*** (0.084)
Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Obs	17,311	17,311	8,711	8,709
R^2	0.638	0.642	0.640	0.640

Standard errors in parentheses, clustered by firm and time

Table IA4: Debt Issuance and Investment Activities: Post-1985 Sample

Firm-level annual regressions of debt issuance and investment activities:

$$Y_{it} = \alpha_i + \eta_t + \beta \text{EBITDA}_{it} + \kappa \text{OCF}_{it} + X'_{it} \gamma + \xi Y_{it-1} + \epsilon_{it}$$

In Panel A, Y_{it} is net long-term debt issuance; in Panel B, Y_{it} is capital expenditures. The right hand side variables are the same as those in Table 3 of the main text. Firm groups are divided by size: large (assets above Compustat median) and small; profit margin: high (above Compustat median) and low; as well as airlines and utilities (two digit SIC 45 and 49). Firm fixed effects and year fixed effects are included (R^2 does not include fixed effects). Sample period is 1986 to 2015. Standard errors are clustered by firm and time.

Panel A. Net Long-Term Debt Issuance

	Size				Margin				Airlines & Utilities	
	Large (1)	(2)	Small (3)	(4)	High (5)	(6)	Low (7)	(8)	(9)	(10)
EBITDA	0.067*** (0.015)	0.156*** (0.017)	-0.028*** (0.006)	0.007 (0.008)	0.067*** (0.014)	0.122*** (0.013)	-0.029*** (0.006)	0.013 (0.009)	-0.061 (0.041)	-0.024 (0.056)
OCF		-0.159*** (0.019)		-0.059*** (0.011)		-0.095*** (0.019)		-0.069*** (0.012)		-0.070 (0.053)
Q	0.007*** (0.002)	0.007*** (0.002)	0.005*** (0.001)	0.004*** (0.001)	0.001 (0.001)	0.001 (0.001)	0.007*** (0.001)	0.006*** (0.001)	0.020* (0.012)	0.021* (0.012)
Past 12m stock ret	0.004 (0.003)	0.003 (0.002)	0.003* (0.001)	0.002* (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.004** (0.002)	0.004** (0.002)	0.010 (0.007)	0.010 (0.007)
L.Cash holding	-0.028** (0.013)	-0.027* (0.014)	-0.048*** (0.011)	-0.052*** (0.012)	-0.014 (0.014)	-0.015 (0.015)	-0.058*** (0.013)	-0.062*** (0.013)	-0.102* (0.053)	-0.116** (0.057)
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs	41,750	41,662	32,915	32,753	36,700	36,596	36,698	36,555	4,787	4,781
R^2	0.066	0.073	0.029	0.033	0.049	0.052	0.036	0.041	0.049	0.050

Standard errors in parentheses, clustered by firm and time

*** p<0.01, ** p<0.05, * p<0.1

Panel B. Capital Expenditures

	Size				Margin				Airlines & Utilities	
	Large (1)	(2)	Small (3)	(4)	High (5)	(6)	Low (7)	(8)	(9)	(10)
EBITDA	0.107*** (0.009)	0.092*** (0.010)	0.009* (0.006)	0.010* (0.006)	0.097*** (0.007)	0.087*** (0.009)	0.006 (0.004)	0.003 (0.005)	0.099*** (0.029)	0.041 (0.028)
OCF		0.028*** (0.007)		-0.000 (0.004)		0.020*** (0.006)		0.005 (0.005)		0.134*** (0.026)
Q	0.007*** (0.001)	0.007*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.007*** (0.001)	0.007*** (0.001)	0.025*** (0.006)	0.023*** (0.006)
Past 12m stock ret	0.006*** (0.001)	0.007*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.009* (0.005)	0.009* (0.005)
L.Cash holding	0.021*** (0.007)	0.022*** (0.007)	0.007 (0.004)	0.008* (0.004)	0.006 (0.008)	0.005 (0.008)	0.016*** (0.005)	0.018*** (0.005)	-0.028 (0.031)	-0.011 (0.030)
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs	44,362	44,263	34,561	34,376	38,794	38,683	38,914	38,749	4,905	4,898
R^2	0.143	0.144	0.043	0.043	0.101	0.101	0.045	0.045	0.122	0.136

Standard errors in parentheses, clustered by firm and time

*** p<0.01, ** p<0.05, * p<0.1

Table IA5: Debt Issuance and Investment Activities:
Controlling for Inventory Purchase

Firm-level annual regressions of debt issuance and investment activities:

$$Y_{it} = \alpha_i + \eta_t + \beta \text{EBITDA}_{it} + \kappa \text{OCF}_{it} + X'_{it} \gamma + \epsilon_{it}$$

The outcome variable Y_{it} is net long-term debt issuance in columns (1) and (2), and capital expenditures in columns (3) and (4). The right hand side variables are the same as in Table 3 of the main text. The additional control is inventory purchase in year t . Firm fixed effects and year fixed effects are included (R^2 does not include fixed effects). Sample period is 1996 to 2015. The sample is restricted to large US non-financial firms that have earnings-based covenants in year t . Standard errors are clustered by firm and time.

	Net LT Debt Iss		CAPX	
	(1)	(2)	(3)	(4)
EBITDA	0.273*** (0.034)	0.212*** (0.039)	0.105*** (0.020)	0.105*** (0.023)
OCF	-0.111*** (0.033)	-0.099*** (0.033)	0.055*** (0.013)	0.056*** (0.013)
Q	0.011** (0.005)	0.012*** (0.005)	0.010*** (0.002)	0.010*** (0.002)
Past 12m stock ret	-0.003 (0.003)	-0.004 (0.003)	0.004* (0.002)	0.004* (0.002)
L.Cash holding	-0.033 (0.044)	0.004 (0.044)	0.012 (0.013)	0.013 (0.013)
Invnt purchase		0.053*** (0.009)		-0.001 (0.003)
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Obs	15,642	15,580	15,576	15,514
R^2	0.116	0.127	0.159	0.159

Standard errors in parentheses, clustered by firm and time

*** p<0.01, ** p<0.05, * p<0.1

Table IA6: Debt Issuance and Investment Activities:
Controlling for Real Estate Collateral Value

Firm-level annual regressions of debt issuance and investment activities:

$$Y_{it} = \alpha_i + \eta_t + \beta \text{EBITDA}_{it} + \kappa \text{OCF}_{it} + X'_{it} \gamma + \epsilon_{it}$$

The outcome variable Y_{it} is net long-term debt issuance in columns (1) and (2), and capital expenditures in columns (3) and (4). The right hand side variables are the same as in Table 3 of the main text. The additional control is market value of firm real estate in year t (estimated following Chaney, Sraer, and Thesmar (2012)). Firm fixed effects and year fixed effects are included (R^2 does not include fixed effects). Sample period is 1996 to 2015. The sample is restricted to large US non-financial firms that have earnings-based covenants in year t and the real estate value estimate is available. Standard errors are clustered by firm and time.

	Net LT Debt Iss		CAPX	
	(1)	(2)	(3)	(4)
EBITDA	0.325*** (0.064)	0.330*** (0.066)	0.077*** (0.022)	0.082*** (0.022)
OCF	-0.135*** (0.037)	-0.134*** (0.037)	0.018 (0.015)	0.019 (0.015)
Q	0.006 (0.006)	0.007 (0.006)	0.013*** (0.004)	0.013*** (0.004)
Past 12m stock ret	-0.004 (0.006)	-0.005 (0.006)	0.002 (0.002)	0.002 (0.002)
L.Cash holding	-0.036 (0.067)	-0.037 (0.066)	0.016 (0.015)	0.015 (0.016)
RE		0.035* (0.018)		0.036*** (0.009)
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Obs	4,554	4,554	4,540	4,540
R^2	0.116	0.116	0.186	0.194

Standard errors in parentheses, clustered by firm and time

*** p<0.01, ** p<0.05, * p<0.1

IA5.2 Informativeness of EBITDA and Q

This section presents a list of checks about the informativeness of EBITDA and Q across firm groups. We would like to test whether among large firms with EBCs, EBITDA is more informative or Q is more mismeasured (less informative), in which case the EBITDA coefficient could have a larger upward bias in the baseline regressions of Tables 3 and 4.

Table IA7 shows statistics of several metrics for accounting quality. Net operating assets is calculated following Hirshleifer, Hou, Teoh, and Zhang (2004), which reflects accumulated accruals. High net operating assets indicates potentially high cumulative earnings management. Operating cycle and trade cycle are calculated following Dechow and Dichev (2002). Longer operating cycles and trade cycles are potentially associated with greater difficulty and less precision in earnings estimates. Larger variability of EBITDA, accrual, and residual accrual (calculated following Dechow and Dichev (2002), which captures accruals not explained by net cash receipts from year $t - 1$ to year $t + 1$) also reflect potential difficulty in earnings estimates. Finally, we also calculate measures of loss avoidance following the idea of Bhattacharya, Daouk, and Welker (2003), using the difference in the probability of small positive net income and that of small negative net income. Across all these measures, it does not appear that earnings of large firms with EBCs have different properties than other large firms.

Furthermore, Table IA8 shows results predicting future EBITDA and net cash receipts (OCF) in year $t + 1$ and $t + 2$. These tests examine the informativeness of EBITDA and Q in predicting future earnings and cash flows. The results show that relative to comparison groups, EBITDA of large firms with EBCs is *not more informative*, while their Q if anything appears *less mismeasured*. Overall, it does not appear Q mismeasurement may lead to a larger upward bias in the EBITDA coefficient among large firms with EBCs; indeed, the concern seems less severe among this group of firms.

Table IA7: Accounting Quality Statistics

Firm characteristics by group. Net operating assets is operating assets minus operating liabilities following Hirshleifer et al. (2004) (normalized by total assets), which captures the accumulated accruals. Operating cycles, trade cycles, and residual accruals are calculated following Dechow and Dichev (2002). Small positive net income is net income (normalized by lagged assets) between zero and 0.01; small negative net income is net income (normalized by lagged assets) between zero and -0.01.

	Large w/ EBCs	Large w/o EBCs	Small	Low Margin	Air & Utilities
Group-Level Medians					
Net operating assets	0.651	0.552	0.522	0.553	0.652
Operating cycle (days)	93.5	101.2	114.5	101.8	68.8
Trade cycle (days)	55.6	56.5	67.6	56.1	26.4
EBITDA SD	0.042	0.040	0.087	0.051	0.025
Accrual SD	0.040	0.036	0.069	0.053	0.024
Residual accrual SD	0.039	0.035	0.066	0.052	0.023
Group-Level Means					
Pr(small pos NI) - Pr(small neg NI)	0.013	0.015	0.013	0.019	0.028

Table IA8: Predicting Future EBITDA and Net Cash Receipts

Firm-level annual regressions of future EBITDA and net cash receipts (OCF):

$$Y_{it+k} = \alpha_i + \eta_t + \beta \text{EBITDA}_{it} + \kappa \text{OCF} + X'_{it} \gamma + \epsilon_{it}$$

The outcome variable Y_{it+k} is EBITDA in Panel A, and net cash receipts (OCF) in Panel B. The right hand side variables are the same as in Table 3 of the main text. Firm groups are the same as in Table 3 and Table 4. Firm fixed effects and year fixed effects are included (R^2 does not include fixed effects). Sample period is 1996 to 2015. Standard errors are clustered by firm and time.

Panel A. Predicting Future EBITDA

$t+k =$	Large w/ EBCs		Large w/o EBCs		Small		Low Margin		Air & Utilities	
	$t+1$	$t+2$	$t+1$	$t+2$	$t+1$	$t+2$	$t+1$	$t+2$	$t+1$	$t+2$
EBITDA	0.327*** (0.034)	0.034 (0.040)	0.372*** (0.068)	0.140* (0.073)	0.392*** (0.063)	0.096 (0.062)	0.376*** (0.065)	0.073 (0.063)	0.337 (0.429)	0.144 (0.109)
OCF	0.069*** (0.024)	0.028 (0.021)	0.162* (0.092)	0.065*** (0.023)	0.083** (0.042)	0.125** (0.057)	0.095** (0.041)	0.130** (0.060)	0.483 (0.589)	0.144 (0.110)
Q	0.009*** (0.002)	0.007** (0.003)	-0.003 (0.003)	0.000 (0.002)	0.004 (0.003)	0.006 (0.005)	0.004 (0.003)	0.005 (0.005)	-0.069*** (0.019)	0.020 (0.018)
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs	14,038	12,544	9,149	8,214	17,384	15,068	19,417	16,765	2,248	2,055
R^2	0.195	0.058	0.116	0.028	0.140	0.019	0.116	0.019	0.379	0.042

Standard errors in parentheses, clustered by firm and time

*** p<0.01, ** p<0.05, * p<0.1

Panel B. Predicting Future Cash Receipts (OCF)

$t+k =$	Large w/ EBCs		Large w/o EBCs		Small		Low Margin		Air & Utilities	
	$t+1$	$t+2$	$t+1$	$t+2$	$t+1$	$t+2$	$t+1$	$t+2$	$t+1$	$t+2$
EBITDA	0.254*** (0.028)	0.072** (0.029)	0.305*** (0.049)	0.207*** (0.057)	0.339*** (0.043)	0.120*** (0.034)	0.340*** (0.045)	0.105*** (0.039)	0.022 (0.535)	0.186 (0.115)
OCF	-0.044 (0.031)	-0.045 (0.031)	0.093 (0.098)	-0.037 (0.033)	-0.020 (0.029)	-0.005 (0.042)	-0.009 (0.029)	0.002 (0.048)	0.482 (0.647)	0.059 (0.140)
Q	0.006*** (0.002)	0.007*** (0.002)	-0.003 (0.003)	0.000 (0.002)	0.004 (0.003)	0.005 (0.004)	0.005 (0.004)	0.008** (0.004)	-0.037** (0.017)	0.022 (0.018)
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs	14,043	12,548	9,160	8,228	17,388	15,071	19,415	16,754	2,249	2,057
R^2	0.097	0.035	0.081	0.026	0.117	0.020	0.100	0.018	0.230	0.039

Standard errors in parentheses, clustered by firm and time

*** p<0.01, ** p<0.05, * p<0.1

IA5.3 Accounting Natural Experiment: Placebo Tests

Table IA9 below presents results of placebo tests using alternative timing. In Table 5, outcome variables are measured in 2006, while EBITDA in 2006 is instrumented using average option compensation expenses in 2002 to 2004. In Table IA9 we shift the same timing backwards, and perform both the first stage and the reduced form tests. For instance, in column (1) option compensation expenses are measured from 1998 to 2000, while outcome variables are measured in 2002.

Table IA9: Placebo Tests

Cross-sectional placebo regressions, for years t from 2002 to 2006:

$$Y_{it} = \alpha + \beta \overline{\text{OptComp}}_{i,t-4,t-2} + X'_{it}\gamma + \epsilon_{it}$$

where $\overline{\text{OptComp}}$ is average option compensation expense in fiscal year $t-4$ to $t-2$. In Panel A, Y is EBITDA in year t (placebo first stage). In Panel B, Y is net long-term debt issuance in year t (placebo reduced form). In Panel C, Y is capital expenditures in year t (placebo reduced form). Control variables are the same as those in Table 5. Industry (Fama-French 12 industries) fixed effects are included; R^2 does not include fixed effects. The sample is restricted to large firms with EBCs in year t . Robust standard errors in parentheses.

Panel A. $Y_i = \text{EBITDA}$

Year $t =$	2002	2003	2004	2005	2006
	(1)	(2)	(3)	(4)	(5)
Avg. option comp expense $t-4$ to $t-2$	-0.245 (0.287)	-0.053 (0.300)	0.469** (0.203)	-0.163 (0.171)	-0.857*** (0.206)
Obs	573	639	689	673	686
R^2	0.770	0.735	0.727	0.748	0.746

Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Panel B. $Y_i = \text{Net Long-Term Debt Issuance}$

Year $t =$	2002	2003	2004	2005	2006
	(1)	(2)	(3)	(4)	(5)
Avg. option comp expense	-0.333 (0.509)	0.104 (0.619)	-0.205 (0.480)	-0.316 (0.322)	-0.745** (0.360)
Obs	575	640	689	673	686
R^2	0.115	0.044	0.104	0.082	0.103

Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Panel C. $Y_i = \text{Capital Expenditures}$

Year $t =$	2002	2003	2004	2005	2006
	(1)	(2)	(3)	(4)	(5)
Avg. option comp expense	-0.224 (0.321)	-0.033 (0.175)	-0.108 (0.113)	-0.251* (0.143)	-0.387*** (0.143)
Obs	565	623	672	660	682
R^2	0.448	0.541	0.512	0.610	0.598

Standard errors in parentheses
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

IA5.4 Great Recession

Table IA10: The Great Recession: Unpacking the Property Price Effects (Tradables Only)

Cross-sectional regression of firm outcomes in the Great Recession and value of firm real estate:

$$\Delta Y_i^{07-09} = \alpha + \lambda \Delta RE_{i,06}^{07-09} + \eta RE_i^{06} + \phi \Delta P_i^{07-09} + X_i' \gamma + u_i$$

The regressions are the same as those in Table 9, but restricted to tradable firms only (tradable classification follows Mian and Sufi (2014)). In Panel A ΔY_i^{07-09} is the change in net long-term debt issuance between 2007 and 2009, in Panel B Y_i^{07-09} is the change in CAPX between 2007 and 2009, normalized by assets by the end of 2006. The main independent variable ΔRE_i^{07-09} is the estimated gain/loss on firm i 's 2006 real estate holdings during the Great Recession, normalized by assets at the end of 2006. RE_i^{06} is the estimated market value of firm i 's real estate at the end of 2006, normalized by assets at the end of 2006. ΔP_i^{07-09} is the percentage change in property value in firm i 's location. Industry (Fama-French 12 industries) fixed effects are included; R^2 does not include fixed effects. Estimates using both OLS and LAD are presented. Robust standard errors in parentheses.

Panel A. Net LT Debt Issuance

Δ LT Debt Iss ⁰⁷⁻⁰⁹	Method 1		Method 2	
	OLS	LAD	OLS	LAD
ΔRE_{06}^{07-09}	-0.198 (0.538)	-0.204 (0.320)	0.088 (0.419)	0.052 (0.129)
RE_{06}	-0.059 (0.047)	-0.022 (0.036)	0.022 (0.040)	0.015 (0.027)
ΔP^{07-09}	0.104 (0.112)	0.052 (0.064)	-0.015 (0.090)	-0.026 (0.033)
$\Delta EBITDA^{07-09}$	0.135 (0.098)	0.086 (0.064)	0.184** (0.087)	0.065* (0.035)
ΔOCF^{07-09}	-0.080 (0.072)	-0.077 (0.054)	-0.258*** (0.067)	-0.096 (0.062)
ΔQ^{07-09}	0.009 (0.008)	0.004 (0.005)	0.009 (0.007)	0.004 (0.006)
Q_{06}	-0.009 (0.008)	-0.001 (0.004)	0.006 (0.004)	0.003 (0.006)
Obs	264	264	300	300
R^2	0.140	-	0.200	-

Standard errors in parentheses

Panel B. Capital Expenditures

Δ CAPX ⁰⁷⁻⁰⁹	Method 1		Method 2	
	OLS	LAD	OLS	LAD
ΔRE_{06}^{07-09}	-0.013 (0.157)	-0.071 (0.107)	0.001 (0.095)	-0.050 (0.057)
RE_{06}	-0.007 (0.018)	-0.011 (0.010)	0.012 (0.014)	0.013 (0.009)
ΔP^{07-09}	0.021 (0.025)	0.014 (0.021)	0.007 (0.016)	0.012 (0.012)
$\Delta EBITDA^{07-09}$	0.071** (0.028)	0.066*** (0.020)	0.080*** (0.030)	0.063*** (0.016)
ΔOCF^{07-09}	-0.025 (0.027)	-0.010 (0.018)	-0.065** (0.026)	-0.031** (0.014)
ΔQ^{07-09}	0.010*** (0.003)	0.006** (0.003)	0.004** (0.002)	0.002 (0.002)
Q_{06}	-0.001 (0.002)	-0.001 (0.001)	-0.001 (0.002)	0.000 (0.002)
Obs	263	263	307	307
R^2	0.222	-	0.213	-

Standard errors in parentheses

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