Anticipating binding constraints: an analysis of financial covenants

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Abstract

This paper sheds light on the extent to which public non-financial firms in the United States are concerned about future covenant violations and investigates the real effects of these concerns. Applying textual analysis to earnings call transcripts, I construct a novel measure of covenant concerns by distinguishing between discussions of covenants that relate to the future as opposed to the past or present. Covenant discussions rise prior to actual violations, indicating that firms anticipate violations to some extent before they occur. At the aggregate level, covenant concerns increase during recessions even among firms that do not violate their covenants. At the firm-level, covenant concerns rise when earnings fall and when within-firm credit risk increases. Firms that are concerned about covenants significantly reduce their investment, debt, and equity financing activities. Investment responds strongly to covenant concerns even after controlling for standard measures of investment opportunities and are large relative to the effects of actual violations.

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1 Introduction

A fundamental question in macro-finance is how financial constraints affect firm investment and financing decisions. Recent work provides clarity on the types of financial constraints that apply to large non-financial firms in the United States (Lian and Ma (2021)). Specifically, one of the most prevalent forms of financial constraints in corporate borrowing are financial covenants. These covenants restrict borrower actions based on their financial ratios, the most common of which specify that total debt cannot exceed a multiple of earnings. A natural question is: how important are financial covenants for firm investment and financing decisions?

In theory, financial constraints affect firm decisions not only when they bind, but also when they are expected to bind in the future.¹ For financial covenants specifically, the existing empirical literature focuses on the effects of covenants when they are violated. In particular, prior work finds that covenant violations lead to significant reductions in investments, net debt issuance, equity payout, acquisitions, and employment.² In contrast, the effects of covenants when they are expected to be violated in the future are unexplored empirically. Leaving out the effects of expected covenant violations risks understating the total effects of covenants on firm investment and financing decisions.

In this paper, I shed light on the extent to which firms are concerned about future covenant violations and investigate the real effects of these concerns. I measure concerns about future violations by distinguishing between discussions of covenants in earnings call transcripts that relate to the future as opposed to the past or present. In particular, I employ an algorithm that parses for sentences in the text about covenants and determines whether each of these sentences are forward-looking or not. The measure of covenant concerns is a binary variable that indicates whether the earnings call for the given firm and quarter contains any covenant-related sentence that is forward-looking.

The procedure for determining whether a sentence is forward-looking proceeds in two steps. First, I identify the tense of a sentence from its grammatical structure, a step that relies on well-developed tools in natural language processing. Second, I search for the usage of forward-looking keywords in the sentence. The second step is necessary as the vast

¹See for example Mendoza and Smith (2006); Mendoza (2010); Bianchi (2011); Bolton, Chen, and Wang (2013); Jeanne and Korinek (2020); Schmitt-Grohe and Uribe (2021).

²Violations occur when firms fail to comply with the restrictions specified in the covenants. In this paper, I equate covenant violations to constraints binding. Prior work on covenant violations include Chava and Roberts (2008); Roberts and Sufi (2009); Nini, Smith, and Sufi (2012); Falato and Liang (2016); Chava, Nanda, and Xiao (2017); Ferreira, Ferreira, and Mariano (2018); Chava, Wang, and Zou (2019); Becher, Griffin, and Nini (2021). While cov-lite loans are not a focus of this study, the literature finds that cov-lite borrowers are still subjected to the discipline of financial covenants. (Becker and Ivashina (2016); Berlin, Nini, and Yu (2020); Brauning, Ivashina, and Ozdagli (2021)).

majority of forward-looking sentences are expressed in the present tense. The algorithm then categorizes a sentence as forward-looking if it is in the present tense and contains a forward-looking keyword or simply if it is in the future tense.

As input to the algorithm, I develop a novel dictionary of forward-looking keywords from safe harbor disclosures in SEC filings. Many of these disclosures include examples of words or phrases that firms use to identify forward-looking statements. A key reason why firms have incentives to be explicit about making such statements is that they can be held liable for making claims that do not materialize. The use of linguistic cues such as "expect", "anticipate" or "believe" signal to investors that a statement is forward-looking, hence should not be taken as historical fact. I implement a text search algorithm to extract these keywords from the safe-harbor disclosures.

To validate that the measure correctly identifies concerns of future covenant violations, I examine the dynamics of covenant concerns around actual violation events. The share of forward-looking covenant discussions peaks in the quarter prior to violation, rather than at violation. This finding supports the interpretation of forward-looking covenant discussions as related to concerns about the future, rather than past or present. Importantly, it also indicates that firms are able to anticipate violations to some extent before they occur. Consistent with this result, I find that covenant concerns is associated with a 4.2 percent increase increase in the probability of violation next quarter. The magnitude of the coefficient is large compared to the average probability of violation of 3.0 percent and is robust to controlling for operating earnings, covenant slack, and their second-order terms.

An examination of covenant discussions across firms and over time reveals several notable findings. First, discussion of covenants among firms with financial covenants increased more than three fold during the 2008-09 financial crisis, which contrasts with a more muted response in covenant violations. Second, covenant concerns vary inversely with earnings at the firm level. This result is intuitive as covenant violation events are more likely to occur following a deterioration of earnings.

There is also significant heterogeneity in the extent to which firms are concerned about covenants conditional on earnings. In particular, I find that firms are more concerned about covenants when they experience an increase in within-firm credit risk, as proxied by leverage rising above the firm-specific average and net worth, cash holdings, and Altman z-score falling below the firm-specific average. Since covenants are commonly defined based on measures of credit risk, firms are closer to violation when credit risk increases. Lenders are also more likely to impose severe penalties conditional on violation when borrowers are at a greater risk of defaulting on their loans.

Next, I investigate how investments and financing activities change when firms are con-

cerned about future covenant violations. Using an event study framework, I find sharp reductions in investment and financing responses in the quarters following mentions of covenant concerns. These changes coincide with a deterioration in firm profitability, but persist even after profitability begins to recover. To further probe the role of firm profitability in explaining changes in observed firm decisions, I match each concerned firms to a group of unconcerned firms with similar profitability one quarter before and when covenant concerns are mentioned. Investment trends of both groups are similar in the quarters leading up to when concerns are mentioned, but diverges in the subsequent quarters. I also find similar patterns in debt and equity financing in the quarters after mention, and even among firms that do not subsequently violate their covenants. These results show that covenant concerns coincide with a greater reduction to investment and financing responses than predicted by the deterioration in firm profitability.

To investigate the economic importance of covenant concerns for firm investment and financing decisions, I compare the effects of covenant concerns to the effects of covenant violations in a regression specification with firm and time fixed effects. In the baseline specification, I find that covenant concerns are associated with a 12 basis point decline in capital expenditure, which is comparable to the 7.8 basis point decline in capital expenditures associated with covenant violations. Moreover, the association between covenant concerns and firm outcomes is not subsumed by other predictors of covenant violation, such as covenant slack and changes in financial ratios commonly used in the definition of covenants.

The results are robust to a variety of alternative specifications. For example, the magnitude and significance of the effects do not change when controlling for operating earnings or covenant slack and their second-order terms. The estimates are also robust to interacting covenant concerns and violations or including higher order terms of proxies of borrower health. Controlling for key state variables that explain a large variation in corporate investment activity (Gala, Gomes, and Liu (2020)) do not significantly alter the estimates. I also assess whether the estimates depend on how firms discuss covenant concerns. For instance, I find that the relationship between covenant concerns and investment holds even when firms express positive sentiment about covenants.

Finally, I evaluate the empirical findings relative to predictions of a standard model of investment with an earnings-based borrowing constraint. The model features risk averse entrepreneurs who face an earnings-based borrowing constraint, where borrowing is restricted to be a function of realized earnings each period. The only source of risk is fluctuations in the entrepreneur's productivity. While the structure of the model is relative parsimonious, it closely matches the frequency of covenant violations observed in the data, average book leverage as well as the first and second moments related to investments. Consistent with the data, model simulations show that covenant concerns rise when earnings growth fall, and are negatively associated with investment and debt and equity financing.

Related literature. This paper contributes to several strands of literature. The first relates to studies on the implications of covenant violations. The literature provides ample evidence that covenant violations have economically meaningful effects on a wide range of firm outcomes, including but not limited to investments, net debt issuance, equity payouts, CEO turnover, employment, and acquisitions (Chava and Roberts (2008); Roberts and Sufi (2009); Nini et al. (2012); Falato and Liang (2016); Chava et al. (2017); Ferreira et al. (2018); Chava et al. (2019); Becher et al. (2021)). Several studies also emphasize the importance of lenders in affecting the outcome of violations (Demiroglu and James (2010); Murfin (2012); Bradley and Roberts (2015); Acharya, Almeida, Ippolito, and Orive (2021); Chodorow-Reich and Falato (2021)). The contribution of this paper is to document evidence that firms cut investments and net debt issuance not only at violation but also when they are concerned about potential future violations. In turn, this supports the idea that the expectation of covenants violations also matter for firm outcomes.

More broadly, this paper relates to a recent literature that investigates the borrowing constraints of large US non-financial corporations. Lian and Ma (2021) document that sixty percent of large US non-financial firms have financial covenants written in their debt contracts. Drechsel (2018) and Greenwald (2019) study the macroeconomic implications of financial covenants. Closely related to this paper, Adler (2020) finds that lower covenant slack is associated with lower investments and total debt growth. While covenant slack is conceptually linked to covenant concerns, the correlation between the two variables is low in the data (correlation = -0.1). An important reason is because covenant slack is defined based on past cash flow realizations, whereas covenant concerns also reflect the expected path of cash flows. The two measures can differ substantially when past cash flows are a poor proxy for future cash flows. Importantly, I find that the relationship between firm responses and covenant concerns are robust to controlling for covenant slack and its squared value.

Third, this paper contributes to a literature that measures financial constraints using textual data.³ Kaplan and Zingales (1997) is a seminal work that measures financial constraints by reading the SEC 10-K filings of 49 low dividend-paying firms. Hoberg and Maksimovic

³Antweiler and Frank (2004); Tetlock (2007); Loughran and McDonald (2011) are early applications of textual analysis in finance. See Gentzkow, Kelly, and Taddy (2019); Loughran and McDonald (2020) for a recent survey of textual analysis in finance. In particular, a growing literature uses modern techniques in computational linguistics to analyze information in corporate disclosures. See Abis (2020); Glasserman, Krstovski, Laliberte, and Mamaysky (2020); Calomiris, Mamaysky, and Yang (2020); Cao, Jiang, Wang, and Yang (2021) for recent examples.

(2014) employs an algorithm to identify financially constrained firms from the universe of SEC 10-K filings, and find that constrained firms cut their investments and issuance policies to a larger extent following unexpected negative shocks compared to unconstrained firms. Buehlmaier and Whited (2018) estimates a text-based classifier on their measure and find that more constrained firms earn higher stock returns. Bodnaruk, Loughran, and McDonald (2015) find that more frequent use of constrained words predict higher probability of dividend omissions and underfunded pensions and lower probability of dividend increases and equity recycling. Previous research studies financial constraints in general and does not look at the effects of future binding constraints. This paper focuses on the role of financial covenants and highlights the importance of concerns about future binding constraints on firm decisions.

I also contribute to a recent literature that constructs text-based measures of unobserved variables of interests from corporate earnings calls. Hassan, Hollander, van Lent, and Tahoun (2019, 2020a); Hassan, van Lent, Hollander, and Tahoun (2020b); Hassan, Schwedeler, Schreger, and Tahoun (2021) construct firm-level measures of political, Brexit, Covid-19 risks and find that they predict investment, hiring, stock returns, as well as other firm-level activities. The unscripted interactions between firm managers and market participants ensures that the most pertinent issues affecting the firm's financial and operating performances are discussed. This paper differs in its focus on distinguishing between references to the future, as opposed to the past or present, from textual data. In this sense, this paper relates to Caldara and Iacoviello (2022) who separately measures the effects of threats and realizations of geopolitical adverse events.

The paper proceeds as follows. Section 2 details how I measure concerns about future covenant violations and discusses the results of the validation exercises. Section 3 documents key stylized facts about when firms are concerned about future covenant violations. Section 4 examines the relationship between covenant concerns and firm responses. Section 5 discusses the model and its predictions. Finally, Section 6 concludes.

2 Data and measurement

2.1 Data and sample selection

The primary data is the earnings call transcripts transcribed and published by FactSet from 2002Q1 to 2020Q1. The sample consists of 418 thousand calls of 12,781 unique firms with matched CUSIP identifiers. Earnings calls are typically held once per quarter and serve as a medium for firms to discuss their most recent earnings results and disclose material informa-

tion to market participants. The typical earnings calls consists of a management discussion section in which senior managers (CEOs and CFOs) discuss the company's most recent financial results and a question and answer section in which management fields questions from market participants.

I merge this data with information on covenant violations reported in SEC 10-K and 10-Q filings as well as firm-quarter level income and balance sheet information from Compustat. Information on covenant violations comes from Becher et al. (2021), who extend the covenant violation data set in Nini et al. (2012).⁴ In particular, the algorithm searches for the joint occurrence of the word "covenant" and the following five phrases in the surrounding seven lines from the initial hit: "waiv", "viol", "in default", "modif", and "not in compliance". I use a similar algorithm to extend the dataset of covenant violations to 2020.

Subsequent analyses focus on a sample of firm-quarter observations of firms incorporated in the United States, excluding utilities (SIC 4900-4999) and financials (SIC 6000-6999), from quarters 2002Q1 to 2020Q1 constructed from the intersection of three datasets: (1) earnings call transcript from Factset, (2) income and balance sheet information from Compustat, and (3) covenant violations data from SEC 10-K and 10-Q filings. I winsorize all continuous variables at the 1 and 99 percent levels. The merged sample consists of 138,111 firm-quarter observations from 5,249 permanent Compustat firm identifiers (gvkey).

I also consider a restricted sample of firm-quarter observations with data on financial covenants from LPC DealScan. LPC DealScan database records information on private syndicated debt contracts, where syndicated means a group of lenders jointly lending to a single borrower (Berlin et al. (2020)). Financial covenant information is available for 12 percent of debt contracts originated or amended between 2000 and 2020. The restricted sample consists of 59,403 firm-quarter observations with 2,415 firms.

2.2 Measuring concern about future covenant violations

The variable of interest is a measure of when firms anticipate future covenant violations. To provide some intuition for the measurement exercise, consider the following four sentences extracted from earnings calls that relates to covenants.

"During the first quarter we exceeded accumulative limit of \$61 million for the add back of these cutover-related costs for covenant purposes."

"Our financial covenants are conservative."

"We will proactively work with our bank groups to seek a waiver."

"It now appears that we are at risk of violating our interest coverage covenant."

⁴I thank Thomas Griffin for generously sharing the dataset of covenant violations.

The first sentence describes events in the past, as illustrated by the past tense form of the root verb "exceeded". To disentangle concern about future violations from discussions of realized violations, it is important to exclude these discussions as they likely describe past covenant violations. The second sentence describes events in the present, as illustrated by the present tense form of the root verb "are". These discussions may not represent concern about future violations if they are simply reporting of existing terms of financial contracts. The last two sentences are examples of discussions about events that may occur in the future, which are the focus of subsequent analyses. The forward-looking nature of the third sentence is captured by the use of the auxiliary modal verb "will".⁵ The forward-looking component of the fourth sentence is less obvious as the sentence does not contain a modal verb. However, the use of the phrase "at risk" provides a strong indicator that the discussion is related to the future.

The construction of forward-looking measure of covenant mentions proceeds as follows. First, I extract all sub-sentences⁶ in earnings calls with variants of the word "covenant", and assign an indicator $1{"covenant"} = 1$ for these subsentences and 0 for other sentences. For each subsentence containing mentions of covenants, I construct an indicator $1{forward}$ to denote whether the sentence is forward-looking. If the subsentence is in past tense, then the indicator assignment is $1{forward} = 0$. If the subsentence is in present tense, then I examine whether a forward-looking keyword is present in the text. If forward-looking keyword is present, then the indicator assignment is $1{forward} = 1$, otherwise it is 0. If the subsentence is in the future tense, the indicator assignment is $1{forward} = 1$. For subsentences with ambiguous tenses, I assign $1{forward} = 1$ if it contains a forward-looking keyword.

Finally, I aggregate these subsentence into a call-level indicator of forward-looking covenant mentions that takes a value of one if the call contains any subsentence with covenant mentions and is labeled as forward-looking. Formally, define S_{it} to be the set of all subsentences in call of firm *i* related to fiscal quarter *t*. The forward-looking covenant mention $CovFuture_{it}$ is given by

$$CovFuture_{it} = \max_{s \in S} \left(1\{ "covenant"\} \times 1\{ forward \} \right)$$

⁵Modal verbs are verbs that are used with other verbs to express ideas such as possibility, necessity, and permission (Merriam-Webster).

⁶As spoken sentences are complex with multiple statements joined by conjunctions, I focus on subsentences by further splitting each sentence based on indicators such as "but", "so" and punctuations such as ",", ";". See Cieslak and Vissing-Jorgensen (2020) for a similar treatment of sentences in FOMC minutes and transcripts. Appendix C.1 provides further details of steps taken to preprocess the text.

2.2.1 Detecting tenses

The procedure for identifying the tense of a subsentence relies on well-developed infrastructure in the natural language processing literature. Specifically, I deploy spaCy's dependency parsing algorithm to process the grammatical structure of a sentence (Honnibal and Johnson (2015)). In dependency parsing, the grammatical structure of a sentence is expressed a directed graph with words as vertices and the relationships between any two words as arcs. To construct the directed graph for a given sentence, the dependency parsing algorithm relies on an "oracle", which is a classifier trained by supervised machine learning to predict the appropriate action to take given a particular configuration of the parse (Jurafsky and Martin (2000)).

For the purpose of identifying the tense of the sentence, a key output of the dependency parse is the root node of a sentence. A sentence is in the past tense if the root node is a past tense verb, or if not a past tense verb, has an auxiliary verb that is in the past tense. Consider again the example sentence provided at the beginning of the section, "During the first quarter we exceeded accumulative limit...for covenant purposes." For this sentence, the former case applies as the root verb "exceeded" is in the past tense, hence the sentence as a whole is past tense. The latter case is applicable for verbs that are in the past continuous tense, such as "was exceeding", or past perfect continuous tense, such as "had been exceeding".

A sentence is in the present tense if the root node is a present tense verb and if any auxiliary verb is not in the past tense or modal form. The example sentence, "Our financial covenants are conservative." satisfies the definition as the root verb "are" is in the present tense and the sentence does not contain an auxiliary verb. On the other hand, the example sentence "We will proactively work with our bank groups to seek a waiver." does not satisfy the criteria as the auxiliary verb "will" is modal, which signals that the sentence is in the future tense.

Identifying future tenses in English is less direct as the future is usually expressed using the present tense (Huddleston and Pullum (2002)). Rather, a primary way to indicate the future is to use modal verbs such as "will", "shall", or "might". I categorize a sentence as a future tense sentence if the root node is a present tense verb and if any auxiliary verb is modal. However, as the fourth example sentence in the beginning of the section illustrates, this strategy leaves out a large number of sentences that describes the future but does not explicitly contain modal auxiliary verbs. For that purpose, I turn to detecting for the usage of forward-looking keywords in the sentence.

2.2.2 Detecting forward-looking keywords

To construct a dictionary of forward-looking keywords, I rely on example keywords provided by firms in their safe harbor disclosures for signaling that a statement is forward-looking. Consider the following safe harbor disclaimer in the 2020-Q1 10-Q filings of Apple Inc., where example keywords are words or phrases that appear in quotation marks:

This section and other parts of this Quarterly Report on Form 10-Q contain forward-looking statements, within the meaning of the Private Securities Litigation Reform Act of 1995, that involve risks and uncertainties. Forward-looking statements provide current expectations of future events based on certain assumptions and include any statement that does not directly relate to any historical or current fact. Forward-looking statements can also be identified by words such as "future," "anticipates," "believes," "estimates," "expects," "intends," "plans," "predicts," "will," "would," "could," "can," "may," and similar terms.

Firms tend to be careful about forward-looking statements to avoid liability in situations where the statements do not subsequently materialize. The Private Securities Litigation Reform Act of 1995 provides a safe-harbor clause that affords protection in such instances, so long as statements made are not misleading and are accompanied by meaningful cautionary statements. (Horwich (2009)) Statements made in the present tense that are accompanied by appropriate linguistic cues can be considered forward looking: "[t]he use of linguistic cues like "we expect" or "we believe," when combined with an explanatory description of the company's intention to thereby designate a statement as forward-looking, generally should be sufficient to put the reader on notice that the company is making a forward-looking statement." (Slayton vs American Express Co, as cited in Rosen and Carey (2016))

Building on this insight, I apply an algorithm that extracts safe-harbor disclosures from all SEC 10-K and 10-Q filings from 2002Q1 to 2021Q4. From the universe of 10-K and 10-Q filings, I identify 57 thousand filings with safe-harbor disclosures that provide examples of forward-looking keywords. The algorithm then identifies portions of the disclosures that provide examples of forward-looking words. After hand-removing false positives, typos, and ambiguous keywords, the text search procedure yields 119 unique forward-looking keywords or phrases.

Table 1 lists the root words of the 30 most commonly occurring forward-looking words in safe-harbor statements. The set of forward-looking keywords is intuitive. It includes words such as "expect", "believ", "anticip", which convey a sense of anticipation about future events, as well as hedging terms such as "probabl", "hope", and "might", which convey a sense of uncertainty that comes with forecasting the future. A closely related word list is the

Word/Phrase	Count	Word/Phrase	Count	Word/Phrase	Count
expect	84545	could	30922	contempl	3161
believ	75291	potenti	19267	will like result	2444
estim	73095	predict	18485	hope	1945
intend	71885	would	17951	possibl	1803
anticip	71480	seek	16125	forese	1665
plan	62660	might	6426	guidanc	1637
will	46940	goal	6151	aim	1513
$\operatorname{project}$	43365	futur	4808	probabl	1246
may	42233	like	4647	opportun	1233
should	41302	outlook	4502	pursu	812

Table 1: 30 most common forward-looking words or phrases extracted from safe-harbor disclosures in 10-K and 10-Q filings. "Count" is number of disclosures a given phrase is used as an example. Appendix C.3 provides the full list of forward-looking keywords.

Loughran and McDonald (2011) dictionary of uncertainty keywords. I find that the word list constructed from safe-harbor disclosures include informative terms not contained in the 2018 release of the Loughran-McDonald dictionary, such as "expect", "foresee", and "intend".

2.3 Validation

In this section, I verify that the text-based measure *CovFuture* describes forward-looking concern about covenants. I begin with a case study of American Vanguard Corp, a large producer of agricultural chemical products listed in the NYSE. The company violated its maximum debt-to-earnings covenant in 2013Q3 but returned to compliance in 2015Q4.

Figure 1 plots the evolution of the firm's debt-to-earnings covenant slack, the standardized difference between the maximum debt-to-earnings threshold specified in the financial covenant and the firm's actual debt-to-earnings ratio, from 2013Q1 to 2016Q1. Positive values indicate compliance with the financial covenant and negative values indicate violation of the covenant. The filled dots indicate year-quarters in which the firm mentions covenants. The blue dots are covenant mentions that are forward-looking, and the red dots are covenant mentions that are non-forward looking.

The figure shows forward-looking mentions of covenants begin two quarters prior to violation, as the firm faces a greater risk of violating its covenants following the precipitous decline in covenant slack. The content of the discussions suggest that the two events are directly linked. In the 2014Q1 earnings call, the CEO provides reassurances that its lenders are "supportive of the company" and that it will "decide...if [it] need[s] to make any minor



Figure 1: Case study of covenant violation event by American Vanguard Corp. Covenant slack is the difference between covenant threshold in DealScan and financial ratio, normalized by standard deviation of financial ratio. Negative values indicate violation. Blue dots show calls in which covenant mentions are forward-looking (CovFuture = 1), red dots show calls in which covenant mentions are backward-looking (CovPast = 1), white dot shows calls with no covenant mentions.

short-term adjustments to key covenants...". The statement is forward-looking given the use of the phrase "short-term" and suggests that management is actively thinking about the consequences of violating its covenants.

Covenant mentions one quarter prior to violation similarly reflects forward-looking concern about covenants. In the 2014Q2 earnings call, the firm states "we believe that in addition to our anticipated cash flow from operations and having worked out some loosening of our key covenants for a few quarters[,] we have the necessary liquidity to work our way through this tough period..." The discussion is labeled as forward-looking given the presence of the word "believe".⁷ Moreover, the discussion suggests that heightened concern is also accompanied by tangible action. In this instance, the firm renegotiates a loosening of covenants in anticipation of greater liquidity needs in the future.

In contrast to forward-looking covenant mentions, non-forward looking covenant mentions occur after the firm violates its covenants. In its 2014Q3 earnings call, the company reminds participants that "[they] obtained covenant release from our vendor group during the third quarter to ensure that [they] had adequate borrowing capacity in light of covenants based on 12 month trailing EBITDA." The sentence is labeled as non-forward looking given that the main verb "obtained" is in past tense form. The company does not mention covenants in 2014Q4, but in 2015Q1 again discusses the terms of the covenant amendment: "[the] covenant changes were a movement up on our leverage ratio from 3.25 to 3.5 for the next three quarters..." The sentence is labeled as non-forward looking given the use of the past tense verb "were".

Figure 2 plots covenant mentions in the quarters around violations reported in SEC filings. The dashed red line (right axis) reports the share of calls in each quarter with any discussions of covenants. The solid blue line (left axis) reports the share of covenant discussions in each quarter that are forward-looking. To provide a clean analysis of covenant discussions pre- versus post-violation, I restrict the sample to violation events with no prior violations reported in the past three quarters.

The figure shows two notable findings. First, covenant mentions in general peak in the quarter that covenants are violated, rising from 10 percent three quarters prior to violation to 24 percent in the quarter of violation. This finding suggests that covenant mentions in earnings call are not boilerplate disclosures, but rather reflect situations when covenants become a significant issue for operating and financing conditions.

Second, Figure 2 reveals that the share of forward-looking covenant mentions peaks in

⁷The use of past participles "anticipated" and "worked out" does not imply that the sentence is in the past tense. Rather, the tense of the sentence is determined by the tense of the main verb. As the main verb "believe" is both in the present tense and forward-looking, the overall sentence is labeled as forward-looking.



Figure 2: Covenant mentions around violations reported in SEC filings. Sample restricted to events with no violations in the preceding 3 quarters (NViol = 1, 167). Left axis shows share of covenant mentions that is forward looking, right axis shows share of observations with any covenant mentions.

the quarter prior to violation, rather than at violation.⁸ This finding supports the idea that the measure captures information that relates to the future as opposed to the past or present. Importantly, this shows that firms anticipate future violations to some extent before they occur and discuss these concerns in their earnings calls.

Discussion of violations. The preceding analysis shows that around a fourth of violations are associated with covenant discussions in earnings calls. This finding bids the question of whether there are differences between violations that are discussed and not discussed. Appendix Table A.3 shows that, holding fixed covenant slack and earnings, covenant discussions are associated with larger reduction to long-term debt growth, higher probability of the borrower receiving an increase in interest rates on loans, a reduction in the borrowing amount, and a credit rating downgrade in the quarter of violation. This result is consistent with the idea that discussions of violations in earnings calls reflect violations of borrowers with credit risk, as Section 3 further documents.

Besides financial covenants, borrowers may also be subjected to affirmative covenants, such as those that require timely submission of financial information, and negative covenants, such as those that restrict payment of dividends or capital expenditures (Nini et al. (2012)). To investigate whether there are differences in the types of violations discussed in earnings

 $^{^{8}}$ Appendix Table A.2 formalizes this finding in a regression specification.

calls, I collect information on violations from a random sample of 360 violation events with matched SEC filings and earnings call transcripts. Appendix Table A.4 reports the share of violations that relates to financial covenants and the share of violations that are relates only to non-financial covenants. The analysis shows that the majority of violations are associated with financial covenants, more so violations that are discussed in earnings calls. In particular, 82.5 percent of violations pertain to a financial covenant in the unconditional sample, compared with 92.6 percent of violations conditional on discussions of covenants in earnings calls.

2.3.1 Covenant concerns predict future violation

I investigate whether covenant concerns are informative about future violations, over and above information contained in other predictors of future violations. In particular, I estimate the regression specification

$$Violation_{it} = \beta_0 + \beta_2 CovFuture_{it-1} + \alpha_i + \delta_t + \epsilon_{it}$$
(1)

where $Violation_{it}$ is an indicator for whether firm *i* violates a covenant in quarter *t*, $CovFuture_{it-1}$ is an indicator for whether firm *i* has a forward-looking covenant mention in quarter t - 1, α_i and δ_t are respectively firm and time fixed effects. The coefficient of interest is β_1 , the change in the probability of violating a covenant in quarter *t*, conditional on covenant concerns expressed in quarter t-1. All specifications control for lagged violation status both as reported in SEC filings as well as computed from DealScan.

I control for two key predictors of future violations: operating earnings and covenant slack. Operating earnings is an important predictor about future covenant violations because most financial covenants are defined to be a function of EBITDA (Lian and Ma (2021)). Prior work also shows that covenant slack, defined as the difference between the covenant threshold and the firm's actual financial ratio, is an important empirical proxy for future violations (Murfin (2012); Demerjian and Owens (2016)). I also include second order terms to allow for a non-linear relationship between violation status and these variables.

Table 2 show that CovFuture predicts a significant increase in the probability of violation next quarter. Column 1 shows that CovFuture predicts a 4.05 percent increase in the probability of SEC-reported violation in the next quarter. Relative to the average violation probability of 3.04 percent, this translates to a 1.3 times increase in the probability of violation. Columns 2 and 3 show that CovFuture remains informative about future violations, over and above information in operating earnings, covenant slack, and their squared values. Columns 4 and 5 repeat the analysis with DealScan-implied violations as the dependent variable. In Column 4, CovFuture is associated with an increase in the probability of vio-

	(1)	(2)	(3)	(4)	(5)
	Violation	Violation	Violation	(Dealscan)	(Dealscan)
L.CovFuture	$ \begin{array}{c} 4.24^{***} \\ (4.85) \end{array} $	4.05^{***} (4.66)	$ \begin{array}{c} 4.20^{***} \\ (4.83) \end{array} $	$\begin{array}{c} 4.32^{***} \\ (5.99) \end{array}$	$4.76^{***} \\ (6.39)$
L.Violation	$\begin{array}{c} 0.32^{***} \\ (12.32) \end{array}$	$\begin{array}{c} 0.32^{***} \\ (12.17) \end{array}$	0.32^{***} (12.26)	0.04^{***} (5.72)	0.05^{***} (5.90)
L.Violation (Dealscan)	0.02^{***} (5.24)	0.01^{***} (4.29)	0.01^{***} (3.15)	0.67^{***} (82.62)	$\begin{array}{c} 0.63^{***} \\ (75.22) \end{array}$
L.Earnings		-0.31*** (-7.50)		-1.35*** (-14.85)	
L.Sq. earnings		-0.30 (-0.85)		-2.67*** (-8.86)	
L.Covenant slack			-1.45^{***} (-4.06)		-15.39^{***} (-14.74)
L.Sq. covenant slack			0.20 (0.80)		-2.95^{***} (-3.72)
Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
R-squared Nobs	$0.31 \\ 56390$	$0.31 \\ 56390$	$0.31 \\ 56390$	$\begin{array}{c} 0.74 \\ 56553 \end{array}$	$0.74 \\ 56553$

Table 2: Predicting future covenant violations. Columns 1-3 report estimates from regression predicting SEC reported violations. Columns 4-5 report estimates from regression predicting Dealscan implied violations. All specifications estimated on sample of observations with covenant information in DealScan. Standard errors are two-way clustered by firm and year-quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

lation by 4.32 percent. This translates to an increase in the probability of DealScan-implied violation by 12.3 percent relative to an average of 35 percent. Column 5 shows that this estimate is similarly robust to non-linear controls in covenant slack.

3 When are firms concerned about covenants?

A finding from past empirical work on covenants is that violation incidences did not rise substantially during the 2008-09 financial crisis (Griffin, Nini, and Smith (2018)). Appendix Figure A.1 shows that violations imputed from covenant thresholds in DealScan also show a modest increase during the 2008-09 financial crisis. A plausible interpretation of this finding is that covenants did not become a more binding constraint despite the large decline in earnings during the financial crisis.

A different picture emerges when examining mentions of covenants in earnings calls. The top panel in Figure 3 compares the annual frequency of covenant discussions in earnings calls and the frequency of covenant violations from 2003 to 2020.⁹ The figure shows a sharp increase in covenant mentions (red line) during the 2008-09 financial crisis, rising from 7.3 percent in 2007 to 22.9 percent in 2009, in contrast to the muted response in covenant violations (blue line) over the same sample period, rising from 5.2 percent in 2007 to 7.6 percent in 2009.

This result is notable in light of recent evidence on the role of covenants in explaining investment and employment during the recession (Falato and Liang (2016); Acharya et al. (2021); Chodorow-Reich and Falato (2021)). While the literature focuses on how covenants affect firm decisions when covenants are violated, the finding suggest that covenants also matter to a broader set of firms including those not presently in violation of covenants. Specifically, the share of firms concerned about covenants in their earnings calls is three times as large as the share of firms in violation (22.9 percent versus 7.6 percent).

The inverse relationship between covenant concerns and earnings also extend to the firmlevel. Figure 4 plots the relationship between covenant concerns and changes in earnings, measured as the difference in earnings from four quarters prior and normalized by firmspecific standard deviation in earnings. The figure shows that concerns about covenants rise when earnings fall, but vary little when earnings rise. This finding that concerns about

⁹I focus on annual frequency to reduce measurement noise due to differences in reporting quality between quarterly 10-Q and annual 10-K SEC filings, consistent with the treatment in past literature (Nini et al. (2012); Griffin et al. (2018); Becher et al. (2021)). The sample consists of Compustat firms, excluding utilites and financials, with financial covenants based on information in DealScan, covenant violations data from SEC filings, and earnings call transcripts in FactSet. Restricting the sample to firms with active financial covenants in DealScan addresses the concern that aggregate trends are driven by changes in the share of firms with covenants.



Figure 3: Annual frequency of covenant violations, covenant mentions, and CovFuture from 2003 to 2020. Top panel computes share of firms reporting covenant violations in SEC filings and any covenant mentions in earnings calls in the full sample. Full sample consists of Compustat firms, excluding utilities and financials, with covenant information in DealScan and earnings call transcripts, from 2003Q1 to 2020Q1. Bottom panel computes share of firms reporting CovFuture in the full sample and in the sample of non-violators. Non-violator sample consists of those not in violation based on information in DealScan and SEC filings. Shaded bars denote year-quarters with NBERsrecession months.



Figure 4: Binned scatter plot of covenant concerns and change in earnings. Change in earnings is the year-over-year difference in earnings, normalized by firm-level standard deviation of earnings.

covenants coincide with deterioration in firm profitability is intuitive as these are precisely periods when firms expect to violate their covenants (Nini et al. (2012)).¹⁰

Firms are more concerned about covenants when their ex-ante credit risk is greater, conditional on a similar decline in earnings. Figure 5 shows that covenant concerns rises more sharply when earnings fall in quarters when credit risk, as proxied by high leverage, low cash holdings, and low Altman z-score (lower score indicates greater financial distress), rises above the firm's average. Since covenants are commonly defined based on these proxies of credit risk, firms are closer to violating their covenants when credit risk is greater. Moreover, lenders are also more likely to impose severe penalties conditional on violation when borrowers are at a greater risk of defaulting on their loans. Greater probability of violation and higher cost of violation means that borrowers are more concerned about the prospects of violating their covenants, given a similar fall in earnings.

Table 3 provides additional summary statistics of covenant concerns and violations in the cross-section of firms. Covenant concerns are discussed in earnings calls across all industries, most commonly by firms in the energy industry and least commonly by firms in the healthcare industry. Notably, covenant concerns rise monotonically with size (book assets) even though

¹⁰Appendix Table A.5 formalizes the findings in a regression specification. In particular, I find that the estimates are robust to controlling for violation status, firm and time fixed effects. In unreported analysis, I find the estimates qualitatively similar after dropping observations in violation in the current and past quarter.



Figure 5: Binned scatter plot of covenant concerns and change in earnings, conditional on leverage, net worth, cash holdings, and Altman-z. To focus on within-firm variation in credit risk, the permanent component of leverage, net worth, cash holdings, and Altman-z are removed by subtracting the firm's average. High (low) leverage, net worth, cash, and Altman-z are observations where the variables are above (below) the firm's average at the beginning of a given quarter. Change in earnings is the year-over-year difference in earnings, normalized by firm-level standard deviation of earnings.

Table 3: Column 1 shows share of firms (as fraction of one) with at least one mention of covenant concerns across all observed quarters in the sample, Column 2 shows share of firms (as fraction of one) with at least one violation, Column 3 shows the difference between Column 1 and Column 2. Industry refers to the Fama-French 12 industry classification, excluding firms that are classified as utilities, financials, and others. Book asset quintiles are constructed by sorting firms into five quintile bins each quarter based on their book asset value at the start of the quarter.

	Any Concern	Any Violation	Difference
All firms	0.31	0.33	-0.02
A. By industry			
Energy	0.39	0.31	0.07
Chemicals	0.36	0.24	0.11
Manufacturing	0.34	0.34	-0.01
Telecom	0.33	0.29	0.04
Durables	0.31	0.40	-0.09
Retail	0.26	0.25	0.01
Non-Durables	0.23	0.29	-0.07
Business-Equipment	0.11	0.22	-0.11
Health	0.08	0.17	-0.09
B. By book asset quintile			
1 (small)	0.06	0.23	-0.17
2	0.14	0.27	-0.12
3	0.26	0.31	-0.05
4	0.33	0.28	0.04
5 (large)	0.36	0.26	0.09
C. By S&P credit rating			
Investment Grade	0.14	0.11	0.03
High Yield	0.44	0.36	0.09
No rating	0.19	0.25	-0.06

no similar pattern is observed for violations.¹¹ This result is consistent with findings in prior work that shows that small firms rely more on asset-based lending rather than cash-flow based lending (Lian and Ma (2021)). Since covenants are restrictions that apply mainly to cash-flow based lending, smaller firms are less likely to be concerned about violating their covenants. Finally, I also find that firms with high yield credit ratings are more concerned about covenants than investment grade firms or unrated firms. This pattern is in line with incidence of covenant violations, which is also higher for firms with high yield credit ratings.

4 How do firms respond when they anticipate covenant violations?

4.1 Event study around covenant concerns

Having examine how covenant concerns vary across firms and over time, I turn to study the relationship between concerns about future covenant violations and investment and financing activity. I begin by exploring the dynamics of investment and financing activities in the quarters when firms mention covenant concerns. The event study is restricted to events in which no violations occur in the quarter concerns are mentioned as well as in the previous four quarters, and no concerns mentioned in any of the previous four quarters.

The top panel of Figure 6 plots the average dynamics of capital expenditures. While there is a downward trend in the four quarters prior to mention, we see an accelerated decline beginning in the quarter when covenant concerns are mentioned. The middle and bottom panels in Figure 6 also show changes to debt and equity financing activities. Longterm debt growth starts to decline in the quarter concerns are mentioned, whereas equity payouts fall sharply in the quarter after concerns are mentioned.

Figure 7 shows the dynamics of three profitability metrics: Tobin's Q, cash flow, and operating earnings. All three variables fall over the four quarters leading up to when concerns are mentioned. These trends indicate that covenant concerns coincide with a period of poor profitability. Notably, while investment and financing outcomes remain low relative to the quarters prior to mention, profitability recovers in the quarters after mention. These opposing trends suggest that the observed changes in firm outcomes may not fully account for the change in firm outcomes, which I turn to examine next.

¹¹Appendix Table A.6 formalizes this relationship in a cross-sectional regression of covenant concerns and size, controlling for analyst coverage, call length, and number of quarters observed. This suggests that the relationship is not mechanically due to larger firms having better earnings call coverage than smaller firms.



Figure 6: Investment and financing responses around covenant concerns. Blue lines show the average responses. Shaded area denotes 95 percent confidence interval of the sample mean. Event study windows restricted to windows where no covenant concerns expressed in four quarters prior to event and no covenant violations occur in four quarters prior to and including quarter of event. (*NEvents* = 1, 355)



Figure 7: Firm outcomes around covenant concerns. Blue lines show the average responses. Vertical bars report 95 percent confidence interval of the sample mean. Event study windows restricted to windows where no covenant concerns expressed in four quarters prior to event and no covenant violations occur in four quarters prior to and including quarter of event. (NEvents = 1, 355)

4.1.1 Covenant concerns and poor profitability

To isolate the response to concerns over and above changes in profitability, I compare the responses to a comparison group of firms that do not mention covenant concerns but have similar profitability. Specifically, I match concerned firms with up to four firms with no mention of covenant concerns based on their similarity, using the Mahalanobis distance metric, along key profitability metrics. The goal of this analysis is to see if covenant concerns can explain firm responses over and above changes in firm profitability.

Firms are matched based on the following profitability metrics: Tobin's Q, cash flow, past 12 month stock returns, log assets and log sales-to-lagged assets and their squared values, operating earnings, sales and earnings growth. I include Tobin's Q and cash flow since they are key proxies of Q in standard investment regressions (Abel and Eberly (1994); Erickson and Whited (2000)). Past 12 month stock returns proxy for variation in discount rates, which matters for Q (Lamont (2000)). I control for log assets and log sales since prior work finds that these variables explain large variation in corporate investment (Gala et al. (2020)). I also match on operating earnings, sales and earnings growth to reduce the imbalance in covariate distribution along those dimensions. To facilitate a clean comparison, I restrict the comparison group to firms with no covenant concerns mentioned in any of the four quarters prior to the event and no violations in any of the four quarters prior to and including the event.

Table 4 summarizes key profitability characteristics for concerned firms and their matched counterparts in the quarter concerns are mentioned, as well as characteristics of all firms with no mention of covenant concerns. Relative to all firms with no mention of covenant concerns, concerned firms are associated with lower Tobin's Q, past 12-month returns, and sales and earnings growth. The matched comparison firms are more similar to the concerned firms along these dimensions, however there is still some differences in levels. Nonetheless, Appendix Figure A.2 shows that the matching process yields firms with comparable profitability trends leading up to when concerns are mentioned.

To estimate differences in investment responses between concerned firms and their comparison groups, I estimate the following difference-in-differences specification

$$Y_{it} = \sum_{\tau = -4, \tau \neq -1}^{4} \beta_{\tau} 1\{h_{it}^{concerned} = \tau\} + \sum_{\tau = -4, \tau \neq -1}^{4} \delta_{\tau} 1\{h_{it}^{All} = \tau\} + \alpha_g + \alpha_{g \times concerned} + \epsilon_{it} \quad (2)$$

where $1\{h_{it}^{concerned} = \tau\}$ are lead-lag indicators of quarter τ relative to the event for concerned firms, $1\{h_{it}^{All} = \tau\}$ are lead-lag indicators of quarter τ relative to the event for all firms in the sample. The group fixed effects α_g allow for differences in responses across groups of

Table 4: Summary statistics for matched event study sample. Columns 1 and 2 describe statistics of concerned firms in the quarter concerns are mentioned. Columns 3 and 4 describe statistics of comparison firms with matched expected profitability in the quarter prior to and when concerns are mentioned. Columns 5 and 6 are statistics for all unconcerned firms in the sample. Sample restricted to concerns where no violations occur in quarters up to and including mention, and no covenant concerns expressed prior to mention.

	Concerned Firms		Matched Unconcerned Firms		All Unconcerned Firms	
	Mean	SD	Mean	SD	Mean	SD
Tobin q	1.17	.82	1.19	.63	1.95	1.54
Cash Flow $(\%)$	2.07	5.15	2.46	2.77	1.42	7.08
Operating Earnings $(\%)$	1.87	5.26	2.73	2.13	1.11	9.04
Log Asset	7.12	1.44	7.3	1.23	6.57	1.87
Log Sales-to-LAsset	-1.69	.81	-1.64	.67	-1.68	.99
Past 12-mth returns $(\%)$	-10.66	64.01	-2.42	44.96	15.51	65.3
Sales Growth (%)	-2.85	66.37	-1.39	56.25	14.97	54.2
Earnings Growth $(\%)$	-16.09	79.69	-15.53	70.8	7	69.83
Nobs	1355		5420		121063	•

concerned firms and their matched counterparts in the baseline quarter h = -1, and the group-concerned fixed effects $\alpha_{g \times concerned}$ allow for group-specific time-invariant differences between concerned firms and their matched counterparts in quarter h = -1.

The left panel in Figure 8 plots the average response of concerned firms in blue and their comparison groups in red. Both groups of firms show similar downward trend in investment in the four quarters prior to mention, consistent with the general decline in profitability of the same period. However, the trends diverge beginning in the quarter that concerns are mentioned, with concerned firms cutting their investments by more than their unconcerned counterparts. The right panel in Figure 8 shows that the difference in response between concerned firms and their comparison group is significant in the quarter of concern. In particular, capital expenditure of concerned firms is 8.3 basis points lower than comparison firms in the quarter of concern, and 25.2 basis points four quarters after concern.

Appendix Figure A.3 examine differences in debt and equity financing responses between concerned firms and their comparison groups. Similar to investment responses, I do not find pre-trends in long-term debt growth and equity payouts (in logs). Equity payouts of concerned firms diverge from their comparison group one quarter after mention and remain low in the subsequent three quarters. Long-term debt growth of concerned firms fall relative to their comparison group, however differences are statistically significant only three quarters after concerns are mentioned.



Figure 8: Dynamics of capital expenditures in the quarters before and after covenant concerns are expressed. Left panel shows raw means, normalized to 0 in horizon h = -1. Blue line is average response of firms that express covenant concerns. Red line is average response of control firms matched by expected profitability in horizon h = 0 and h = -1. Right panel shows differential response given by coefficient estimates from OLS specification. Shaded area denotes 95 percent confidence interval.

4.1.2 Covenant concerns and ex-post violations

Figure 9 shows that while concerned firms have similar profitability to their comparison group in the quarter concerns are mentioned, they face a greater probability of violating their covenants in the subsequent quarters. In particular, the figure shows the probability of violation rises sharply for concerned firms and remains high in the subsequent three quarters. Four quarters after mention, around ten percent of concerned firms experience at least one violation, whereas only around four percent of their comparison groups experience a violation (left panel). The right panel shows that the probability of a violation, conditional on no prior violation, is the highest one quarter after mention.

While violations become more likely in the quarters after concerns, I find a significant response following mention of concerns, even among firms that do not subsequently violate their covenants. The left panel of Figure 10 shows that firms with no ex-post violation cut their expenditures by 7.5 basis points (s.e. = 3.1 bps) in the quarter of concern relative to their comparison group. Four quarters after concerns, capital expenditures of these firms is lower by 21.8 bps (s.e. = 5.1 bps) relative to their comparison groups. The right panel shows that firms that subsequently violate their covenants cut their investments by more than firms that remain in compliance of covenants. Capital expenditures fall by 13.1 bps (s.e. = 13.1 bps) relative to their concern, albeit imprecisely estimated.



Figure 9: Probability of violation after covenant concerns are mentioned. Cumulative violation is the probability of any violation in the current and previous quarters following mention. New violation is the probability of a violation in the current quarter, conditional on no violation in the previous quarters following mention.



Figure 10: Blue line is average response of firms that express covenant concerns. Red line is average response of control firms matched by expected profitability in horizon h = 0 and h = -1. Shaded area denotes 95 percent confidence interval. Red vertical line in the right panels are the average quarter of first violation for firms that express concerns (2.13 quarters after mention).

Four quarters after mention, capital expenditures is lower by 58.6 bps (s.e. = 12.8 bps) relative to their comparison group. Appendix Figure A.4 show that firms that subsequently violate their covenants also cut their debt and equity financing by more than firms that remain in compliance.

4.2 Panel regression estimates

In this section, I use a panel regression framework to study how firm investment and financing activities are associated with covenant concerns. The goal of this analysis is two fold. First, by including additional covariates, the regression framework allows for evaluating whether covenant concerns remains informative about firm outcomes, over and above other determinants of investment and financing activities. Second, the regression coefficients allows for a comparison of the marginal effects of covenant concerns to the marginal effects of covenant violations, which speaks to the economic magnitude of the response to violation. Formally, I estimate the following panel regression specification

$$Y_{it} = \beta_0 + \beta_1 CovFuture_{it} + \beta_2 Violation_{it} + \Gamma X_{it} + \alpha_i + \delta_t + \epsilon_{it}$$
(3)

where Y_{it} are the firm outcomes of interest, X_{it} are a set of time-varying controls, and α_i and δ_t are firm and time fixed effects.

The choice of controls in the baseline specification builds on prior work studying the effects of covenant violations (Roberts and Sufi (2009); Nini et al. (2012)). These include variables commonly used in the definition of financial covenants to proxy for borrower health: cash flow, book leverage, interest expense, net worth, current ratio. I also control for Tobin's Q, which is a common proxy of Q in standard investment regressions. Additionally, I control for information about borrower's health in credit rating-related variables: Altman z-score, indicators for rating downgrade, and the presence of high yield or investment grade credit ratings.

Table 5 reports the response of capital expenditures to covenant concerns and violations. In the baseline specification (Column 1), covenant concerns are associated with a 12.15 bps (s.e. = 3.41 bps) decline in capital expenditures, whereas covenant violations are associated with a 7.88 bps (s.e. = 2.97 bps) decline in capital expenditure. Relative to the sample average (119.94 bps), this corresponds to a relative decline of 10.13 percent and 6.56 percent, respectively.

Column 2 additionally controls for information in operating earnings. Since most financial covenants are defined to be a function of earnings, changes in earnings directly affects the tightness of financial covenants (Lian and Ma (2021)). The estimated coefficient on covenant

Table 5: Capital expenditure to lagged assets (basis points). Covenant controls include cash flow, book leverage, interest expense, net worth, current ratio, and Tobin's q. Rating controls include Altman z-score, and indicators for rating downgrade, high yield, and investment grade credit ratings. Standard errors clustered by firm and quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	Capital Expenditure					
	(1)	(2)	(3)	(4)	(5)	
CovFuture	-12.82*** (-3.81)	-11.43*** (-3.43)	-11.30*** (-3.34)	-12.99*** (-3.86)	-12.72*** (-3.70)	
Violation	-8.71*** (-2.93)	-6.83** (-2.30)	-7.45** (-2.52)	-8.86*** (-2.99)	-10.65^{***} (-3.57)	
Earnings		2.38^{***} (6.55)				
Sq. earnings		3.70^{***} (2.92)				
$\log(Asset)$			32.76^{***} (3.68)			
Sq. $\log(Asset)$			-1.99^{***} (-2.87)			
$\log(\mathrm{Sales}/\mathrm{L.Asset})$			43.90^{***} (10.75)			
Sq. $\log(\text{Sales}/\text{L.Asset})$			$4.16^{***} \\ (8.76)$			
Past 12mth Stock Returns				-1.92** (-2.30)		
Covenant Slack					22.67^{***} (5.59)	
Sq. Covenant Slack					3.19 (1.12)	
Covenant Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Rating Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
R-squared	0.6	0.6	0.6	0.6	0.7	
Nobs	92672	92672	92672	92672	48080	

concerns falls slightly but remains highly significant in this specification. Column 3 controls for information in the firm's log book assets and log sales-to-lagged assets, which are key state variables in standard structural models of investments. Using annual Compustat data, Gala et al. (2020) finds that these state variables account for a greater share of variation in corporate investment than standard predictors of Q. Consistent with their findings, I find that both variables and their second-order terms are statistically significant predictors of investment. The coefficient on covenant concerns and violation are largely unaffected after controlling for these state variables. Column 4 show that estimates are also robust to controlling for the firm's past 12 month stock returns (Lamont (2000)).

Lastly, Column 5 compares the information content in covenant concerns with covenant slack, which is the standardized difference between the covenant threshold and the firm's actual financial ratios. Conceptually, covenant slack is linked to covenant concerns as a lower slack implies a higher probability of violating covenants. However, in the data the correlation between covenant slack and covenant concerns is low (correlation of -0.1). A key reason why these two variables differ is because covenant slack is based on past cash flow realizations, whereas covenant concerns also reflect the future path of cash flows. Both measures can differ substantially when past earnings are a poor proxy for future cash flows, for instance when earnings are more volatile or less persistent. I find that controlling for covenant slack does not diminish the relationship between covenant concerns and capital expenditures. Here, covenant concerns explain a decline of 12.72 bps (*s.e.* = 3.43 bps). For comparison, a one standard deviation decline in slack is associated with a 22.79 bps (*s.e.* = 4.11 bps) decline in capital expenditures for a firm with the average covenant slack of 0.02.

Tables 6 and 7 show that covenant concerns also predict a significant decline in long-term debt growth and equity payouts. In the baseline specification (Table 6 Column 1), covenant concerns are associated with a 6.39 log percentage point (*s.e.* = 1.94 log pp) decline in long-term debt growth. Covenant violations, by comparison, are associated with a decline of 9.52 log percentage points (*s.e.* = 1.66 log pp). These estimates translate to a relative decline of 1.7 times and 2.6 times, respectively, the average long-term debt growth of 3.68 log percentage points. Table 7 Column 1 show that covenant concerns are associated with a 11.98 log percentage point (*s.e.* = 2.82 log pp) decline in equity payouts, whereas covenant violations is associated with a 5.98 log percentage point (*s.e.* = 2.59 log pp) decline. This translates to a relative decline of 8.7 percent and 4.3 percent the average equity payout of 138.2 log percentage points. Columns 2-4 of the respective tables show that coefficients on covenant concerns are robust to additional controls for operating earnings, key state variables (log assets and log sales-to-lagged assets), and covenant slack.

Table 6: Change in log long-term debt (log points ×100). Covenant controls include cash flow, book leverage, interest expense, net worth, current ratio, and Tobin's q. Rating controls include Altman z-score, and indicators for rating downgrade, high yield, and investment grade credit ratings. Standard errors clustered by firm and quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	LT Debt Growth					
	(1)	(2)	(3)	(4)	(5)	
CovFuture	-6.39*** (-3.29)	-5.84*** (-3.04)	-5.12^{***} (-2.68)	-6.38*** (-3.30)	-6.30*** (-2.81)	
Violation	-9.48*** (-5.69)	-8.76*** (-5.30)	-8.37*** (-5.13)	-9.47^{***} (-5.71)	-12.90^{***} (-5.93)	
Earnings		0.90^{***} (6.98)				
Sq. earnings		1.23^{***} (2.92)				
$\log(Asset)$			18.91^{***} (5.40)			
Sq. $\log(Asset)$			-0.41 (-1.64)			
$\log(\text{Sales}/\text{L.Asset})$			39.07^{***} (17.38)			
Sq. $\log(\text{Sales}/\text{L.Asset})$			3.48^{***} (12.02)			
Past 12mth Stock Returns				$0.08 \\ (0.15)$		
Covenant Slack					-5.02^{***} (-3.14)	
Sq. Covenant Slack					$1.29 \\ (1.09)$	
Covenant Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Rating Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
R-squared	0.05	0.05	0.07	0.05	0.06	
Nobs	93080	93080	93080	93080	48096	

Table 7: Log equity payouts (log points ×100). Covenant controls include cash flow, book leverage, interest expense, net worth, current ratio, and Tobin's q. Rating controls include Altman z-score, and indicators for rating downgrade, high yield, and investment grade credit ratings. Standard errors clustered by firm and quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	Equity Payout					
	(1)	(2)	(3)	(4)	(5)	
CovFuture	-11.48^{***} (-4.07)	-10.08*** (-3.60)	-12.12^{***} (-4.10)	-12.45*** (-4.41)	-10.67^{***} (-2.65)	
Violation	-6.58^{**} (-2.54)	-4.68^{*} (-1.82)	-6.86^{***} (-2.66)	-7.27*** (-2.83)	-5.12 (-1.47)	
Earnings		2.24^{***} (9.06)				
Sq. earnings		3.44^{***} (4.24)				
$\log(Asset)$			-64.80^{***} (-5.25)			
Sq. $\log(Asset)$			7.81^{***} (7.51)			
$\log(\text{Sales}/\text{L.Asset})$			6.10^{*} (1.70)			
Sq. $\log(\text{Sales}/\text{L.Asset})$			$0.53 \\ (1.50)$			
Past 12mth Stock Returns				-9.02*** (-7.69)		
Covenant Slack					32.12^{***} (6.21)	
Sq. Covenant Slack					8.75^{**} (2.52)	
Covenant Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Rating Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
R-squared	0.7	0.7	0.7	0.7	0.7	
Nobs	85136	85136	85136	85136	44785	

Robustness checks. I probe the robustness of the estimates to alternative specifications. In the sample, twelve percent of concerns are mentioned when a violations occurs, hence a question is whether the responses are driven by concerns mentioned when firms in violation. Appendix Table A.9 reports a specification that includes the interaction of covenant concerns and violations. With the inclusion of the interaction term, the coefficient estimates on covenant concerns remains robust for capital expenditures and equity payouts, while the coefficient estimates for long-term debt growth falls with the inclusion of the interaction term.

Building on the specification in Nini et al. (2012) and Becher et al. (2021), I evaluate whether the results are robust to including second and third order polynomials of cash flow, leverage, interest expense, net worth, current ratio and Tobin's Q as well as four-quarter lags of these variables. These controls flexibly controls for operating conditions at the time covenant concerns and violations occur. Appendix Table A.10 reports the estimates from this regression specification and shows that the estimates of covenant concerns and violations are largely similar to those from the baseline specification.

Next, I investigate whether responses to covenant concerns differ when the sentiment of covenant discussions are positive¹² and when covenant discussions are mentioned more than once. Appendix Table A.11 shows that the coefficient estimates on covenant concerns are not significantly different at the 10 percent level when sentiment is positive or when covenant concerns are mentioned more than once.

Appendix Table A.11 further probes whether the estimates differ depending on whether covenant concerns are discussed in the scripted management discussion (MDA) section or questions and answers (QA) section of earnings calls. I also check for differences in estimates between covenant concerns discussed in SEC filings. I do not find significant differences in the relationship between covenant concerns and capital expenditures in these two cases. However, I do not find a significant relationship between covenant concerns and long-term debt growth and equity payouts when they are mentioned in the QA section or SEC filings.

5 Discussion of findings

In this section, I examine whether the predictions of a standard model of investments with an earnings-based borrowing constraint are qualitatively consistent with the empirical findings.

¹²The measure of covenant sentiment CovSent is constructed as CovSent = (|PosWords| - |NegWords|)/(|PosWords| + |NegWords|), where |PosWords| (|NegWords|) are the number of positive (negative) sentiment words in sentences with covenant-related terms in the earnings call. The list of positive and negative keywords come from the Loughran-McDonald sentiment dictionary (Loughran and McDonald (2011)).

I focus on two key empirical findings: (1) covenant concerns when earnings growth falls, with the sensitivity increasing with lower earnings growth, (2) covenant concerns are associated with decreases in investments, debt issuance, and equity payouts.

5.1 Entrepreneur's problem

Entrepreneurs have access to production technology $y_t = z_t k_t^{\alpha}$, where z_t is a productivity shock, k_t is the entrepreneur's capital stock. Capital used in production in period t is predetermined at time t - 1. Entrepreneurs own their capital, which evolves according to the capital accumulation equation $k_{t+1} = i_t + (1 - \delta)k_t$, where i_t is the entrepreneur's investment in period t and δ is the depreciation rate of capital. Installing capital is costly and incurs quadratic adjustment cost $\frac{\psi}{2} \frac{(k_{t+1}-k_t)^2}{k_t}$.

Entrepreneurs can borrow and lend only through one-period risk-free debt d_{t+1} . Positive values of d_{t+1} represents net borrowing, and negative values of d_{t+1} represents net lending. Building on Lian and Ma (2021), I model financial covenants as a limit on total debt as a multiple of earnings, given by

$$\frac{d_{t+1}}{R} \le \kappa y_t$$

where R is the gross interest rate on loans and κ is the covenant threshold. There is no default in this model, so the gross interest rate is equal to the risk free rate. Lian and Ma (2021) discusses why financial covenants are reasonably modeled as an earnings-based borrowing constraint. In particular, financial covenants apply to total borrowing of the firm, are typically defined as a function of EBITDA (earnings before interest, taxes, depreciation, and amortization), and are monitored for compliance on a quarterly basis. As the only input of production is capital and entrepreneurs own the capital stock, earnings equal output y_t . In the model, a violation occurs when $\frac{d_{t+1}}{R} = \kappa y_t$.

The entrepreneur's problem can be described recursively. In particular, let $V(z_t, k_t, d_t)$ be the expected utility of an entrepreneur that starts a period with productivity shock z_t , capital stock k_t , and debt d_t . The entrepreneur chooses consumption c_t , next period's capital k_{t+1} and debt d_{t+1} to maximize their expected utility

$$V(z_t, k_t, d_t) = \max_{c_t, k_{t+1}, d_{t+1}} \frac{c_t^{1-\gamma}}{1-\gamma} + \beta E \Big[V(z_{t+1}, k_{t+1}, d_{t+1}) \Big| z_t \Big]$$
(4)

subject to

$$c_t = y_t - d_t + \frac{d_{t+1}}{R} - i_t - \frac{\psi}{2} \frac{(k_{t+1} - k_t)^2}{k_t}$$
(5)

$$i_t = k_{t+1} - (1 - \delta)k_t \tag{6}$$

$$y_t = z_t k_t^{\alpha} \tag{7}$$

$$\frac{d_{t+1}}{R} \le \kappa y_t \tag{8}$$

Productivity follows a log AR(1) process given by

$$\log z_t = \rho_z \log z_{t-1} + \sigma_z \epsilon_t \tag{9}$$

where $\epsilon_t \sim N(0, 1)$ are innovations in productivity. Appendix Section D.1 describes the optimality conditions of the entrepreneur's problem.

5.2 Future covenant violations affect optimal policy in the present

To see how the expectation of future borrowing constraints binding affects the entrepreneur's choices today, consider the first order condition for d_{t+1} . Define μ_t as the Lagrange multiplier on the borrowing constraint (5). After substituting in the first order condition for c_t and iterating the equation forward by $J < \infty$ periods, we have

$$c_t^{-\gamma} = \beta^J R^J \underbrace{\left(\frac{1}{1-\mu_t}\right)}_{\text{actual violations}} E_t \Big[\prod_{j=1}^{J-1} \underbrace{\left(\frac{1}{1-\mu_{t+j}}\right)}_{\text{expected violations}} c_{t+J}^{-\gamma} \Big]$$
(10)

Equation (10) implies that the optimizing entrepreneur equalizes the present value of marginal benefit of consumption across periods, in this case between period t and period t + J. The right hand side shows that the present value is affected not just by the Lagrange multiplier of the borrowing constraint in period t, μ_t , but also the sequence of Lagrange multipliers up to J-1 periods ahead. In other words, the entrepreneur's consumption depends not only on the borrowing constraint binding today, but also the expectation of the constraint binding in future periods.

Note that the expectation of future Lagrange multipliers is weakly decreasing in consumption today. In particular, holding fixed c_{t+J} , an increase in μ_{t+j} for any j = 0, ..., J - 1increases the present value of marginal benefit of consumption in period t + J. This implies an increase in the marginal value of consumption today $c_t^{-\gamma}$, which corresponds to a lower value of consumption c_t today.
We can also see how this affects investment and borrowing today. For simplicity, suppose that adjustment costs are zero $\psi = 0$ for all t. From the budget constraint (5), we have

$$c_t = y_t + (1 - \delta)k_t - d_t + \left(\frac{d_{t+1}}{R} - k_{t+1}\right)$$

Since y_t, k_t , and d_t are fixed at the start of each period, lower consumption c_t today implies lower $\frac{d_{t+1}}{R} - k_{t+1}$ It follows that the entrepreneur's borrowing and investment decisions in period t changes when any of the Lagrange multipliers μ_{t+j} for j = 0, ..., J - 1 changes.

The preceding analysis assumes that entrepreneurs have a preference for smoothing consumption over time, which is governed by the parameter γ . Entrepreneurs with high elasticity of inter-temporal substitution (low γ) are sensitive to changes in the discount rate of future marginal benefits of consumption. One interpretation of the consumption smoothing motive is that it captures a preference for smoothing dividends over time (Lintner (1956)). Graham (2022) confirms this idea in a recent survey of CFOs, reporting that 77 percent of dividend paying firms consider maintaining historical levels of dividends a very important or top priority for the firm.

5.3 Mapping model to data

In this section, I examine whether the model predictions are qualitatively consistent with the empirical findings. I focus on two key empirical findings: (1) covenant concerns rise when earnings growth falls, with the sensitivity increasing with lower earnings growth, (2) covenant concerns are associated with decreases in investments, debt issuance, and equity payouts.

I start by defining covenant concerns in the model. Building on the discussion in the previous section, I link covenant concerns to the expectation of the Lagrange multiplier on the borrowing constraint $E_t \mu_{t+j}$ for some j > 0. Given that covenant concerns have the strongest predictive power for violations in the next quarter, I focus on the expectation of the Lagrange multiplier in the next quarter $E_t \mu_{t+1}$. To interpret the units of the Lagrange multiplier μ_t , rewrite the first order condition for d_t to get

$$\mu_t = \frac{\lambda_t - \beta R E_t \lambda_{t+1}}{\lambda_t}$$

where λ_t is equal to the marginal benefit of consumption in period t. In words, the Lagrange multiplier μ_t is the percentage difference in the marginal benefit of consumption in period t and the marginal benefit of consumption in period t + 1 discounted at rate βR .

To compare the model predictions with the data, I calibrate the nine parameters in the

model using standard values from the literature as well as to match key moments of the data. I find that the model matches the four targeted moments well: mean and standard deviation of investment rate, average debt-to-asset, and the share of covenant violations. Having solve for the policy functions in the model, I simulate the model for five million periods, dropping the first 500 thousand observations as burn-in. Appendix Sections D.2 and D.3 describes the calibration and model fit in detail.

Having solved the model numerically, I examine how covenant concerns covary with earnings growth in the model. Appendix Figure A.5 replicates the empirical finding documented in Figure 4 using model simulated data.¹³ The figure shows that the model predictions are qualitatively consistent with the empirical findings. In particular, the left panel shows that the model predicts a significant negative relationship between covenant concerns and earnings growth, whereas the right panel shows that covenant concerns increase when leverage increases, conditional on earnings growth. To conclude, I find that the rise in covenant concerns is consistent with an increase in the expectation of future constraints binding as earnings growth falls.

Next, I turn to investigating the relationship between covenant concerns and firm responses. As in the data, I focus on three key firm responses: investments, debt issuance, and equity payouts, all scaled by beginning of quarter capital. In the model, investments is defined as the change in capital stock after depreciation, $k_{t+1} - (1 - \delta)k_t$, debt issuance is defined as the change in log debt, $log(d_{t+1}/R) - log(d_t)$, and equity payouts is defined as log consumption, $\log c_t$. Appendix Figure A.6 shows that that covenant concerns are negatively associated with investments, debt issuance, and equity payouts, respectively. This is consistent with the empirical findings that higher concerns about borrowing constraints binding lead to more conservative investments and financing policies.

6 Conclusion

A fundamental question in macro-finance is how financial constraints affect firm investment and financing decisions. I analyze the role of financial covenants since recent work documents that they are one of the most common types of borrowing constraints that apply to nonfinancial US firms. While it is intuitive that financial covenants should matter not only when they are violated but also when they are expected to be violated in the future, a key challenge lies in measuring when firms are concerned about the prospects of violating their

 $^{^{13}}$ In particular, I group simulated observations into 25 quantile bins based on the distribution of earnings growth and compute the average value of the expectation of Lagrange multiplier next quarter for each bin. This is a similar to how Figure 4 is constructed in the data.

covenants in the future. Leaving out the effects of expected covenant violations understates the total effects of covenants on firm investment and financing decisions.

In this paper, I use textual analysis of earnings call transcripts to build a novel measure of when firms are concerned about future covenant violations. To construct the measure of concern about future binding covenants, I employ an algorithm that parses for sentences in the text about covenants and determines whether each of these sentences are forward-looking or not. The measure of covenant concerns is a binary variable that indicates whether an earnings call contains any covenant-related sentences that relates to the future. As validation that the measure captures forward-looking concerns, I find the share of discussions that are forward-looking rise prior to violation as opposed to at violation. Additionally, I find that covenant concerns rises during recessions even for firms not in violation, covary inversely with earnings, and predict a greater probability of violation in the next quarter.

Next, I turn to examining how firms respond when they are concerned about future violations. Using an event study framework, I find that investments exhibit an accelerated decline in the quarters after concerns are mentioned relative to the quarters before. I also find sharp reductions to debt and equity financing in the quarters after concerns are mentioned. While these changes coincide with a deterioration in firm profitability, the changes persist even after profitability begins to recover.

To further investigate the role of profitability in explaining the observed responses, I compare the response of each concerned firms to a group of unconcerned firms with similar profitability one quarter before and when covenant concerns are mentioned. The investment trends of both groups are similar in the quarters leading up to when concerns are mentioned but diverges in the subsequent quarters, indicating that covenant concerns are associated with a greater reduction in investment than explained by a deterioration in firm profitability. Estimates from a panel regression specification shows that the information in covenant concerns is not subsumed by other predictors of covenant violations, such as changes in financial ratios commonly used in the definition of covenants. Taken together, these findings suggest that financial covenants matter not only when they are violated but when they are expected to be violated at some point in the future, which is predicted by theory but not previously tested in empirical studies.

References

- ABEL, A. AND J. EBERLY (1994): "A Unified Model of Investment under Uncertainty," American Economic Review, 84, 1369–84.
- ABIS, S. (2020): "Man vs. Machine: Quantitative and Discretionary Equity Management," SSRN Electronic Journal.
- ACHARYA, V. V., H. ALMEIDA, F. IPPOLITO, AND A. P. ORIVE (2021): "Credit Lines and the Liquidity Insurance Channel," *Journal of Money, Credit and Banking*, 53, 901–938.
- ADLER, K. (2020): "Financial Covenants, Firm Financing, and Investment," SSRN Electronic Journal.
- ANTWEILER, W. AND M. Z. FRANK (2004): "Is All That Talk Just Noise? The Information Content of Internet Stock Message Boards," *The Journal of Finance*, 59, 1259–1294.
- BECHER, D. A., T. P. GRIFFIN, AND G. NINI (2021): "Creditor Control of Corporate Acquisitions," *The Review of Financial Studies*.
- BECKER, B. AND V. IVASHINA (2016): "Covenant-Light Contracts And Creditor Coordination," Working Paper Series 325, Sveriges Riksbank (Central Bank of Sweden).
- BERLIN, M., G. NINI, AND E. G. YU (2020): "Concentration of control rights in leveraged loan syndicates," *Journal of Financial Economics*, 137, 249–271.
- BIANCHI, J. (2011): "Overborrowing and Systemic Externalities in the Business Cycle," American Economic Review, 101, 3400–3426.
- BODNARUK, A., T. LOUGHRAN, AND B. MCDONALD (2015): "Using 10-K Text to Gauge Financial Constraints," *Journal of Financial and Quantitative Analysis*, 50.
- BOLTON, P., H. CHEN, AND N. WANG (2013): "Market timing, investment, and risk management," *Journal of Financial Economics*, 109, 40–62.
- BRADLEY, M. AND M. R. ROBERTS (2015): "The Structure and Pricing of Corporate Debt Covenants," *Quarterly Journal of Finance (QJF)*, 5, 1–37.
- BRAUNING, F., V. IVASHINA, AND A. K. OZDAGLI (2021): "High-Yield Debt Covenants and Their Real Effects," *SSRN Electronic Journal*.
- BUEHLMAIER, M. M. M. AND T. M. WHITED (2018): "Are Financial Constraints Priced? Evidence from Textual Analysis," *The Review of Financial Studies*, 31, 2693–2728.

- CALDARA, D. AND M. IACOVIELLO (2022): "Measuring Geopolitical Risk," American Economic Review, 112, 1194–1225.
- CALOMIRIS, C. W., H. MAMAYSKY, AND R. YANG (2020): "Measuring the Cost of Regulation: A Text-Based Approach," NBER Working Papers 26856, National Bureau of Economic Research, Inc.
- CAO, S. S., W. JIANG, J. L. WANG, AND B. YANG (2021): "From Man vs. Machine to Man Machine: The Art and AI of Stock Analyses," *SSRN Electronic Journal*.
- CHAVA, S., V. NANDA, AND S. C. XIAO (2017): "Lending to Innovative Firms," *Review of Corporate Finance Studies*, 6, 234–289.
- CHAVA, S. AND M. ROBERTS (2008): "How Does Financing Impact Investment? The Role of Debt Covenants," *Journal of Finance*, 63, 2085–2121.
- CHAVA, S., R. WANG, AND H. ZOU (2019): "Covenants, Creditors Simultaneous Equity Holdings, and Firm Investment Policies," *Journal of Financial and Quantitative Analysis*, 54.
- CHODOROW-REICH, G. AND A. FALATO (2021): "The Loan Covenant Channel: How Bank Health Transmits to the Real Economy," *The Journal of Finance*.
- CIESLAK, A. AND A. VISSING-JORGENSEN (2020): "The Economics of the Fed Put," *The Review of Financial Studies*, 34, 4045–4089.
- COOPER, R. W. AND J. EJARQUE (2001): "Exhuming Q: market power capital market imperfections," Working Papers 611, Federal Reserve Bank of Minneapolis.
- DEMERJIAN, P. R. AND E. L. OWENS (2016): "Measuring the probability of financial covenant violation in private debt contracts," *Journal of Accounting and Economics*, 61, 433–447.
- DEMIROGLU, C. AND C. M. JAMES (2010): "The Information Content of Bank Loan Covenants," *Review of Financial Studies*, 23, 3700–3737.
- DRECHSEL, T. (2018): "Earnings-Based Borrowing Constraints and Macroeconomic Fluctuations," 2018 Papers pdr141, Job Market Papers.
- ERICKSON, T. AND T. WHITED (2000): "Measurement Error and the Relationship between Investment and q," *Journal of Political Economy*, 108, 1027–1057.

- FALATO, A. AND N. LIANG (2016): "Do Creditor Rights Increase Employment Risk? Evidence from Loan Covenants," *Journal of Finance*, 71, 2545–2590.
- FERREIRA, D., M. A. FERREIRA, AND B. MARIANO (2018): "Creditor Control Rights and Board Independence," *Journal of Finance*, 73, 2385–2423.
- GALA, V. D., J. F. GOMES, AND T. LIU (2020): "Investment without Q," Journal of Monetary Economics, 116, 266–282.
- GENTZKOW, M., B. KELLY, AND M. TADDY (2019): "Text as Data," Journal of Economic Literature, 57, 535–574.
- GLASSERMAN, P., K. KRSTOVSKI, P. LALIBERTE, AND H. MAMAYSKY (2020): "Choosing news topics to explain stock market returns," in *Proceedings of the First ACM International Conference on AI in Finance*, ACM.
- GOMES, J. F. (2001): "Financing Investment," American Economic Review, 91, 1263–1285.
- GRAHAM, J. R. (2022): "Presidential Address: Corporate Finance and Reality," *The Journal* of Finance, 77, 1975–2049.
- GREENWALD, D. (2019): "Firm Debt Covenants and the Macroeconomy: The Interest Coverage Channel," 2019 Meeting Papers 520, Society for Economic Dynamics.
- GRIFFIN, T., G. NINI, AND D. C. SMITH (2018): "Losing Control: The 20-Year Decline in Loan Covenant Restrictions," *SSRN Electronic Journal*.
- HASSAN, T. A., S. HOLLANDER, L. VAN LENT, AND A. TAHOUN (2019): "Firm-Level Political Risk: Measurement and Effects*," *The Quarterly Journal of Economics*, 134, 2135--2202.
- (2020a): "The Global Impact of Brexit Uncertainty," NBER Working Papers 26609, National Bureau of Economic Research, Inc.
- HASSAN, T. A., M. SCHWEDELER, J. SCHREGER, AND A. TAHOUN (2021): "Country Risk," Tech. rep.
- HASSAN, T. A., L. VAN LENT, S. HOLLANDER, AND A. TAHOUN (2020b): "Firm-Level Exposure to Epidemic Diseases: Covid-19, SARS, and H1N1," Boston University - Department of Economics - The Institute for Economic Development Working Papers Series dp-340, Boston University - Department of Economics.

- HOBERG, G. AND V. MAKSIMOVIC (2014): "Redefining Financial Constraints: A Text-Based Analysis," *The Review of Financial Studies*, 28, 1312–1352.
- HONNIBAL, M. AND M. JOHNSON (2015): "An Improved Non-monotonic Transition System for Dependency Parsing," in *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing*, Lisbon, Portugal: Association for Computational Linguistics, 1373–1378.
- HORWICH, A. (2009): "Cleaning the murky safe harbor for forward-looking statements: An inquiry into whether actual knowledge of falsity precludes the meaningful cautionary statement defense," J. Corp. L., 35, 519.
- HUDDLESTON, R. D. AND G. K. PULLUM (2002): The Cambridge Grammar of the English Language, Cambridge University Press.
- JEANNE, O. AND A. KORINEK (2020): "Macroprudential Regulation versus mopping up after the crash," *The Review of Economic Studies*, 87, 1470–1497.
- JURAFSKY, D. AND J. H. MARTIN (2000): Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, USA: Prentice Hall PTR, 1st ed.
- KAPLAN, S. N. AND L. ZINGALES (1997): "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?" The Quarterly Journal of Economics, 112, 169–215.
- LAMONT, O. (2000): "Investment Plans and Stock Returns," Journal of Finance, 55, 2719–2745.
- LIAN, C. AND Y. MA (2021): "Anatomy of Corporate Borrowing Constraints*," *The Quar*terly Journal of Economics, 136, 229–291.
- LINTNER, J. (1956): "Distribution of incomes of corporations among dividends, retained earnings, and taxes," *The American Economic Review*, 46, 97–113.
- LOUGHRAN, T. AND B. MCDONALD (2011): "When Is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks," *The Journal of Finance*, 66, 35–65.
- (2020): "Textual Analysis in Finance," Annual Review of Financial Economics, 12, 357–375.

- MENDOZA, E. AND K. SMITH (2006): "Quantitative implications of a debt-deflation theory of Sudden Stops and asset prices," *Journal of International Economics*, 70, 82–114.
- MENDOZA, E. G. (2010): "Sudden Stops, Financial Crises, and Leverage," American Economic Review, 100, 1941–1966.
- MURFIN, J. (2012): "The Supply-Side Determinants of Loan Contract Strictness," *The Journal of Finance*, 67, 1565–1601.
- NINI, G., D. C. SMITH, AND A. SUFI (2012): "Creditor Control Rights, Corporate Governance, and Firm Value," *Review of Financial Studies*, 25, 1713–1761.
- ROBERTS, M. AND A. SUFI (2009): "Control Rights and Capital Structure: An Empirical Investigation," *Journal of Finance*, 64, 1657–1695.
- ROSEN, R. A. AND J. S. CAREY (2016): "The Safe Harbor for Forward-Looking Statements after Twenty Years," Tech. rep., Paul, Weiss, Rifkind, Wharton Garrison LLP.
- SCHMITT-GROHÉ, S. AND M. URIBE (2014): "Finite-State Approximation Of VAR Processes: A Simulation Approach," Tech. rep., Columbia University.
- SCHMITT-GROHE, S. AND M. URIBE (2021): "Multiple Equilibria in Open Economies with Collateral Constraints," *Review of Economic Studies*, 88, 969–1001.
- TETLOCK, P. C. (2007): "Giving Content to Investor Sentiment: The Role of Media in the Stock Market," *The Journal of Finance*, 62, 1139–1168.

Appendix to "Anticipating binding constraints: an analysis of financial covenants"

A Additional figures and tables

Table A.1: Summary statistics of full sample and conditional on forward-looking covenant concern CovFuture.

		All			CovFutu	re=1
	Nobs	Mean	Std. dev.	Nobs	Mean	Std. dev.
CovMention(pct)	138111	7.02	25.54	2395	100.00	0.00
CovFuture(pct)	138111	1.73	13.05	2395	100.00	0.00
Investment/L.Assets (bps)	136153	119.94	147.55	2355	123.25	156.90
$\Delta \log(\text{LTDebt}) \ (\log \text{pp})$	125854	3.68	63.89	2227	-2.49	77.85
$\log(\text{Equity}) \ (\log \text{pp})$	123731	138.20	179.88	2207	99.67	145.41
Sales Growth (pct)	135887	13.50	56.13	2344	-12.05	71.32
EBITDA growth (pct)	130477	6.07	71.98	2229	-20.21	86.69
Past stock returns (pct)	90662	14.48	72.71	1784	-11.12	93.02
Tobin's Q	126510	1.88	1.51	2073	1.06	0.72
CashFlow/L.Asset (pct)	119374	1.46	6.92	2299	2.18	4.68
$\rm EBITDA/L.Asset~(pct)$	133870	1.13	8.77	2331	1.65	4.87
$\log(Asset)$	137089	6.54	1.85	2392	6.95	1.44
${ m Debt}/{ m Asset}~({ m pct})$	137684	24.44	28.94	2389	44.89	31.81
$\operatorname{Cash}/\operatorname{Asset}(\operatorname{pct})$	137954	22.36	24.05	2394	7.69	11.13
Altman z-score	116681	3.75	5.81	1836	0.99	1.92
Has rating (pct)	138111	25.46	43.56	2395	38.79	48.74
High yield (pct)	138111	15.99	36.65	2395	34.95	47.69
Violation(pct)	138111	3.04	17.17	2395	12.65	33.25
Implied Violation (pct)	59403	35.24	47.77	1574	66.07	47.36
Covenant slack (sd)	59403	0.02	0.37	1574	-0.21	0.40

Table A.2: Event study of covenant mentions around SEC violations. The base horizon is three quarters prior to violation (*Horizon* = -3), with estimates are given by the constant term. Column 1 shows the change in probability of any covenant mention *CovMention* in each horizon, relative to the base horizon. Column 2 shows the change in probability of covenant concerns *CovFuture* conditional on *CovMention* = 1. Standard errors clustered by firm and time. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1) CovMention	(2) CovFuture
Horizon=-2	0.014 (1.31)	0.002 (0.03)
Horizon=-1	0.039^{***} (3.41)	0.100** (2.02)
Horizon=0	0.116^{***} (8.63)	$0.019 \\ (0.45)$
Horizon=1	0.083^{***} (6.29)	$0.022 \\ (0.61)$
Horizon=2	0.056^{***} (4.37)	-0.034 (-0.77)
Constant	$\begin{array}{c} 0.118^{***} \\ (15.38) \end{array}$	$\begin{array}{c} 0.315^{***} \\ (10.62) \end{array}$
Firm & Time FE	\checkmark	\checkmark
R-squared	0.43	0.45
Nobs	9204	1336

Table A.3: Covenant discussions associated with more severe consequences of violation. 1{Increase Loan Rate} is an indicator for a loan amendment that increases interest rates in the SEC filing in the quarter of violation. 1{Reduce Loan Amount} is an indicator for a loan amendment that decreases borrowing amount in the quarter of violation. Sample restricted to firm-quarter observations in which violation is reported in SEC filings. Standard errors are two-way clustered by industry and year-quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1) Capital Expenditure	(2) Long-term Debt Growth	(3) Equity Payout	(4) 1{Increase Loan Rate}	(5) 1{Reduce Loan Amount}	(6) 1{Rating Downgrade}
CovMention	-11.82 (-1.61)	-15.12*** (-4.25)	-0.20*** (-2.70)	4.69^{**} (2.43)	8.73^{***} (2.82)	5.98^{***} (4.65)
Covenant slack	41.09^{**} (2.44)	-13.20 (-1.58)	0.73^{***} (3.51)	-4.44** (-2.08)	-2.73 (-0.99)	-3.12** (-2.45)
Sq. covenant slack	26.74^{***} (2.77)	-4.82 (-0.68)	0.51^{***} (3.69)	$0.36 \\ (0.17)$	$1.43 \\ (0.63)$	-0.81 (-0.58)
Earnings	$1.70 \\ (1.40)$	0.85^{*} (1.79)	0.06^{***} (3.28)	$0.14 \\ (0.76)$	-0.15 (-0.77)	$0.05 \\ (0.46)$
Sq. earnings	17.02^{***} (3.33)	-2.08 (-0.69)	0.19^{**} (2.65)	2.34^{**} (2.39)	-1.59 (-1.30)	-0.65 (-1.14)
Industry & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
R-squared	0.40	0.052	0.30	0.14	0.15	0.14
Nobs	1876	1912	1723	1495	1495	1923

Table A.4: Summary statistics of types of violation reported for 360 randomly sampled violation events with matched SEC filings and earnings call transcripts. All values are in percentage points, except for "Number of violations". Values for "Dividend restrictions", "Capx restrictions", "Reporting requirement", and "Others" are reported as a share of all non-financial covenant violations. Sample "conditional on covenant mentions" refer to violation events with associated discussions of covenants in earnings call transcripts. "Unclear" refers to cases where the types of violations cannot be inferred from SEC filings.

	Percent of violation
A. Unconditional sample	
Number of violations	360
Financial covenant	82.5
Non-financial covenant only	10.6
Dividend restriction	7.9
Capx restriction	15.8
Reporting requirement	50
Others	26.3
Unclear	6.9
B. Conditional on covenant mention	ı
Share of violations	26.4
Financial covenant	92.6
Non-financial covenant only	5.3
Dividend restriction	20
Capx restriction	0
Reporting requirement	80
Others	0
Unclear	2.1

Table A.5: Relationship between *CovFuture*, change in earnings, and book leverage. Permanent component of leverage removed by subtracting firm average. $\omega(X_{it})$ is an indicator for high ex-ante credit risk (see text for details). $\Delta Earnings$ is the year-over-year difference in earnings, normalized by firm-level standard deviation of earnings. $1\{\Delta Earnings < 0\}$ is an indicator for negative change in earnings. Column 2 violation controls include violation, *Viol*, and *Viol* × 1{ $\Delta Earnings < 0$ }. Column 4 violation controls include *Viol*, *Viol* × 1{ $\Delta Earnings < 0$ }, *Viol* × $\omega(X_{it})$, and *Viol* × 1{ $\Delta Earnings < 0$ } × $\omega(X_{it})$. Standard errors clustered by firm. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

$$CovFuture_{it} = \beta_0 + \beta_1 \Delta Earnings_{it} + \beta_2 \{\Delta Earnings_{it} < 0\} + \beta_3 \omega(X_{it}) \\ + \beta_4 \{\Delta Earnings < 0\} \times \omega(X_{it}) + \beta_5 \{\Delta Earnings_{it} < 0\} \times \Delta Earnings_{it} \\ + \beta_6 \omega(X_{it}) \times \Delta Earnings_{it} + \beta_7 \{\Delta Earnings_{it} < 0\} \times \Delta Earnings_{it} \times \omega(X_{it}) \\ + ViolControls + \alpha_i + \delta_t + \epsilon_{it}$$

	(1) CovFuture	(2) CovFuture	(3) CovFuture	(4) CovFuture	(5) CovFuture
Δ Earnings	0.297^{***} (2.84)	0.0926 (1.03)	0.124 (1.11)	-0.135 (-1.44)	0.0994 (0.65)
1{ Δ Earnings<0}=1 × Δ Earnings	-1.578*** (-6.69)	-0.482** (-2.09)	-0.602** (-2.33)	-0.0492 (-0.23)	-1.046*** (-3.14)
1{ Δ Earnings<0}=1 × Leverage=1 × Δ Earnings		-2.030*** (-5.58)			
1{ Δ Earnings<0}=1 × NetWorth=1 × Δ Earnings			-1.937^{***} (-4.75)		
1{ Δ Earnings<0}=1 × Cash=1 × Δ Earnings				-3.023^{***} (-5.63)	
1{ Δ Earnings<0}=1 × Altmanz=1 × Δ Earnings					-1.678*** (-3.36)
Violation controls Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
R-squared Nobs	$\begin{array}{c} 0.11\\ 94814 \end{array}$	$0.12 \\ 89857$	$0.12 \\ 89998$	$0.12 \\ 90002$	$0.11 \\ 61691$

 $t\ {\rm statistics}$ in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Table A.6: Any concern is an indicator that equals one if a firm mentions covenant concerns in any quarter in the sample. Any violation is an indicator that equals one if a firm violations covenants in any quarter in the sample. Industry classification based on 2-digit SIC classification code. Standard errors clustered by industry. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1)	(2) Any Violation
	Any Concern	Any violation
$\log(Asset)$	3.24***	-1.32
	(6.04)	(-1.55)
Analyst coverage	-1.93***	-1.53***
	(-7.83)	(-11.16)
Num. quarters observed	0.53***	0.50***
	(9.48)	(10.49)
Call length	12.54***	2.09
	(3.43)	(1.06)
Industry FE	\checkmark	\checkmark
R-squared	0.2	0.1
Nobs	4381	4381

Table A.7: Any concern is an indicator that equals one if a firm mentions covenant concerns in any quarter in the sample. Any violation is an indicator that equals one if a firm violations covenants in any quarter in the sample. Covenant tightness is the smallest difference between financial covenant threshold and the corresponding financial ratio at loan origination. Num. covenants is the average number of financial covenants reported in DealScan. Industry classification based on 2-digit SIC classification code. Standard errors clustered by industry. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1) Any Concern	(2) Any Violation
Covenant tightness	-20.84*** (-4.85)	-15.11^{**} (-2.57)
Num. covenants	3.40^{**} (2.38)	4.11^{**} (2.58)
Industry FE	\checkmark	\checkmark
R-squared Nobs	$\begin{array}{c} 0.07 \\ 1968 \end{array}$	$\begin{array}{c} 0.06 \\ 1968 \end{array}$

Table A.8: Predicting future covenant violations. Covenant controls include cash flow, book leverage, interest expense, net worth, current ratio, and Tobin's q. Rating controls include Altman z-score, and indicators for rating downgrade, high yield, and investment grade credit ratings. Columns 1 and 2 report estimates from regression predicting SEC reported violations. Columns 3 and 4 report estimates from regression predicting Dealscan implied violations. All specifications estimated on sample of observations with covenant information in DealScan. Standard errors are two-way clustered by firm and year-quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1)	(2)	(3)	(4) Violation	(5) Violation
	Violation	Violation	Violation	(Dealscan)	(Dealscan)
L.CovFuture	4.03^{***} (4.62)	3.92^{***} (4.50)	$\begin{array}{c} 4.02^{***} \\ (4.61) \end{array}$	3.60^{***} (4.17)	4.15^{***} (4.80)
L.Violation	0.30^{***} (11.27)	0.30^{***} (11.23)	0.30^{***} (11.24)	0.03^{***} (3.79)	0.04^{***} (4.18)
L.Violation (Dealscan)	0.01^{***} (3.12)	0.01^{***} (2.65)	0.01^{**} (2.12)	0.64^{***} (69.39)	0.61^{***} (66.81)
L.Earnings		-0.23*** (-4.94)		-1.29*** (-10.11)	
L.Sq. earnings		-0.75^{***} (-3.19)		-1.95*** (-3.84)	
L.Covenant slack			-0.82* (-1.77)		-12.59*** (-11.86)
L.Sq. covenant slack			0.41 (1.40)		-1.76** (-2.31)
Covenant Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Rating Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
R-squared	0.32	0.32	0.32	0.74	0.74
Nobs	46754	46754	46754	47030	47030

	(1) Capital Expenditure	(2) Long-term Debt Growth	(3) Equity Payout
CovFuture	-13.53*** (-3.81)	-3.10* (-1.84)	-12.93*** (-4.21)
Violation	-8.94*** (-3.05)	-7.70^{***} (-5.01)	-6.34^{**} (-2.51)
(CovFuture x Violation)	8.98 (1.23)	-26.62** (-2.34)	$4.05 \\ (0.54)$
Cash Flow	66.30^{***} (5.57)	-65.39^{***} (-7.58)	$72.86^{***} \\ (6.23)$
Leverage	-62.53^{***} (-6.65)	57.82^{***} (9.44)	-0.62 (-0.05)
Interest Expense	-171.00 (-1.63)	-366.90** (-2.64)	-655.83*** (-3.50)
Net Worth	-7.65 (-0.96)	$14.24^{***} \\ (3.83)$	54.35^{***} (4.80)
Current Ratio	-3.02*** (-5.85)	3.94^{***} (13.43)	$0.49 \\ (1.15)$
Tobin's Q	$\frac{11.74^{***}}{(11.12)}$	1.68^{***} (4.18)	7.38^{***} (5.59)
Rating Controls	\checkmark	\checkmark	\checkmark
Firm & Time FE	\checkmark	\checkmark	\checkmark
R-squared	0.64	0.056	0.72
Nobs	99074	99031	90225

Table A.9: Specification interacting covenant concerns and covenant violations. Rating controls include Altman z-score, and indicators for rating downgrade, high yield, and investment grade credit ratings. Standard errors clustered by firm and quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A.10: Specification with higher order and lagged covenant controls. Covenant controls are cash flow, book leverage, interest expense, net worth, current ratio, and Tobin's q. Higher order controls are squared and cubed terms of these variables. Lagged controls are four-quarter lags of these variables. Standard errors clustered by firm and quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1)	(2)	(3)
	Capital	Long-term	Equity
	Expenditure	Debt Growth	Payout
CovFuture	-11.11***	-7.54***	-10.55^{***}
	(-3.22)	(-3.89)	(-3.68)
Violation	-7.70**	-8.07***	-5.79**
	(-2.61)	(-4.19)	(-2.07)
Cash Flow	0.50^{***}	-0.73***	0.62^{***}
	(3.78)	(-8.19)	(5.28)
Leverage	$0.04 \\ (0.22)$	1.98^{***} (12.61)	$0.17 \\ (0.62)$
Interest Expense	-9.87**	-1.73	-45.76^{***}
	(-2.27)	(-0.49)	(-9.62)
Net Worth	-8.28	-8.33	25.94^{*}
	(-0.85)	(-1.33)	(1.92)
Current Ratio	-15.36***	15.64^{***}	-5.70^{***}
	(-7.77)	(13.29)	(-2.79)
Tobin's Q	57.09^{***}	5.49^{***}	54.82^{***}
	(12.94)	(3.18)	(10.36)
Higher Order Controls	\checkmark	\checkmark	\checkmark
Lag Controls	\checkmark	\checkmark	\checkmark
Rating Controls	\checkmark	\checkmark	\checkmark
Firm & Time FE	\checkmark	\checkmark	\checkmark
R-squared	0.66	0.096	0.74
Nobs	89744	89551	81815

Table A.11: CovSent is a measure of sentiment of covenant discussions in earnings calls. *NMentions* is the number of forward-looking covenant discussions in earnings calls. "Difference" refers to the difference in the reported coefficients within the same specification. For example, "Difference" in Column 1 is the difference between when discussion of concerns are mentioned with positive sentiment $CovFuture \times CovSent > 0$ and when they are mentioned with negative or neutral sentiment $CovFuture \times CovSent \leq 0$, with the t-statistics reported in parentheses. Covenant controls include cash flow, book leverage, interest expense, net worth, current ratio, and Tobin's q. Rating controls include Altman z-score, and indicators for rating downgrade, high yield, and investment grade credit ratings. Standard errors clustered by firm and quarter, t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	Capital		Long-	Long-term		uity
	Exper	Expenditure		Debt Growth		vout
	(1)	(2)	(3)	(4)	(5)	(6)
CovFuture x CovSent > 0	-18.56***		-2.93		-15.13**	
	(-4.11)		(-0.97)		(-2.47)	
CovFuture x CovSent ≤ 0	-10.29**		-7.19***		-11.49***	
	(-2.60)		(-3.07)		(-4.30)	
CovFuture x NM entions= 1	. ,	-11.55***	. ,	-4.89**		-11.59***
		(-3.18)		(-2.45)		(-4.01)
CovFuture x NM entions ≥ 1		-17.54***		-11.50*		-16.76***
		(-3.16)		(-1.69)		(-3.24)
Difference	-8.28	5.98	4.25	6.61	-3.65	5.16
	(-1.58)	(1.06)	(1.22)	(.93)	(6)	(1.01)
Covenant Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Rating Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
R-squared	0.64	0.64	0.06	0.06	0.72	0.72
Nobs	99074	99074	99031	99031	90225	90225

Table A.12: CovFuture (MDA) is an indicator that equals one when covenant concerns are mentioned int the management discussion section (MDA) of earnings calls. CovFuture (QA) is an indicator that equals one when covenant concerns are mentioned in the question and answers (QA) section. CovFuture (SEC) is an indicator that equals one when covenant concerns are mentioned in SEC filings. "Difference" refers to the difference in the reported coefficients within the same specification. For example, "Difference" in Column 1 is the difference between when discussion of concerns are mentioned in the MDA section CovFuture(MDA) and when they are mentioned in the QA section CovFuture (QA), with the t-statistics reported in parentheses. Covenant controls include cash flow, book leverage, interest expense, net worth, current ratio, and Tobin's q. Rating controls include Altman z-score, and indicators for rating downgrade, high yield, and investment grade credit ratings. Standard errors clustered by firm and quarter. t-stat in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	Capital		Long	Long-term		Equity	
	Expen	diture	Debt (Debt Growth		rout	
	(1)	(2)	(3)	(4)	(5)	(6)	
CovFuture (MDA)	-9.60**		-6.97***		-14.52***		
	(-2.53)		(-2.85)		(-4.29)		
CovFuture (QA)	-19.82***		-1.39		-7.26		
	(-2.98)		(-0.58)		(-1.47)		
CovFuture (EarnCalls)		-12.70***		-6.37***		-12.04***	
		(-3.62)		(-2.96)		(-3.52)	
CovFuture (SEC)		-7.52***		-1.03		-3.70	
		(-3.45)		(-1.39)		(-1.40)	
Difference	10.22	-5.18	-5.59	-5.35	-7.27	-8.34	
	(1.35)	(-1.27)	(-1.79)	(-2.26)	(-1.18)	(-1.94)	
Covenant Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Rating Controls	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
Firm & Time FE	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
R-squared	0.64	0.65	0.06	0.07	0.72	0.73	
Nobs	99074	75411	99031	75436	90225	68516	



Figure A.1: Annual frequency of covenant violations imputed from DealScan and covenant mentions from 2003 to 2020. Sample consists of Compustat firms, excluding utilities and financials, with covenant information in DealScan and earnings call transcripts, from 2003Q1 to 2020Q1. Shaded bars denote year-quarters with NBER recession months.



Figure A.2: Blue line is average response of firms that express covenant concerns. Red line is average response of comparison firms matched by expected cash flows in horizon h = 0 and h = -1. Vertical bars report 95 percent confidence interval of the sample mean. Event study windows restricted to windows where no covenant concerns expressed in four quarters prior to event and no covenant violations occur in four quarters prior to and including quarter of event. (*NEvents* = 1, 356)]



Figure A.3: Dynamics of debt growth and equity payouts in the quarters before and after covenant concerns are mentioned. Left panel shows raw means, normalized to 0 in horizon h = -1. Blue line is average response of firms that express covenant concerns. Red line is average response of control firms matched by expected profitability in horizon h = 0 and h = -1. Right panel shows differential response given by coefficient estimates from OLS specification. Shaded area denotes 95 percent confidence interval.



Figure A.4: Blue line is average response of firms that express covenant concerns. Red line is average response of control firms matched by expected profitability in horizon h = 0 and h = -1. Shaded area denotes 95 percent confidence interval. Red vertical line in the right panels are the average quarter of first violation for firms that express concerns (2.13 quarters after mention).



Figure A.5: Covenant concerns, earnings growth, and leverage in the model. Figures shows binscatter plot using model simulated data.



Figure A.6: Covenant concerns, investment, and financing in the model. Figures shows binscatter plot using model simulated data.

B Data

B.1 Financial covenants

I obtain data on debt covenants from Thomson Reuters LPC DealScan database. The database records information on private syndicated debt contracts at the point of origination, where syndicated means a group of lenders jointly lending to a single borrower (Berlin et al. (2020)). These contracts, known as deals in the database, typically bundles different types of tranches, such as revolvers or lines of credits and term loans. Coverage in DealScan is available from 1981 onwards, with more than individual 101 thousand deals involving US-based borrowers. Chava and Roberts (2008) find that DealScan covers 50-75 percent of all commercial loans issued in the United States.

Information on financial covenants comes from the variable "all_covenants_financial", which provides a textual description of the types of financial covenants as well as their respective thresholds. The covenant information provided is common across tranches within a deal package. I use this text-based variable, instead of the information provided in the individual covenant variables provided by Dealscan as I found many missing entries in the individual covenant variables even though information is provided in "all_covenants_financial". I apply a simple text search algorithm to extract information on the type of covenants and the threshold that applies.

Next, I construct a firm-quarter panel of covenant thresholds from DealScan. To this end, I define a covenant threshold as active from the date the tranche becomes active ("tranche_active_date"). A covenant threshold no longer is relevant when the tranche matures ("tranche_maturity_date") or if the tranche is amended, that is if a new "tranche_active_date" is recorded for the same "lpc_tranche_id" that is before the "tranche_maturity_date". I obtain the Compustat GVKEY ID of each borrower from the Roberts Dealscan-Compustat linking database (Chava and Roberts (2008)). This allows me to know which covenant threshold applies in a given firm and year-quarter. If a firm has multiple covenant thresholds that apply in a given quarter, I keep the tightest threshold.

Covenant Type	No. Obs	p25	p50	p75	Mean
Max. Debt to EBITDA	118788	2.5	3	3.9	3.34
Min. Interest Coverage	94024	2.5	3	3.5	2.98
Min. Fixed Charge Coverage	73679	1.15	1.3	1.6	1.5
Min. Tangible Net Worth	37438	45	275	1500	4367
Max. Leverage ratio	36738	0.5	0.6	0.65	0.8
Min. Net Worth	31247	87	257	800	3373
Max. Senior Debt to EBITDA	23527	2	2.5	3.1	2.81
Min. Current Ratio	22148	1	1	1.2	1.37
Min. Debt Service Coverage	17691	1.2	1.3	1.75	1.56
Max. Debt to Tangible Net Worth	17320	1	1.5	2.25	2.3
Max. Debt to Equity	5407	1	1.5	2.23	3.74
Min. Cash Interest Coverage	3267	1.5	2.25	3	2.43
Max. Loan to Value ratio	1673	0.5	0.65	0.75	6.11

Table B.1: Prevalence of financial covenants in Dealscan. "No. Obs" is the number of firm-quarter observations in which a covenant type applies. "p25", "p50", "p75", "Mean" are, respectively, the 25th, 50th, 75th percentiles, and average covenant threshold across all firm-quarter observations. See text for constructing firm-quarter panel of covenant thresholds from Dealscan information. Sample consists of borrowers with Compustat GVKEY ID available in the Roberts Dealscan-Compustat linking database (Chava and Roberts (2008)) and financial covenant information in the variable "all_covenants_financial" in Dealscan from 2002Q1 to 2020Q1.

Table B.1 shows the prevalence of different types of financial covenants in DealScan. As documented in prior literature, most financial covenants are related to operating earnings or EBITDA (earnings before interest, taxes, depreciation, and amortization) (Drechsel (2018); Lian and Ma (2021); Adler (2020)). These covenants are restrictions on total debt at the firm level, not just for a particular loan contract. The remaining set of financial covenants, such as the minimum net worth and maximum leverage ratio covenants, are based on book values of the firm's assets and liabilities. I obtain accounting variables from Compustat to compute financial ratios corresponding to each of the financial covenants, using the definitions of financial ratios provided in Demerjian and Owens (2016).



(a) Share of firms in Compustat, excluding utilities (SIC 4900-4999) and financials (SIC 6000-6999) with maximum debt-to-earnings and minimum interest coverage covenants in DealScan, that have matched earnings call transcripts from FactSet.



(b) Share of calls by Fama-French 12 industry classifications. Figure shows that industry representation of earnings call transcripts remain relatively stable over the relevant time period.

Figure B.1: Call coverage.



(a) Size distribution by sample. Size is the natural logarithm of asset book value.



(b) Log book leverage distribution by sample. Book leverage is the ratio of debt to asset book value.

Figure B.2: Distribution by sample. Compustat refers to firm-quarter observations in Compustat with matched SEC filings, excluding utilities (SIC 4900-4999) and financials (SIC 6000-6999), from 2002Q1 to 2020Q1. Compustat-EarningsCall refers to firm-quarter observations in the Compustat sample with earnings call transcripts. Compustat-EarningsCall-DealScan refers to firm-quarter observations in Compustat-EarningsCall sample with financial covenant information in DealScan.



(a) Operating earnings distribution by sample. Operating earnings is the ratio of EBITDA to lagged book value of asset.



(b) Tobin's Q distribution by sample. Tobin's Q is the ratio of market to book value of asset.

Figure B.3: Distribution by sample. Compustat refers to firm-quarter observations in Compustat with matched SEC filings, excluding utilities (SIC 4900-4999) and financials (SIC 6000-6999), from 2002Q1 to 2020Q1. Compustat-EarningsCall refers to firm-quarter observations in the Compustat sample with earnings call transcripts. Compustat-EarningsCall-DealScan refers to firm-quarter observations in Compustat-EarningsCall sample with financial covenant information in DealScan.



(a) Cash holdings distribution by sample. Cash holdings is the ratio of cash to lagged book value of asset.



(b) Covenant slack distribution by sample.

Figure B.4: Distribution by sample. Compustat refers to firm-quarter observations in Compustat with matched SEC filings, excluding utilities (SIC 4900-4999) and financials (SIC 6000-6999), from 2002Q1 to 2020Q1. Compustat-EarningsCall refers to firm-quarter observations in the Compustat sample with earnings call transcripts. Compustat-EarningsCall-DealScan refers to firm-quarter observations in Compustat-EarningsCall sample with financial covenant information in DealScan.

Variable	compustat formula and notes	
Investments	capxq / l1.atq where $capxq = capxy - l1.capxy$ if	Compustat
	fqtr!=1 and $capxq = capxy$ if $fqtr==1$	
Net debt issuance	(dltisq - dltrq) / l1.atq	Compustat
Operating earnings	${ m oibdpq} \ / \ { m l1.atq}$	Compustat
Size	$\log(atq)$	Compustat
Acquisitions	acq / l1.atq	Compustat
Book leverage	$({ m dlttq}+{ m dlcq}) \;/\; { m atq}$	Compustat
Tobin's Q	(dlttq + dlcq + mcap) / atq where mcap = prc *	Compustat,
	shrout / 1000	CRSP
Cash holdings	m cheq~/~atq	Compustat
PPE	ppentq / atq	Compustat
Interest expense	xintq / l1.atq	Compustat
Depreciation	$ m dpq \ / \ l1.atq$	Compustat
Max. Debt-to-EBITDA	$(dlttq + dlcq) / ann_oibdpq where ann_oibdpq =$	Compustat
	oibdpq + l1.oibdpq + l2.oibdpq + l3.oibdpq	
Min. Interest Coverage	ann_oibdpq / ann_xintq where ann_xintq =	Compustat
	${ m xintq} + { m l1.xintq} + { m l2.xintq} + { m l3.xintq} { m and} { m intpnq} =$	
	intp ny - l. intpny if fqtr!=1 and intpnq=intpny if	
	fqtr==1	
Covenant slack	Difference between accounting ratio and threshold	Compustat,
	in covenants, normalized by standard deviation of	Dealscan
	accounting ratio. If multiple covenants present,	
	take whichever is tighter (more negative).	
Violation	Covenant slack ≤ 0	Compustat,
		Dealscan
Earnings persistence	Coefficient of regressing operating earnings on its	Compustat
	one-quarter lagged value. Regression estimated	
	firm-by-firm on a rolling basis using the previous 20	
	quarters of observations, with a minimum of 8	
	quarters of observations.	

B.2 Variable definitions

C Textual analysis

C.1 Preprocessing

I begin by extracting discussions of firm participants in earnings call transcripts. I include both prepared remarks in the management discussion and analysis section as well as unprepared remarks by management in the question and answer section. I exclude the first 15 sentences in each call to remove the boilerplate statements made before beginning discussions of operating and financial results. As the measurement strategy relies on identifying forward-looking keywords typically found in these boilerplate discussions, their removal is necessary to ensure that the measure constructed reflects economically meaningful content.

As spoken sentences are often complex with multiple statements joined by conjunctions, I use SpaCy's sentence tokenizer algorithm to split the text of each call into subsentences by detecting for the presence of the following indicators:

",", ".", "!", "?", ";", "or", "after", "because", "but", "so", "when", "where", "while", "although", "however", "though", "whereas" "so that", "despite"

Next, I apply a simple cleaning algorithm to each sentence.

- Remove any words that occur in brackets or squared brackets.
- Remove months ("January", "February", etc), irrelevant mentions of covenants ("covenant skills" and "customer covenant").
- Remove capitalization, punction, and numbers.

Finally, I stem words to their roots using the Porter stemming algorithm (Porter, 1980). For instance, words such as "earnings" are stemmed to "earn" and "risks" are stemmed to "risk". The purpose is to reduce the number of variations in words that convey the same meaning.

C.2 Tense detection

I use SpaCy's dependency parser to learn the grammatical structure of each subsentence. The relevant output of the dependency parser is each word's part-of-speech tag and the dependency relation with the head node. A part-of-speech (POS) tag identifies the grammatical category (e.g. noun, verb, adverb) of each word. The part-of-speech tags follow the Universal Dependency scheme (source: https://universaldependencies.org/u/pos/), which is commonly used in natural language processing applications. The dependency relation identifies the dependency relation between each word. Importantly, this identifies the root word

of a subsentence and auxiliary words. The root word of a sentence is the word in which all other words directly or indirectly depend. Auxiliary words are functional words associated with verbal predicates that express tense, mood, aspect, or voice. (Universal Dependencies, n.d.)

A subsentence is labeled past tense if the following criteria is satisfied:

- The root word has POS tag: VBD (verb, past tense) or VBN (verb, past participle), or;
- Any child of the root word that is an auxiliary word (AUX or AUXPASS) has POS tag: VBD or VBN.

A subsentence is labeled as present tense if the following criteria is satisfied:

- The root word has POS tag: VB (verb, base form), VBG (verb, gerund or present participle), VBP (verb, non-3rd person singular present), VBZ (verb, 3rd person singular present), and;
- Any child of the root word that is an auxiliary word (AUX or AUXPASS) does not have POS tag: VBD, VBN, or MD (modal).

A subsentence is labeled as future tense if the following criteria is satisfied:

- The root word has POS tag: VB (verb, base form), VBG (verb, gerund or present participle), VBP (verb, non-3rd person singular present), VBZ (verb, 3rd person singular present), and;
- Any child of the root word that is an auxiliary word (AUX or AUXPASS) has POS tag: MD.

C.3 Forward-looking keywords

Table C.1: Forward-looking keywords or key phrases obtained from safe-harbor disclosures of SEC 10-K and 10-Q filings. Keywords and key phrases are stemmed to their roots using the NLTK library's Porter Stemmer algorithm. "Count" is the number of safe-harbor disclosures in which the keyword or key phrase is given as an example of words that indicate a statement as forward-looking. "Variants" is the variant of the stemmed word that appears in the safe harbor disclosure.

$\mathbf{Word}/\mathbf{Phrase}$	Count	Variants
(Stemmed)		
expect	84545	expect, expects, expected, expectations, expectation,
		expecting
believ	75291	believe, believes, believer
estim	73095	estimate, estimates, estimated
intend	71885	intend, intended
anticip	71480	anticipate, anticipates, anticipated, anticipating
plan	62660	plan, plans, planned, planning
will	46940	will
project	43365	project, projects, projection, projected, projections,
		projecting
may	42233	may
should	41302	should
could	30922	could
potenti	19267	potential, potentially
predict	18485	predict, predicts, predictions, predicted, predicting,
		predictable
would	17951	would
seek	16125	seek, seeks, seeking
might	6426	might
goal	6151	goal, goals
futur	4808	future
like	4647	likely
outlook	4502	outlook
contempl	3161	contemplate, contemplates, contemplated
will like result	2444	will likely result
hope	1945	hope, hopes, hopeful, hopefully
possibl	1803	possible, possibly, possibility
forese	1665	foresee, foresees, foreseeable
guidanc	1637	guidance
aim	1513	aim, aims, aimed, aiming

Table C.3: Forward-looking keywords or key phrases obtained from safe-harbor disclosures of SEC 10-K and 10-Q filings. Keywords and key phrases are stemmed to their roots using the NLTK library's Porter Stemmer algorithm. "Count" is the number of safe-harbor disclosures in which the keyword or key phrase is given as an example of words that indicate a statement as forward-looking. "Variants" is the variant of the stemmed word that appears in the safe harbor disclosure.

Word/Phrase (Stemmed)	Count	Variants
probabl	1246	probably, probable, probability
opportun	1233	opportunity, opportunities
pursu	812	pursue, pursuing
consid	713	consider, considers
can have	649	can have
shall	623	shall
appear	570	appear, appears
indic	570	indicate, indicates, indicator, indicative, indication
schedul	558	scheduled, schedule
propos	551	propose, proposed, proposes
see	501	see, sees
suggest	399	suggest, suggests
think	371	think, thinks
prospect	363	prospects, prospective, prospect
is like	358	is likely
trend	323	trend, trends
pro forma	290	pro forma
feel	260	feel, feels
confid	234	confident, confidence
preliminari	227	preliminary
endeavor	214	endeavor, endeavors
look forward	177	looking forward, look forward, looks forward
depend	150	depend, depends
view	107	view, views
prioriti	98	priorities, priority
drive	97	drive, driving
tent	95	tentative
look ahead	94	looking ahead
upsid	90	upside
belief	89	belief, beliefs
could be	87	could be
envis	85	envision, envisions
risk	81	risk
Table C.5: Forward-looking keywords or key phrases obtained from safe-harbor disclosures of SEC 10-K and 10-Q filings. Keywords and key phrases are stemmed to their roots using the NLTK library's Porter Stemmer algorithm. "Count" is the number of safe-harbor disclosures in which the keyword or key phrase is given as an example of words that indicate a statement as forward-looking. "Variants" is the variant of the stemmed word that appears in the safe harbor disclosure.

Word/Phrase	Count	Variants
$(\mathbf{Stemmed})$		
pipelin	76	pipeline
is like to	75	is likely to
explor	74	explore, exploring
pend	68	pending
seek to	55	seek to, seeks to
are like	54	are likely
do not expect	51	do not expect
will like	51	will likely
may not	51	may not
do not anticip	51	do not anticipate
may be	48	may be
presum	48	presume
look forward to	43	look forward to
on pace	37	on pace
will like be	36	will likely be
may impact	34	may impact
improv	33	improve
expect to	31	expects to, expect to
move toward	24	moving toward
would be	23	would be
like will result	21	likely will result
express confid	15	expressed confidence
may continu	15	may continue
remain confid	15	remain confident
may result	14	may result
forse	13	forsees
shortterm	13	shortterm
can be	12	can be
uncertainti	11	uncertainty, uncertainties
call for	11	calls for
with a view to	11	with a view to
schedul to	10	scheduled to

Table C.7: Forward-looking keywords or key phrases obtained from safe-harbor disclosures of SEC 10-K and 10-Q filings. Keywords and key phrases are stemmed to their roots using the NLTK library's Porter Stemmer algorithm. "Count" is the number of safe-harbor disclosures in which the keyword or key phrase is given as an example of words that indicate a statement as forward-looking. "Variants" is the variant of the stemmed word that appears in the safe harbor disclosure.

Word/Phrase (Stemmed)	Count	Variants
go to	9	going to
work toward	8	work toward, working toward
go forward	7	going forward
unknown	6	unknown
unanticip	6	unanticipated
appear to	6	appear to
abl to remain	6	able to remain
estim will	6	estimate will
likelihood	6	likelihood
like to	6	likely to
on target	6	on target
up to	5	up to
could depend	5	could depends
well posit to	5	well positioned to
tailwind	5	tailwind
headwind	5	headwind
longterm	4	longterm
may depend	3	may depend
short term	3	short term
not expect	3	not expected
may affect	3	may affect
hypothes	3	hypothesize
uncertain	2	uncertain
could potenti	1	could potentially
ought	1	ought
may becom	1	may become
full year guidanc	1	full year guidance

C.4 Sentence examples

Table C.9: Example of subsentences that contains forward-looking covenant mentions. Quarters to violation refer to the fiscal quarter relative to violation event in quarter 0. Bolded words are keywords that identifies a subsentence as forward looking. The text is selected among Compustat firms with maximum Debt-to-EBITDA or minimum interest coverage financial covenants in LPC DealScan, excluding firms in financial and utilities industries.

Quarters to viola- tion	Text excerpt
-4	 "We believe that we are currently compliance with all material covenants of our mortgages and revolving credit facility." (Alerislife Inc, Mar 1, 2006) "This coupled with the reduce level of capital spending that I mentioned in the use of free cash flow repay debt should results and coverage under covenants actually improving beginning in the first quarter of 2009." (Hercules Offshore Inc, Oct 29, 2008) "as you can see we had significant cushion in both of these covenants and looking ahead" (United Rentals Inc, Oct 29, 2008) "as you can see we had significant cushion in both of these covenants and looking ahead" (United Rentals Inc, Oct 29, 2008) "it would not impact compliance with our debt covenants as it would be a non-cash expense." (Amn Healthcare Services Inc, Feb 26, 2009) "In addition we expect that the Company will remain in compliance with the financial covenants" (Key Energy Services Inc, Feb 26, 2009) "We believe that the reduction in debt – reduction in indebtedness combined with the improvement in debt-to-total capitalization and debt-to-EBITDA covenant better position American Dental Partners Inc, Jul 28, 2009) "You'll note that we have continued to improve on our covenant ratios." (Pharmerica Corp, Feb 5, 2010) "we will proactively reach out to our lender's to discuss our performance relative to our covenants and we will determine the appropriate course of action." (Federal Signal Corp, Nov 3, 2010) "we don't see significant pressure on that covenant as we model out the future." (Tivity Health Inc, Oct 24, 2011) "We intend to initially allocate the free cash flow to leverage reduction and we expect covenant leverage of approximately 4.5 times by year end 2016 and that
	3, 2016)

Table C.10: Example of subsentences that contains forward-looking covenant mentions. Quarters to violation refer to the fiscal quarter relative to violation event in quarter 0. Bolded words are keywords that identifies a subsentence as forward looking. The text is selected among Compustat firms with maximum Debt-to-EBITDA or minimum interest coverage financial covenants in LPC DealScan, excluding firms in financial and utilities industries.

 -3 1) "We believe that we are totally in compliance with all material covenants of our mortgages and revolving credit facility." (Alerislife Inc, May 10, 2006) 2) "the less obvious potential remedies we've already commenced discussions with our agent bank on our options for gaining additional flexibility under the 	Quarters to viola- tion	Text excerpt
 covenants during this cyclical downturn." (Hercules Offshore Inc, Feb 10, 2009) 3) "we believe our lenders will work with us to negotiate some relief on covenants if market conditions persist." (Pioneer Energy Services Corp, May 7, 2009) 4) "at some point in the future we might chip those covenants and speculate that's what the bank's response would be" (Bronco Drilling Co, May 8, 2009) 5) "Therefore we do not believe that we have covenant issues related to the consolidation of receivables." (Cabelas Inc, July 30, 2009) 6) "As such we remain very comfortable that we will stay in compliance with our covenants even if 2010 proves to be another year of declining EBITDA leaving us with ample excess to liquidity should we need it." (Starwood Hotels & Resort world, Jul 23, 2009) 7) "We are reviewing our options for replacing this credit facility primarily due to certain covenant limitations." (Englobal Corp, Nov 9, 2009) 8) "But we don't have a concern about an issue with that covenant and the 	-3	 "We believe that we are totally in compliance with all material covenants of our mortgages and revolving credit facility." (Alerislife Inc, May 10, 2006) "the less obvious potential remedies we've already commenced discussions with our agent bank on our options for gaining additional flexibility under the covenants during this cyclical downturn." (Hercules Offshore Inc, Feb 10, 2009) "we believe our lenders will work with us to negotiate some relief on covenants if market conditions persist." (Pioneer Energy Services Corp, May 7, 2009) "at some point in the future we might chip those covenants and speculate that's what the bank's response would be" (Bronco Drilling Co, May 8, 2009) "Therefore we do not believe that we have covenant issues related to the consolidation of receivables." (Cabelas Inc, July 30, 2009) "As such we remain very comfortable that we will stay in compliance with our covenants even if 2010 proves to be another year of declining EBITDA leaving us with ample excess to liquidity should we need it." (Starwood Hotels & Resort world, Jul 23, 2009) "But we don't have a concern about an issue with that covenant and the payment rate is in line with our expectations." (Conn's Inc, Mar 27, 2014) "we plan to use cash to pay down debt as we move back under the bank covenant ind 3-to-1 debt to EBITDA ratio." (Essendant Inc, Apr 21, 2016) "We intend to initially allocate free cash flow to leverage reduction and expect covenant leverage of approximately 4.5 times by year end 2016 and that assumes no net proceeds from the spectrum auction." (Nexstar Media Group, Aug 9, 2016)
		payment rate is in line with our expectations ." (Conn's Inc, Mar 27, 2014) 9) "we plan to use cash to pay down debt as we move back under the bank covenant constraint of 3-to-1 debt to EBITDA ratio." (Essendant Inc, Apr 21, 2016)
payment rate is in line with our expectations ." (Conn's Inc, Mar 27, 2014) 9) "we plan to use cash to pay down debt as we move back under the bank covenant constraint of 3-to-1 debt to EBITDA ratio." (Essendant Inc, Apr 21, 2016)		10) "We intend to initially allocate free cash flow to leverage reduction and expect covenant leverage of approximately 4.5 times by year end 2016 and that assumes no net proceeds from the spectrum auction." (Nexstar Media Group, Aug 9, 2016)

Table C.11: Example of subsentences that contains forward-looking covenant mentions. Quarters to violation refer to the fiscal quarter relative to violation event in quarter 0. Bolded words are keywords that identifies a subsentence as forward looking. The text is selected among Compustat firms with maximum Debt-to-EBITDA or minimum interest coverage financial covenants in LPC DealScan, excluding firms in financial and utilities industries.

Quarters to viola- tion	Text excerpt
-2	 "there is a reasonable likelihood we will not be in compliance with covenant and revolving credit agreement as we exit the fourth quarter." (Brunswick Corp, Oct 23, 2008) "we believe that our liquidity position is strong and we currently have sufficient headwind on our three financial covenants." (Newpark Resources, Feb 20, 2009) "we are currently pursuing other changes to the financial covenants underlying the credit facility to provide us with ongoing financial flexibility in response of the current economic environment." (Flow International Corp, Mar 12, 2009) "we determine that we will need more cushion under these covenants and have better visibility as to what we would need" (Hercules Offshore Inc, Apr 28, 2009) "we believe that we will continue to maintain compliance with such financial covenants." (Calumet Specialty Products, Nov 4, 2009) "We are taking actions to maintain compliance including entering discussions with the lenders in our ABL and ABS facilities regarding potential amendment of the covenants and are reviewing options to reduce the outstanding balance of debt on our balance sheet including the ability to sell and lease back owned real estate" (Conn's Inc, Nov 25, 2009) "We do not believe that we will violate any covenants under the line of credit" (ITT Educational Services Inc, Jan 24, 2013) "we anticipate our covenants will be [tight] on a go forward basis." (Amedisys Inc, Mar 12, 2014) "if we need to make any minor short-term adjustments to key covenants as we work through this trading period." (American Vanguard Corp, May 1, 2014) "So I think the concern about covenants today in the downturn is considerably less than any concerns we would have then." (Asbury Automotive Group Inc, Feb 4, 2016)

Table C.12: Example of subsentences that contains forward-looking covenant mentions. Quarters to violation refer to the fiscal quarter relative to violation event in quarter 0. Bolded words are keywords that identifies a subsentence as forward looking. The text is selected among Compustat firms with maximum Debt-to-EBITDA or minimum interest coverage financial covenants in LPC DealScan, excluding firms in financial and utilities industries.

Quartera	Toyt execut				
to viole	Text excerpt				
tion					
01011					
-1	1) "We believe that we are currently in compliance with all material covenants of				
	our mortgages and revolving credit facility." (Alerislife Inc, Nov 9, 2006)				
	2) "We will be working with our lenders to obtain a modification of covenants for				
	future periods." (Ruby Tuesday Inc, Jan 9, 2008)				
	3) "we would ask for a waiver from our long-standing bank group regarding				
	compliance with these financial covenants for a specific period of time." (Steel				
	Dynamics Inc, Apr 23, 2009)				
	4) "we feel we will remain in compliance with our debt covenants for the				
	remainder of 2009." (Arc Document Solutions Inc, May 7, 2009)				
	5) "we might stand against the two financial covenants contained in our credit				
	agreement." (Hercules Offshore Inc, Jul 23, 2009)				
	6) "We do anticipate continued pressure on our leverage covenant in 2010 due to				
	lower margins and throughput in our Midstream Business." (Eagle Rock Energy				
	Partnrs LP, Nov 5, 2009)				
	7) "we believe we have sufficient cushion in our covenants to satisfy our debt				
	covenant test." (Education Management Corp, Nov 1, 2012)				
	8) "This guidance would suggest that we will be running close to our leverage				
	covenant of 4.0 at the end of the year." (Ranger Oil Corporation, Feb 26, 2015)				
	9) "we believe that in addition to our anticipated cash flow from operations				
	and having worked out some loosening of our key covenants for a few quarters."				
	(American Vanguard Corp, Jul 31, 2014)				
	10) "Our current internal financial forecast indicates that we will not remain in				
	compliance with this interest coverage covenant as early as the end of the first				
	quarter of our fiscal 2017" (Tidewater Inc, May 26, 2016)				
	10) "Our current internal financial forecast indicates that we will not remain in compliance with this interest coverage covenant as early as the end of the first quarter of our fiscal 2017" (Tidewater Inc, May 26, 2016)				

Table C.13: Example of subsentences that contains covenant mentions in the past tense. Quarters to violation refer to the fiscal quarter relative to violation event in quarter 0. Bolded words are keywords that identifies a subsentence as in the past tense. The text is selected among Compustat firms with maximum Debt-to-EBITDA or minimum interest coverage financial covenants in LPC DealScan, excluding firms in financial and utilities industries.

Quarters to viola- tion	Text excerpt
0	 "The banks agreed to exclude the majority of the one-time cost attributable to the strike in Cedar Rapids and relaxed previously established thresholds for this covenant ratio. " (Penford Corp, Dec 16, 2004) "this forbearance agreement is designed to provide time for our management team along with the banks to evaluate the structure in terms of this facility and to address our ability to satisfy certain financial covenants." (Ultralife Corp, Aug 2, 2007) "we did not meet two of the financial ratio covenants required by \$75million unsecured revolving credit facility." (Tandy Brands Accessories Inc, Nov 13, 2007) "removed all the maintenance covenants that caused so" (Axiall Corp, Feb 18, 2010) "we were not incompliance with the consolidated leverage covenant in our credit agreement." (Kids Brands Inc, Aug 14, 2012) "Net interest coverage was 2.85 times compared to a covenants requirement of 1.85." (West Corp, Jan 31, 2013) "we obtained covenant release from our vendor group during the third quarter to ensure that we had adequate borrowing capacity in light of covenants based on 12 month trailing EBITDA." (American Vanguard Corp, Oct 30, 2014) "Crestwood also amended certain terms of our revolving credit facility such as increasing the total leverage ratio covenant from 5.0 times to 5.5 times and adding a senior secure level ratio of 3.75 times." (Crestwood Equity partners LP, Nov 3, 2015) "our credit agreement has been simplified to only have one leverage
	 covenant." (Nexstar Media Group, Aug 8, 2017) 10) "we amended our revolving credit facility to obtain a waiver of financial leverage covenants for four quarters through the first quarter of 2021." (Hyatt Hotels Corp, May 7, 2020)

Table C.14: Example of subsentences that contains covenant mentions in the past tense. Quarters to violation refer to the fiscal quarter relative to violation event in quarter 0. Bolded words are keywords that identifies a subsentence as in the past tense. The text is selected among Compustat firms with maximum Debt-to-EBITDA or minimum interest coverage financial covenants in LPC DealScan, excluding firms in financial and utilities industries.

Quarters to viola- tion	Text excerpt
1	 "We extended the majority of our facilities to six years revised some of the covenants and reduced the recorded annual principal payments from 16 million to 2 million." (Pantry Inc, Jan 26, 2006) "we had conversations with many of our banks regarding our need for an amendment of the covenant package in our credit facility." (Avis Budget Group Inc, Nov 7, 2008) "the Company significantly exceeded its debt covenant requirements which resulted in are moving down two pricing levels on our interest cost to 200 basis points over LIBOR." (Craft Brew Alliance Inc, Mar 31, 2010) "we worked closely with our bank syndicate to revise our credit agreement to provide additional flexibility in our loan covenants." (1-800-flowers.com, Aug 19, 2010) "The company paid down nearly \$17 million in debt during the quarter and achieve a net leverage ratio of 3.35 times which is significantly below our leverage covenant of 3.50." (Lodgenet Interactive Corp, Feb 25, 2011) "increased the company's flexibility with respect to certain financial covenants." (Alliance Healthcare Services Inc, Nov 9, 2011) "We extended the 4.5 times beverage covenant through the end of 2013" (Ranger Oil Corporation, Nov 1, 2012) "we received unanimous support from our lenders to address our debt covenants for the quarterly reporting periods in 2013." (Cleveland Cliffs Inc, Apr 25, 2013) "Our debt covenants were reinstated at the fourth quarter and we are in full compliance." (Pilgrim's Pride Corp, Feb 15, 2013) "we finished the year with a net debt-to-EBITDA ratio of 2.9 times based on our bank covenant definition." (Acco Brands Corp, Feb 11, 2015)

Table C.15: Example of subsentences that contains covenant mentions in the past tense. Quarters to violation refer to the fiscal quarter relative to violation event in quarter 0. Bolded words are keywords that identifies a subsentence as in the past tense. The text is selected among Compustat firms with maximum Debt-to-EBITDA or minimum interest coverage financial covenants in LPC DealScan, excluding firms in financial and utilities industries.

Quarters to viola- tion	Text excerpt
2	 "relaxed the number of the restrictive covenants including those relating to debt incurrence" (Guitar Center Inc, Jan 29, 2004) "We did meet our covenants under the agreement for the quarter." (PRGX Global Inc, Jul 28, 2005) "we maintained our debt covenant compliance throughout the year and ended 2009 with a total debt covenant ratio of 3.1 times which was well below the required level under our credit agreement of 3.75 times." (Barnes Group Inc, Feb 18, 2010) "We had limited scope for investment due to our obligations to meet our debt covenants." (Brocade Communications Sys, Sep 15, 2010) "we reduced our debt and the effect of this was to eliminate all of our maintenance covenants that were part of the term loan." (Dana Inc, Feb 23, 2011) "We also made various modifications to financial covenants under the facilities that provide PAA and PNG with increased flexibility." (Plains All American Pipeline, Nov 3, 2011) "this amendment provided Alliance with greater flexibility under our financial maintenance covenants." (Alliance Healthcare Services, Mar 15, 2012) "We ended the quarter with significant cushion in our credit statistics with our leverage ratio as defined in our Credit Agreement at 3.1 times consolidated EBITDA compared to our covenant maximum of 6 times." (NPC Restaurant Holdings LLC, Mar 10, 2014) "we successfully removed the limiting restricted cash covenant allowing us to redeploy the additional capital into the business." (AV Homes Inc, Feb 24, 2017) "eliminated almost all financial covenants and generally provides the company with more financial flexibility." (Seaworld Entertainment Inc, Nov 5, 2018)

D Model

D.1 Optimality conditions

Consider the entrepreneur's problem characterized by Equations (4)-(9) in the main text. Let λ_t be the Lagrange multiplier on the budget constraint (5) and $\lambda_t \mu_t$ the Lagrange multiplier on the earnings-based borrowing constraint (8). These Lagrange multipliers represent the additional value in utils of relaxing the budget constraint and earnings-based constraint, respectively, by one unit. The first order conditions for optimality are given by

$$\lambda_t = c_t^{-\gamma} \tag{11}$$

$$\beta E[V_{d,t+1}] + \frac{\lambda_t}{R} - \frac{\lambda_t \mu_t}{R} = 0$$
(12)

$$\beta E[V_{k,t+1}] - \lambda_t \left(1 + \Psi_{1,t} \right) = 0 \tag{13}$$

where $V_{d,t+1}$ and $V_{k,t+1}$ are, respectively, the first derivative of the value function $V(z_t, k_t, d_t)$ and $\Psi_{1,t}$ is the first derivative of the adjustment cost function $\Psi(k_{t+1}, k_t) \equiv \frac{\psi}{2} \frac{(k_{t+1}-(1-\delta)k_t)^2}{k_t}$ with respect to k_{t+1} .

From the envelope conditions, we have

$$V_{d,t} = \lambda_t \tag{14}$$

$$V_{k,t} = \lambda_t \left(\alpha z_t k_t^{\alpha - 1} (1 + \mu_t \kappa) + 1 - \delta - \Psi_{2,t} \right)$$
(15)

where $\Psi_{2,t}$ is the first derivative of $\Psi(k_{t+1}, k_t)$ with respect to k_t . Simplify by substituting (11) and (14) into (12) and by substituting (11) and (15) into (13).

The equilibrium allocations $\{c_t, d_{t+1}, k_{t+1}\}_{t=0}^{\infty}$ and Lagrange multipliers $\{\lambda_t, \mu_t\}_{t=0}^{\infty}$ are characterized by the following conditions

$$\lambda_t = c_t^{-\gamma} \tag{16}$$

$$\lambda_t (1 - \mu_t) = \beta R E[\lambda_{t+1}] \tag{17}$$

$$\lambda_t (1 + \Psi_{1,t}) = \beta E \Big[\lambda_{t+1} \Big(\alpha z_{t+1} k_{t+1}^{\alpha - 1} (1 + \mu_{t+1} \kappa) + 1 - \delta - \Psi_{2,t+1} \Big) \Big]$$
(18)

$$c_t = y_t + (1 - \delta)k_t - d_t + \frac{d_{t+1}}{R} - k_{t+1} - \Psi(k_{t+1}, k_t)$$
(19)

$$\mu_t \left(\kappa y_t - \frac{d_{t+1}}{R} \right) = 0; \\ \mu_t \ge 0; \\ \kappa y_t \ge \frac{d_{t+1}}{R}$$

$$\tag{20}$$

given stochastic productivity process $\{z_t\}_{t=0}^{\infty}$.

Derivation of Equation (10) in the main text. I show that the entrepreneur balances

the present value of marginal benefit of consumption across periods. To see this, substitute (16) into (17) and iterate the equation forward by $J < \infty$ periods

$$c_t^{-\gamma} = \beta^J R^J E \left[\prod_{j=0}^{J-1} \left(\frac{1}{1-\mu_{t+j}} \right) c_{t+J}^{-\gamma} \right]$$

From (18), we have

$$\frac{1}{\beta} = E \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{\alpha z_{t+1} k_{t+1}^{\alpha - 1} (1 + \mu_{t+1} \kappa) + 1 - \delta - \Psi_{2,t+1}}{1 + \Psi_{1,t}} \right]$$

From (17), we have

$$E\left[\frac{\lambda_{t+1}}{\lambda_t}\right] = \frac{1-\mu_t}{\beta R}$$

Applying the definition of covariances and combining both equations we have

$$\begin{aligned} \frac{1}{\beta} \Big(1 - \frac{(1-\delta)(1-\mu_t)}{R} \Big) &= \frac{1-\mu_t}{\beta R} E \Big[\frac{\alpha z_{t+1} k_{t+1}^{\alpha-1} (1+\mu_{t+1}\kappa) - \Psi_{2,t+1}}{1+\Psi_{1,t}} \Big] \\ &+ Cov \Big(\frac{\lambda_{t+1}}{\lambda_t}, \frac{\alpha z_{t+1} k_{t+1}^{\alpha-1} (1+\mu_{t+1}\kappa) - \Psi_{2,t+1}}{1+\Psi_{1,t}} \Big) \end{aligned}$$

Assume that $\psi = 0$, and $\mu_t = 0$, we have

$$\underbrace{E\left[\alpha z_{t+1}k_{t+1}^{\alpha-1}(1+\mu_{t+1}\kappa)\right]}_{\text{marginal benefit of capital}} = \underbrace{r+\delta-\beta RCov\left(\frac{\lambda_{t+1}}{\lambda_t},\alpha z_{t+1}k_{t+1}^{\alpha-1}(1+\mu_{t+1}\kappa)\right)}_{\text{marginal cost of capital}}$$

Under the more general assumption that $\psi = 0$, and $\mu_t \ge 0$, we have

$$E\left[\alpha z_{t+1}k_{t+1}^{\alpha-1}(1+\mu_{t+1}\kappa)\right] = \frac{r+\delta+\mu_t(1-\delta)-\beta RCov\left(\frac{\lambda_{t+1}}{\lambda_t},\alpha z_{t+1}k_{t+1}^{\alpha-1}(1+\mu_{t+1}\kappa)\right)}{1-\mu_t}$$

Since $\mu_t \ge 0$, a presently binding constraint has the effect of increasing the marginal cost of capital.

D.2 Parametrization

Description	Parameter	Value	Notes
Production technology	α	0.6956	Cooper and Ejarque (2001)
Risk aversion coefficient	γ	2	Standard calibration
Productivity persistence	$ ho_z$	0.8874	Gomes (2001)
Productivity std. dev.	σ_ϵ	0.0882	Gomes (2001)
Interest rate	R	$1.015^{1/4}$	Calibrate to real interest rate in
			Dealscan loans
Depreciation rate	δ	0.015	Target steady state avg. investment
			rate
Capital adjustment cost	ψ	4	Target steady state std. dev.
			investment rate
Subjective discount factor	β	0.95	Target steady state share
			constrained & avg. debt/asset
Debt-to-earnings covenant	κ	1.15×4	Target steady state share
			constrained & avg. debt/asset

Table D.1: Quarterly calibration of the baseline model.

Table D.1 lists the parameter values adopted in the baseline model, which is calibrated to a quarterly frequency. The nine parameters can be assigned into two groups based on their calibration methods. The first set of parameters $(\alpha, \gamma, R, \rho_z, \sigma_z)$ are chosen based on standard values from the literature or data sources external to the model. The second set of parameters $(\delta, \psi, \beta, \kappa)$ are chosen to match key moments of the data. I describe how these values are set below.

The returns to scale parameter α is set to 0.6956 following Cooper and Ejarque (2001). The productivity parameters ρ_z and σ_z are set to 0.8874 and 0.0882, respectively, following Gomes (2001) after converting the annual values to their quarterly equivalents. The coefficient of risk aversion γ is set to 2, a conventional value in the macro literature. To calibrate the interest rate on debt R, I compute the real interest rate of loans in DealScan, following Greenwald (2019). This is set equal to 1.5 (0.37) percent per year (quarter).

The remaining parameters are disciplined by targeting key empirical moments from the literature. The first set of parameters (δ, ψ) are calibrated by targeting moments related to the firm's investment policy reported in Lian and Ma (2021) based on large nonfinancial firms in Compustat with earnings-based constraints over the sample period from 1997 to 2018. In particular, I set the depreciation rate δ to match the average annualized investment-to-capital ratio of 6 (1.5) percent per year (quarter), and the capital adjustment cost ψ to 4 to match the standard deviation of investment-to-capital ratio of 8 (2) percent per year (quarter).

The second set of parameters (β, κ) are calibrated to target moments related to the firms' debt financing policy. In particular, the subjective discount factor β and debt-to-earnings covenant κ are calibrated by targeting the share of violations of 23 percent and the average book leverage (debt-to-asset) of 32 percent. I draw statistics on covenant violations from Chodorow-Reich and Falato (2021), who study loan data from the Shared National Credit Program (SNC) from 2006 to 2009. Statistics on book leverage are drawn from Lian and Ma (2021). The calibrated subjective discount rate β is 0.95. The financial covenant κ restricts borrowing d_{t+1}/R to a maximum of 4.6 (1.15) times quarterly (annual) earnings y_t .

The model is solved by value function iteration over discretized state space. In particular, I discretize the state space with 30 equally spaced points for $\log z$ from -0.6046 to 0.6046, 60 equally spaced points for capital k and debt d, respectively. The transition probability for $\log z$ is computed using the simulation algorithm in Schmitt-Grohé and Uribe (2014). The grid for capital k is $[0.25 \times k_{nss}, 2.75 \times k_{nss}]$, where k_{nss} is the non-stochastic steady state of capital stock. While a relatively large grid is adopted, given the calibration of productivity process adopted in the baseline calibration, all points of the capital grid are visited with positive probability in equilibrium.

The grid for debt d is [150, 2100]. In the baseline calibration of the model, all but four end points of the capital grid are visited with positive probability. The solution of the model are the policy functions for next period's capital k' = g(z, k, d) and debt d' = g(z, k, d). Given the policy functions, I then simulate the model for 5 million periods, dropping the first 500 thousand observations as burn-in.

Targeted moments	Definition	Model	Data
Share constrained	$E[1\{d'/y = \kappa\}]$	0.17	0.23
Debt-to-asset	E[d/k]	0.31	0.32
Avg. annualized investment rate	E[i/k]	0.061	0.060
Std. annualized investment rate	$\sigma(i/k)$	0.097	0.080

D.3 Model fit: Distributional moments

Table D.2: Stochastic steady state distributional moments in the baseline calibration.

Table D.2 compares the four targeted empirical moments and the corresponding stochastic steady-state moments computed from the model simulation. Overall, I find that the model provides a relatively close match of the four targeted moments. The average share of constrained firms in the model is 23 percent, which matches the share of covenant violations documented in Chodorow-Reich and Falato (2021). The average book debt-to-asset ratio of firms in the sample is 32 percent, which matches the average debt-to-asset ratio of firms in Lian and Ma (2021). Similarly, average investments is a close match to the empirical moment from the literature of 6 percent per year. However, investments in the model are slightly more volatile relative to the data, with a standard deviation of 10 percent per year relative to a standard deviation of 8 percent per year in the data.

Some discussion of the empirical moments are warranted. In my sample, I find that around 29.8 percent of firms are in violation in the average quarter. This is within the estimates in Chodorow-Reich and Falato (2021), who document between 24 to 34 percent of loans were in violation between 2006 to 2009. Chava and Roberts (2008) similarly reports that between 25 and 32 percent of loans are in violation of the net worth and current ratio covenants in a later sample between 1994 and 2005.

Notably, Nini et al. (2012) documents lower fraction of loans in violation when they examine violations reported in SEC filings. They find between 10 to 20 percent of firms were in violation in the average quarter between 1997 and 2008. A key reason is that regulation does not require firms to report violations if they obtain an amendment or waiver before the end of the quarter (Chodorow-Reich and Falato (2021)). However, covenant amendments and waivers are still costly to firms as they incur substantial amendment fees (Lian and Ma (2021)). As such, in the baseline model I do not differentiate between violations that result in changes to loan terms or those that are waived.

I compare the remaining three empirical moments to those in the literature. The average book leverage (debt-to-asset) in my sample is 0.32, which is similar to what Lian and Ma (2021) finds in their sample of large US non-financial Compustat firms. Chava and Roberts (2008) finds an average book leverage of between 0.26 and 0.29 in the sample of firms with net worth or current ratio covenants. Roberts and Sufi (2009) reports an average book leverage of 0.23 in their sample.

Firms in my sample have an average annualized investment-to-lagged asset ratio of 5.3 percent and standard deviation of 6.2 percent. This is lower than the average annualized investment-to-lagged asset ratio of 6 percent and standard deviation of 8 percent documented in Lian and Ma (2021). Chava and Roberts (2008) examines investments normalized by lagged PPE, hence do not report statistics related to investments normalized by lagged assets. In the model, assets at the beginning of each period is equivalent to the capital stock net depreciation, hence there is no difference between lagged assets and lagged PPE.