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The Screening Role of Covenant Heterogeneity

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ABSTRACT: We investigate whether differences in the mix of financial covenants in debt contracts (i.e., covenant heterogeneity) reflect—and provide a way for lenders to elicit, or screen—borrowers' pre-contractual private information about their future risk profile. Consistent with adverse selection theories, we predict and find that borrowers with higher future risk negotiate loans with covenants that are less sensitive to performance, compared to borrowers with lower future risk. We differentiate between screening and incentive explanations for this finding and provide evidence that screening accounts for a substantial portion of this overall relation. Our study highlights how, in addition to shaping borrowers' incentives through monitoring, covenant heterogeneity reflects borrowers' future risk profiles and can help lenders screen accordingly.

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I. INTRODUCTION

Although a typical bank loan contains relatively few financial covenants, there is substantial variation in the type and "mix" of covenants across different borrowers' debt contracts. We collectively refer to these contrasting patterns as *covenant heterogeneity*. We argue and present evidence that this heterogeneity—which is an unresolved "puzzle" in the literature (Skinner 2011; Christensen, Nikolaev, and Wittenberg-Moerman 2016)—results, in part, from lenders' use of different types of covenants to elicit borrowers' pre-contractual private information about their future risk profile.

Accurately assessing prospective borrowers' future risk is crucial for lenders to make profitable lending decisions (e.g., Merton 1974; Jensen and Meckling 1976; Smith and Warner 1979). Moreover, unresolved adverse selection can

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have dramatic credit market consequences—especially when it exacerbates moral hazard problems (Laffont and Martimort 2002)—and can ultimately lead to credit rationing (e.g., Stiglitz and Weiss 1981). Lenders often address adverse selection by offering borrowers a choice from a "menu" of contracts that vary in their provisions, such as collateral or maturity (e.g., Bester 1985; Diamond 1993). Different types of borrowers tend to both prefer and agree to different types of contracts, thereby allowing lenders to screen borrowers according to their pre-contractual private information (e.g., Rothschild and Stiglitz 1976).

Labor economic studies note that varying the performance-sensitivity of agents' compensation contracts (e.g., piece-wise rates versus hourly salaries) can be a particularly effective way to screen agents according to their risk preferences or other unobservable differences. Specifically, more risk-averse workers tend to prefer contracts that are less performance-based (e.g., an hourly wage), whereas more risk-tolerant workers tend to prefer more performance-based (e.g., piece-rate) pay (e.g., Stiglitz 1975; Lazear 1986). Employees' choice about the extent of their performance-based pay informs their employers about unobservable differences in employees' "type" (e.g., risk preferences) and allows employers to design other contractual provisions accordingly, improving the overall efficiency of the contracting relationship.

We adopt this theoretical framework from labor economics to examine the screening role of covenant heterogeneity in debt contracting. Unlike most of the other provisions in debt contracts, financial covenants differ in the extent to which they depend on borrowers' performance (e.g., Christensen and Nikolaev 2012). Accordingly, they may be particularly well suited to elicit borrowers' pre-contractual private information about their future risk profile.

We operationalize this notion by classifying financial covenants according to their sensitivity to borrowers' performance. Specifically, we classify covenants into three groups: (1) interest coverage and debt-to-EBITDA (earnings before interest, taxes, depreciation, and amortization) covenants ("high performance-sensitivity covenants"); (2) leverage and net worth covenants ("medium performance-sensitivity covenants"); and (3) liquidity covenants ("low performance-sensitivity covenants"). Group (1) represents the most performance-sensitive covenants since they are tied to borrowers' current performance (i.e., income statement measures). Covenants in group (2) depend only on balance sheet items, including equity, which reflects current performance, but less so than covenants in group (1). Covenants in group (3) are the least sensitive to borrowers' performance, as they only depend on current assets and liabilities. We then examine whether the performance-sensitivity of borrowers' covenant mix conveys information about their future risk profile.[1]

Recent studies show that borrowers intending to make riskier investments tend to have less predictable future performance, making them more likely to violate covenants with high performance sensitivity compared to less performance-sensitive covenants (Demerjian and Owens 2016; Nikolaev 2018). Because covenant violations are often costly, especially for riskier borrowers, riskier borrowers should prefer loans with a greater proportion of less performance-sensitive covenants, whereas safer borrowers should either be indifferent toward covenant mix or prefer a greater proportion of higher performance-sensitivity covenants to signal that they are less risky.[2] Thus, given the opportunity to trade off different types of financial covenants with one another or for other contractual provisions, we expect less risky (riskier) borrowers to negotiate loans that include a greater proportion of higher performance-sensitivity (lower performance-sensitivity) covenants.[3]

We start our empirical investigation by providing two pieces of descriptive evidence about the screening role of covenant heterogeneity. First, we show that there is a negative association between the use of high-performance-sensitivity covenants and the use of low-performance-sensitivity covenants, consistent with borrowers trading off different covenant types. Second, we present evidence from multivariate regressions that financial covenants with different levels of performance-sensitivity differ in their relationship with borrowers' future risk profile. We find a significant *negative* relation between borrowers' future risk and the proportion of high performance-sensitivity covenants in their loans and, conversely, a significant *positive* relationship between borrowers' future risk and the proportion of low performance-sensitivity covenants in their loans, consistent with our predictions. Moreover, the relation between covenants and

[1] As we discuss in more detail in Section II, performance pricing provisions (PPP) could also create variation in the performance-sensitivity of the loan contract and hence serve as a screening device (e.g., Manso, Strulovici, and Tchistyi 2010). However, we find that PPP appear to largely serve as a mechanism to fine-tune the performance-sensitivity of high-sensitivity covenants rather than an independent screening mechanism.

[2] Roberts and Sufi (2009a); Nini, Smith, and Sufi (2012); Ozelge and Saunders (2012); and others document evidence of the significant costs that covenant violations can impose on borrowers (or borrowers' managers). Although covenant violations may not impose high costs on all borrowers (e.g., Bordeman and Demerjian 2022), riskier firms tend to bear greater violation costs (e.g., Roberts and Sufi 2009a), and hence should have stronger preferences for covenants with lower risk of violation.

[3] This notion that lenders allow borrowers to negotiate or choose between multiple sets of contract terms is consistent with both extant debt contracting studies (e.g., Bester 1985; Berger, Scott Frame, and Ioannidou 2011) and descriptions from industry practitioners (e.g., Box 2010). Moreover, even if borrowers do not actively negotiate during the loan contracting process, we would still expect screening of borrowers according to their risk profiles (e.g., if different lenders each offer a borrower a different contract, a borrower expecting higher future risk would be more likely to reject a contract with high performance-sensitivity covenant compared to a borrower that expects a lower risk profile going forward).

borrowers' future risk increases monotonically as covenant performance-sensitivity decreases. Collectively, these findings indicate that different types of borrowers negotiate loans with different mixes of financial covenants and that these differences explain borrowers' subsequent risk profiles.

In addition, to reflecting borrowers' pre-contractual information about their future risk profiles (i.e., screening), covenant mix may also influence borrowers' post-contractual risk-taking *incentives* (i.e., moral hazard). We conduct several tests to attempt to differentiate between these two alternative explanations for our findings. We begin with two analyses that exploit the fact that borrowers and lenders frequently renegotiate loan contracts, which results in new (or amended) loan contracts that supersede the previous contract (e.g., Roberts and Sufi 2009a). As a result, the set of enforceable covenants that borrowers are subject to tends to change over time. For our first analysis, we distinguish between covenants in the borrowers' current loan package ("current" covenants) and covenants in the borrower's previous loan package ("superseded" covenants). The intuition for this distinction is that the superseded covenants are no longer in effect and therefore should not affect borrowers' current incentives. Thus, any relation between superseded covenants and future risk is unlikely to capture the covenants' effect on borrowers' behavior (i.e., incentives) and instead should reflect borrowers' underlying risk profile (i.e., screening). We find a significant relation between the performance-sensitivity of superseded covenant mix and borrowers' future risk, consistent with the importance of screening in explaining the overall relation between borrowers' covenant mix and future risk.[4]

For our second analysis, we distinguish between covenants that exist in both borrowers' current and previous loan contract ("persistent" covenants) and those that were newly introduced in the current loan contract ("incremental" covenants), then examine the relation between each set of covenants and borrowers' future risk profile. The intuition for this test is that incremental covenants represent a change in the contract's covenant mix and therefore potentially a change in borrowers' incentives. In addition, a borrower's "type" (i.e., a risk-tolerant versus a risk-averse borrower) is unlikely to change radically in the short-run. Thus, any relation between incremental covenants and borrowers' future risk profile is likely to primarily capture how covenants affect borrowers' incentives. Conversely, any relation between persistent covenants and borrowers' future risk profile is likely to capture both incentive and screening effects. Therefore, any difference in the relation between incremental and persistent covenants with borrowers' future risk profile should represent the screening component of the relation between covenant mix and risk.[5] We find that the relation between the performance-sensitivity of covenant mix and future risk is significantly larger for persistent covenants than for incremental covenants, providing further evidence that covenant heterogeneity can serve an important screening role.

Our third analysis differentiates between screening and incentive effects by exploiting post-contractual variation in covenant slack (i.e., the difference between the threshold specified in the covenant and the borrower's actual performance). The idea is that covenants should only affect a borrower's actions to the extent that they potentially impose binding constraints (i.e., when covenants become tight, they are more likely to affect borrowers' actions, whereas loose covenants should provide little if any incentives). Accordingly, we follow each loan contract over time and measure how variation in covenant slack over the course of the loan for different types of covenants is related to borrowers' future risk profile.

Ideally, the changes in post-contractual slack should be exogenous. Thus, we exclude years immediately following a loan's inception and only focus on changes well into the future (from the second year onward), when changes in covenant slack are more likely to be unexpected. We classify each set of low and high performance-sensitivity covenants into three groups: loose, medium, and tight, according to how close the actual accounting metric on which the covenant is based is to the contractual threshold. We find a significant negative (positive) relation between high (low) performance-sensitivity covenants and future risk, even among covenants with the most post-contractual slack, consistent with these covenants conveying information about borrowers' future risk profile even in the absence of incentives. We also find that these relations become stronger as covenant slack decreases, suggesting that our previous findings are not *entirely* due to screening (i.e., high and low performance-sensitivity covenants also have opposite effects on borrowers' risk-taking incentives).

Finally, we study how the screening value of covenant heterogeneity may vary with firm characteristics and over time.[6] Across a wide range of observable firm characteristics (e.g., size, age, or investment opportunities), we find similar relations between covenant mix and borrowers' future risk profile, suggesting that the screening value of covenant heterogeneity is applicable to a wide range of prospective borrowers. We also find a secular decline in borrower risk that is highly correlated with the decline in the use of low performance-sensitivity covenants, consistent with the long-term

[4] In Section V, we show that this relation is not simply an artifact of covenants' incentive effects taking time to materialize in our risk measures.

[5] The idea that the correlation between contractual provisions and future outcomes reflects the combination of both screening and incentives is well-recognized in the insurance literature (e.g., Chiappori and Salanie 2000; Cohen and Siegelman 2010; Lazear 2000). As noted by others (e.g., Lazear 2000), it follows that the portion of the relation that is *not* explained by incentives should reflect screening.

[6] See Appendix C for a description of and results from these tests.

trend away from balance sheet-based, low performance-sensitivity covenants (e.g., Demerjian 2011). This decline in borrowers' risk is the result of both a decline in individual borrowers' riskiness and changes in the types of borrowers that access the private debt market. However, except for a modest decrease around the financial crisis, the *relation* between borrowers' covenant mix and future risk has remained similar throughout our sample period, suggesting that covenant mix remains a useful screening mechanism even with the long-term decline in borrowers' risk noted above.

Our study advances our understanding of why financial covenant *heterogeneity* is observed in practice, which is an open question in the literature (Skinner 2011; Christensen et al. 2016). We argue that the selection of different types of financial covenants conveys information about borrowers' future risk profile, and therefore that the variation in covenant mix is a way for lenders to screen prospective borrowers. Our evidence that screening is an important source of the heterogeneity observed in loan covenants complements prior studies that show how lenders use different types of covenants to satisfy differences in their monitoring needs (e.g., Christensen and Nikolaev 2012). These studies largely view financial covenants as a *post*-contractual monitoring mechanism or renegotiation device in a moral hazard or incomplete contracting framework. Our evidence shows that the mix of accounting signals on which covenants are based conveys important *pre*-contractual information about borrowers' future risk, in addition to providing the monitoring benefits examined in prior literature. For example, we find that covenants that are no longer enforceable continue to exhibit a relationship with—and therefore provide information about—borrowers' future risk profile. This finding is both consistent with our screening framework and incremental to the monitoring role of covenants in incomplete contracting theory. Our findings also highlight the importance of considering the *mix*, in addition to the *number* (e.g., the covenant intensity index in Bradley and Roberts 2004), of covenants when examining borrowers' future risk profile.

Although some prior literature also examines covenant characteristics through the lens of adverse selection (e.g., Demiroglu and James 2010; Li, Vasvari, and Wittenberg-Moerman 2016), we believe that our study expands upon these findings in several important ways. First, we focus on covenant heterogeneity, whereas Demiroglu and James (2010) and Li et al. (2016) both view covenants as largely homogeneous and focus on variation in provisions such as covenant thresholds or slack.[7] In contrast, we make *opposing* predictions for different covenant types, and our empirical evidence supports these predictions.[8] In addition, the focus of our study is on borrowers' future risk profile, whereas Demiroglu and James (2010) and Li et al. (2016) are largely focused on borrowers' future performance.[9] Although both are likely to be of interest to potential lenders, we believe they are distinct (although potentially related) characteristics. Importantly, risk is typically much more difficult to directly contract on compared to performance (e.g., Smith and Warner 1979; Armstrong, Guay, and Weber 2010). As a result, mechanisms that can help screen borrowers based on their future risk profile potentially offer substantial improvements in contracting efficiency.

II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

Lenders include a wide array of financial covenants in their loan contracts, such as restrictions on net worth, liquidity, leverage, and debt-to-EBITDA ratios. However, a typical contract only includes about two of these covenants, and the specific restrictions imposed by these covenants vary substantially between contracts (Skinner 2011). In other words, *individual* debt contracts tend to include a relatively small number of covenants, and there is substantial variation in the structure (or mix) of these covenants *across* debt contracts. Prior literature describes these two patterns—which we collectively refer to as *covenant heterogeneity*—as "puzzling" and in need of an explanation (Skinner 2011; Christensen et al. 2016).

We argue that covenant heterogeneity arises, at least in part, as a result of lenders' efforts to address adverse selection, as offering different types of covenants allows lenders to screen borrowers and elicit their *pre-contractual* private information about their future risk profile. Our study complements recent studies that examine how different types of covenants (i.e., covenant heterogeneity) serve to influence or constrain borrowers' *post-contractual* actions to alleviate incentive conflicts between borrowers and lenders (e.g., Demerjian 2011; Christensen and Nikolaev 2012; Christensen, Macciocchi, Morris, and Nikolaev 2021). In other words, these studies largely examine the *post-contractual* role of

[7] For example, Demiroglu and James (2010) test the same predictions for both current ratio (low performance-sensitivity) and Debt/EBITDA (high-performance sensitivity) covenants, and in several of their tests they combine these two types of covenants into a single measure. Likewise, Li et al. (2016) focus solely on high performance-sensitivity covenants and exclude lower performance-sensitivity covenants from their analysis.

[8] Conceptually, removing a covenant can also be interpreted as setting the corresponding covenant threshold very loose (i.e., very high slack). However, our emphasis is variation in covenant mix, holding the total number of covenants fixed. Assuming a fixed number of total covenants, altering the mix of covenants entails "loosening" one covenant while simultaneously "tightening" another.

[9] Demiroglu and James (2010) find that variables such as firm size, cash flows, leverage, and investment grade rating are related to covenant tightness. They interpret this evidence as riskier borrowers having tighter covenants.

covenant heterogeneity from a moral hazard or incomplete contracting perspective, whereas we focus on the *pre-contractual* role of covenant heterogeneity to mitigate adverse selection.[10]

We posit that covenant heterogeneity is an effective screening device with respect to borrowers' risk profiles based on intuition from agency-theoretic models of labor and insurance markets. In labor economics, Stiglitz (1975) and Lazear (1986) show how workers who differ in their characteristics that are unobservable to employers (e.g., risk tolerance) tend to choose contracts with different compensation provisions, and employers can use differences in workers' choices to learn their precontractual private information. In particular, more risk-averse workers tend to prefer contracts that are less sensitive to their future performance (e.g., hourly salaries). Conversely, more risk-tolerant workers tend to prefer more performance-based contracts (e.g., piecewise rates or equity-based compensation) with payoffs that are more closely tied to future performance. These differential preferences allow employers to better assess a particular worker's characteristics, such as risk tolerance, and design other provisions of the contract accordingly, increasing the overall contract efficiency.

Similar to compensation contracts, financial covenants differ substantially in their reliance on future performance: some covenants depend primarily on borrowers' future performance (e.g., covenants based on interest coverage ratios), other covenants rely less or not at all on borrowers' future performance (e.g., liquidity covenants), and some fall somewhere in between (e.g., net worth covenants, which have some exposure to performance through equity, but are less sensitive compared to covenants tied to the income statement). Since greater risk entails greater uncertainty about future performance, borrowers who make riskier investments and decisions will have a greater likelihood of violating covenants that are more sensitive to performance. Conversely, the riskiness of borrowers' decisions will have less of an influence on the likelihood of violating covenants that are largely independent of future performance (i.e., low performance-sensitivity).[11] Thus, by observing borrowers' covenant preferences (e.g., during the contract negotiation), lenders can infer each borrower's future risk profile (e.g., Rothschild and Stiglitz 1976). This differential preference for different types of covenants among borrowers is especially likely considering that covenant violations are often costly for borrowers, or borrowers' managers (e.g., Roberts and Sufi 2009a; Nini et al. 2012; Ozelge and Saunders 2012). For example, covenant violations can impose costs on borrowers, such as reduced access to and/or increased cost of financing (e.g., Roberts and Sufi 2009a). Violations can also impose costs more directly on managers, such as an increased likelihood of turnover (e.g., Nini et al. 2012; Ozelge and Saunders 2012) or investment restrictions, even if these restrictions ultimately enhance firm value.[12]

Because financial covenants exhibit substantial variation in their sensitivity to borrowers' future performance, covenant heterogeneity seems particularly well suited for eliciting borrowers' precontractual private information about their risk profiles compared to other contractual screening devices that exhibit less variation in their dependence on future performance (e.g., maturity or collateral). Thus, we predict that more (less) risk-averse borrowers will select more (less) performance-sensitive covenants in their loan contracts. Importantly, this prediction does not require that covenant violation is highly costly for *all* borrowers (e.g., Bordeman and Demerjian 2022 suggest that many borrowers do not appear to experience significant costs from covenant violation). Rather, the costs vary as a function of each borrower's risk profile, and relatively high-risk borrowers face significant covenant violation costs. Evidence in prior literature supports the notion that costs of covenant violation exhibit substantial cross-sectional variation, with riskier firms tending to bear greater costs (e.g., Roberts and Sufi 2009a).

Conceptually, the presence of PPP can also influence the performance-sensitivity of the loan contract and therefore also function as a mechanism to screen borrowers. PPP that allow loan pricing to increase if subsequent performance deteriorates could be particularly well suited for screening, as they are likely to impose greater expected costs on riskier borrowers. At the same time, PPP also face several limitations that may render them less effective than covenant mix as a screening mechanism with respect to borrowers' future risk. First, extant work highlights that PPP are used to screen borrowers' according to expected future performance, rather than risk (e.g., Li et al. 2016). Moreover, interest increasing PPP also tend to have relatively "smooth" or continuous pricing grids, where each threshold introduces a fairly small cost (i.e., a higher interest rate). Covenants, on the other hand, shift substantial bargaining power to lenders upon violation, and prior studies show that lenders take relevant and significant actions following violations. Because of these more acute costs of covenant violation, we expect covenant heterogeneity to serve as a more effective screening mechanism compared to PPP.[13]

[10] Similarly, Saavedra (2018) relates the size of the loan syndicate with covenant choice using a contracting cost framework that highlights post-contractual coordination costs among syndicate members.

[11] Recent studies provide evidence that more performance-sensitive covenants are, indeed, violated more frequently (Demerjian and Owens 2016; Nikolaev 2018).

[12] For example, Demiroglu and James (2010, 3730) note: "Nini, Smith, and Sufi (2009) provide evidence that investment restrictions following covenant violations may be value enhancing by reducing overinvestment. Nevertheless, the reduction is presumably considered as costly to the firm's manager/decision maker."

[13] Consistent with our expectations, virtually none of the PPP in our sample reflect low performance-sensitivity provisions (i.e., based on liquidity ratios), rather than high performance-sensitivity provisions (i.e., based on income statement measures). In other words, PPP appear to largely serve as a mechanism to fine-tune the performance-sensitivity of high sensitivity covenants, rather than substitute for or complement variation in covenant mix.

Beyond covenant mix and PPP, there are other provisions in loan contracts that lenders can potentially use to screen borrowers according to their risk profile. Classic examples include loan maturity (Diamond 1993) or collateral (Bester 1985), whereas more recent examples include how tightly covenants are initially set (e.g., Gârleanu and Zwiebel 2009; Li et al. 2016). Compared to these other provisions, covenant mix is particularly well suited to elicit information on borrowers' risk because different financial covenants are based on different accounting signals with a wide range of sensitivities to borrowers' performance. This differential reliance on borrowers' performance can provide more specific information about their future risk profile (e.g., Lazear 1986). Moreover, covenant mix is less likely to reflect differences in borrowers' funding needs.[14] Accordingly, we expect the mix of financial covenants to convey information on borrowers' future risk profile incremental to the information conveyed by other contractual provisions (e.g., collateral or maturity).[15]

III. VARIABLE MEASUREMENT AND DESCRIPTIVE STATISTICS

Borrower Risk Profile

Our main dependent variable is borrowers' future risk profile, which we measure three different ways. First, we consider borrowers' unlevered stock return (i.e., asset) volatility, defined as the annualized standard deviation of daily stock returns during the year multiplied by the firm's equity-to-value ratio (Schwert 1989). We use unlevered volatility because our focus is on the riskiness of borrowers' investments, rather than their capital structure. Second, we consider the ratio of R&D expense to lagged total assets. Similar to unlevered stock volatility, this ratio provides a measure of the riskiness of borrowers' investment policy (e.g., Coles, Daniel, and Naveen 2006). Third, we consider the volatility of return on assets (ROA), defined as the natural logarithm of the standard deviation of the year-over-year change in quarterly ROA computed over the 12 quarters from year t to year t+2, where ROA is EBIT scaled by total assets (Ljungqvist, Zhang, and Zuo 2017). This measure captures volatility in the outcome of investment policies, excluding the effects of financing decisions (i.e., interest expense). For parsimony, in our primary analyses we condense these three measures by performing a factor analysis and taking the first factor as a summary measure of borrowers' future risk profile.[16]

Classification of Financial Covenants

Conceptually, covenants may exhibit a wide spectrum of performance sensitivities depending on the underlying measure on which they are written. We categorize covenants into three groups: (1) interest coverage and debt-to-EBITDA covenants; (2) leverage and net worth covenants; and (3) current and quick ratio covenants.[17] In our theoretical framework, group (1) represents the most performance-based group, as it based on income statement measures, and the link to performance progressively decreases across groups (2) and (3). In particular, group (2) is based only on the balance sheet and primarily emphasizes long-term assets and liabilities (and therefore captures performance through changes in equity), and group (3) is based solely on short-term assets and liabilities (i.e., liquidity) and the least sensitive to current performance. Thus, we classify group (1) as *high performance-sensitivity covenants*, group (2) as *medium performance-sensitivity covenants*, and group (3) as *low performance-sensitivity covenants*.

Sample Selection and Descriptive Statistics

We use DealScan, provided by Thomson Reuters, to collect data on private debt contracts, including the number and type of covenants. We retrieve financial and accounting information about borrowers from Compustat and merge this data with DealScan using the linking table provided by Chava and Roberts (2008). Consistent with several extant papers (e.g., Demerjian 2011; Christensen and Nikolaev 2012; Ball, Li, and Shivakumar 2015), we exclude loans with missing financial

[14] For example, although lenders adjust loan maturity in response to borrowers' observable risk-taking incentives (e.g., Brockman, Martin, and Unlu 2010), maturity usually reflects the investment duration rather than borrowers' characteristics (e.g., Hart and Moore 1998) and can fail to differentiate between very low and very high-risk borrowers (e.g., Diamond 1993). Similarly, loan structure (e.g., term loan versus revolving line) primarily reflects the type of investment that borrowers intend to pursue, rather than the borrower's risk profile (e.g., Tirole 2006; Wight, Cooke, and Gray 2009).

[15] Notably, we focus on the mix of covenants in, rather than the overall tightness of, loan contracts. Fu and Zhang (2011) examine whether more restrictive loan covenants protect lenders from borrowers' risk-taking, where covenant restrictiveness is defined as the number of contractual provisions (e.g., sweep provisions, dividend restrictions, collateral requirements, etc.). Their measure effectively assumes that all types of covenants (or contractual provisions) are equally effective in limiting borrowers' risk-taking. In contrast, we argue that different *types of financial covenants* can have different relations with borrowers' future risk depending on their sensitivity to borrowers' performance.

[16] A borrower's future risk profile can reflect a combination of future risk-taking activities as well as uncertainty regarding the outcome of prior actions. Our first and third measures (i.e., asset volatility and ROA volatility) are likely to at least partially capture the latter dimension, whereas R&D expense provides a more direct measure of the former. Hence, in some analyses, we separately examine R&D to assess whether covenant mix provides information about borrowers' future risk-taking *actions*, in addition to their risk profiles more broadly.

[17] Appendix A details the specific covenant measures we include in each group.

covenant data.[18] Our decision is driven by two factors. First, loans with missing covenant data primarily tend to be contracts where DealScan has not collected covenant information, rather than contracts that have no covenants (e.g., Drucker and Puri 2009; Christensen and Nikolaev 2012; Berlin et al. 2019). Second, our focus is loan contracts with financial covenants, as our framework is specific to the covenant mix, rather than the presence of covenants in general. We collect stock returns from CRSP. Finally, we require available data on the probability of covenant violation data (Demerjian and Owens 2016). Our sample consists of roughly 9,000 borrower-package observations from 1995 through 2017 for 3,067 distinct borrowers.

Table 1 presents descriptive statistics for our main variables. High performance-sensitivity covenants are the most common type of covenant, and the average debt contract in our sample has about 1.55 of these covenants. Low performance-sensitivity covenants are the least common, with the average contract having 0.13 such covenants. Medium performance-sensitivity covenants fall in between at an average of 0.62 per contract. Table 2 presents correlations between our measures of risk and the various contractual provisions. High (low) performance-sensitivity covenants are negatively (positively) correlated with risk. Medium performance-sensitivity covenants are also positively correlated with risk, although the magnitude is smaller than for low performance-sensitivity covenants. These correlations provide preliminary evidence that different types of financial covenants have different relations with borrowers' subsequent risk profile.

Variation in Covenant Structure

We first explore whether our assumptions underlying our screening framework are consistent with variation in covenant mix in our sample. Specifically, we investigate the sensitivity of different types of covenants to borrowers' performance and whether borrowers appear to trade off low and high performance-sensitivity covenants (i.e., these covenants exhibit a negative association). First, we consider whether our covenant classifications correspond to observed variation in performance sensitivity. Specifically, similar to Li (2016), we estimate the following model:

$$Covenant\ Metric_{i,t} = \beta_0 + \beta_1 Performance_{i,t} + \varepsilon_{i,t} \tag{1}$$

for each firm i and year t. We measure *Performance* as ROA (defined as earnings before interest and taxes (EBIT) scaled by total assets)[19] and consider three Covenant Metric measures: interest coverage ratio (high sensitivity), net worth (medium sensitivity), and current ratio (low sensitivity), which we compute following Demerjian and Owens (2016).[20] These measures represent the most common performance metric in each of the three performance-sensitivity groupings discussed above (Demerjian and Owens 2016). As in Li (2016), we standardize all variables to facilitate coefficient comparisons and estimate the model using firms with at least one loan in DealScan during our sample period.

Table 3, Panel A reports results from estimating Equation (1). Consistent with our covenant classifications, we find that the coefficient on performance is largest for the interest coverage ratio (high sensitivity) and monotonically decreases with our performance-sensitivity classifications. Collectively, these results help validate that our empirical covenant classification is capturing our underlying theoretical construct of variation in performance sensitivity.[21]

Next, we examine the relation between low and high performance-sensitivity covenants using the following:

$$\#Low\ sensitivity_{i,t} = \alpha_0 + \alpha_1 \#High\ sensitivity_{i,t} + \alpha_2 \#Medium\ sensitivity_{i,t} + \beta Controls_{i,t,t-1} + \varepsilon_{i,t} \tag{2}$$

where *#Low sensitivity*, *#High sensitivity*, and *#Medium sensitivity* are the number of low, high, and medium performance-sensitivity covenants in the loan contract, respectively.

We estimate this model using debt packages as the unit of analysis since covenants are typically specified at the package level (subscript i). To control for information that lenders would have at the contract's inception, we include several firm-level characteristics, including size, book-to-market, leverage, and performance. We also control for the presence of dividend restrictions, the number of sweep and PPP, the probability of covenant violation, interest spread,

[18] This restriction does not imply that we exclude "cov-lite" contracts (i.e., contracts with no maintenance covenants). Berlin, Nini, and Yu (2019) find that it is very rare for the entire loan package—which is the level at which we measure covenant mix—to be "cov-lite." In addition, Becker and Ivashina (2016) and Berlin et al. (2019) argue that the use of cov-lite loans is largely driven by lender considerations (e.g., coordination costs) rather than borrower demand, which suggests that cov-lite loans are unlikely to provide much insight into borrowers' pre-contractual private information.

[19] We use EBIT (rather than net income) to prevent interest expense mechanically affecting performance. We find similar results if we use EBITDA instead of EBIT (untabulated).

[20] We considered looking at changes in (rather than levels of) net worth and current ratio since both measures represent stock variables, whereas performance is measured as a flow variable. However, we believe that the levels of net worth and current ratio are most appropriate given the purpose of our analysis (i.e., to assess the performance-sensitivity of different types of covenants), as the actual terms of these covenants are almost exclusively based on levels, rather than changes (Demerjian and Owens 2016).

[21] Given that interest coverage ratios are based on EBITDA, it would be surprising for these ratios to not be highly correlated with performance measures such as EBIT or EBITDA. This is one reason why, conceptually, we believe it is appropriate to categorize interest coverage covenants as high performance-sensitivity.

TABLE 1

Descriptive Statistics

	n	Mean	Std. Dev.	25th	Median	75th
Risk						
Risk factor	8,956	−0.01	0.94	−0.65	−0.21	0.38
Asset volatility	8,956	0.34	0.22	0.20	0.28	0.41
R&D / Lagged Assets	8,956	0.02	0.05	0.00	0.00	0.02
ln(SD ROA)	8,956	−3.80	0.97	−4.48	−3.88	−3.22
Contractual Features						
Nr of low performance-sensitivity covenants	8,956	0.13	0.34	0.00	0.00	0.00
Nr of high performance-sensitivity covenants	8,956	1.55	0.90	1.00	2.00	2.00
Nr of medium performance-sensitivity covenants	8,956	0.62	0.70	0.00	0.00	1.00
% low performance-sensitivity covenants	8,956	0.05	0.14	0.00	0.00	0.00
Nr of financial covenants	8,956	2.30	0.99	2.00	2.00	3.00
Nr of performance pricing	8,956	0.92	0.84	0.00	1.00	1.00
Nr of sweep	8,956	0.91	1.53	0.00	0.00	2.00
Dividend restriction	8,956	0.69	0.46	0.00	1.00	1.00
Probability of covenant violation	8,956	0.35	0.41	0.01	0.10	0.85
Loan size ($Mil)	8,956	500.11	1045.67	65.00	200.00	500.00
Loan maturity (months)	8,956	45.98	19.87	36.00	48.00	60.00
Loan spread	8,956	182.03	118.32	100.00	150.00	250.00
Secured	8,956	0.57	0.49	0.00	1.00	1.00
Nr of banks per package	8,956	8.05	7.86	2.00	6.00	11.00
% Current low performance-sensitivity covenants	8,956	0.05	0.14	0.00	0.00	0.00
% Superseded low performance sensitivity	6,926	0.05	0.13	0.00	0.00	0.00
% Incremental low performance-sensitivity covenants	8,956	0.01	0.05	0.00	0.00	0.00
% Persistent low performance-sensitivity covenants	6,926	0.03	0.11	0.00	0.00	0.00
Nr of superseded financial covenants	6,926	2.35	0.98	2.00	2.00	3.00
Nr of incremental covenants	8,956	0.15	0.45	0.00	0.00	0.00
Nr of persistent covenants	6,926	2.04	0.85	1.00	2.00	3.00
Other Firm Controls						
Size	8,956	6.55	1.99	5.18	6.60	7.96
Book to market	8,956	0.93	0.50	0.58	0.85	1.17
Leverage	8,956	0.26	0.21	0.10	0.21	0.37
Z-score	8,956	1.48	1.06	0.87	1.43	2.01
Cash flow to sales	8,956	0.09	0.53	0.04	0.09	0.15
Stock return	8,956	0.20	0.61	−0.16	0.11	0.41
Return on assets	8,956	0.03	0.11	0.01	0.05	0.08

This table presents descriptive statistics for select variables that are used in our analysis. The sample consists of 8,956 borrower-package observations from 1995 through 2017.
All variables are defined in Appendix A.

loan size, maturity, the presence of collateral, and the number of lenders in the syndicate. Appendix A provides variable definitions. We also include industry and year fixed effects. We measure characteristics of the debt contract in the year of the contract's inception (i.e., time t) and all other variables in the year prior to the contract's inception (i.e., time $t-1$) to ensure that lenders would have this information when negotiating the contract.

Table 3, Panel B reports the estimation results for Equation (2). Column (1) contains only our covenant variables and industry and year fixed effects, column (2) adds borrower-level controls, and column (3) also adds loan contract-level controls. Across all specifications, we find a significant negative relation between high and low performance-sensitivity covenants, consistent with the assumption that borrowers can trade off between different types of covenants. Conversely, low and medium performance-sensitivity covenants exhibit a positive association, suggesting that this trade-off is primarily between high and low sensitivity covenants. Although the evidence in Table 3 is only descriptive, it is

TABLE 2

Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) *Risk factor*	**1.00**											
(2) *Asset volatility*	**0.81**	**1.00**										
(3) *R&D / Lagged Assets*	**0.52**	**0.24**	**1.00**									
(4) *ln(SD ROA)*	**0.78**	**0.42**	**0.12**	**1.00**								
(5) *Nr of low performance-sensitivity covenants*	**0.30**	**0.19**	**0.09**	**0.32**	**1.00**							
(6) *Nr of high performance-sensitivity covenants*	**−0.11**	**−0.06**	**−0.08**	**−0.11**	**−0.11**	**1.00**						
(7) *Nr of medium performance-sensitivity covenants*	**0.16**	**0.18**	0.01	**0.12**	**0.14**	**−0.34**	**1.00**					
(8) *% low performance-sensitivity covenants*	**0.30**	**0.17**	**0.11**	**0.32**	**0.92**	**−0.17**	**0.06**	**1.00**				
(9) *Nr of financial covenants*	**0.10**	**0.13**	**−0.03**	**0.09**	**0.32**	**0.65**	**0.43**	**0.18**	**1.00**			
(10) *% Current low performance-sensitivity covenants*	**0.30**	**0.17**	**0.11**	**0.32**	**0.92**	**−0.17**	**0.06**	1.00	**0.18**	**1.00**		
(11) *% Superseded low performance sensitivity*	**0.34**	**0.22**	**0.14**	**0.34**	**0.62**	**−0.13**	**0.10**	**0.64**	**0.14**	**0.64**	**1.00**	
(12) *% Incremental low performance-sensitivity covenants*	**0.15**	**0.10**	**0.09**	**0.11**	**0.41**	**−0.08**	**0.05**	**0.43**	**0.09**	**0.43**	**−0.05**	**1.00**
(13) *% Persistent low performance-sensitivity covenants*	**0.25**	**0.14**	**0.07**	**0.30**	**0.81**	**−0.15**	**0.04**	**0.89**	**0.15**	**0.89**	**0.73**	**−0.04**
(14) *Nr of incremental covenants*	**0.09**	**0.07**	**0.03**	**0.07**	**0.14**	**0.29**	**0.20**	**0.07**	**0.45**	**0.07**	0.02	**0.18**
(15) *Nr of persistent covenants*	**0.06**	**0.10**	**−0.06**	**0.05**	**0.27**	**0.56**	**0.35**	**0.16**	**0.85**	**0.16**	**0.15**	−0.01
(16) *Nr of superseded financial covenants*	**0.13**	**0.15**	**−0.03**	**0.11**	**0.19**	**0.39**	**0.24**	**0.12**	**0.58**	**0.12**	**0.19**	−0.02
(17) *Nr of performance pricing*	**−0.10**	**−0.07**	**−0.07**	**−0.09**	**−0.07**	**0.20**	**−0.04**	**−0.09**	**0.14**	**−0.09**	**−0.07**	**−0.04**
(18) *Nr of sweep*	**−0.05**	**−0.04**	**−0.07**	−0.01	**−0.10**	**0.33**	**−0.17**	**−0.10**	**0.15**	**−0.10**	**−0.08**	**−0.03**
(19) *Dividend restriction*	**0.14**	**0.13**	**−0.03**	**0.16**	**0.09**	**0.25**	0.00	**0.08**	**0.26**	**0.08**	**0.08**	**0.02**
(20) *Probability of covenant violation*	**0.13**	**0.11**	**−0.07**	**0.18**	**0.18**	**0.20**	**0.04**	**0.18**	**0.27**	**0.18**	**0.17**	**0.05**
(21) *Loan size (ln)*	**−0.47**	**−0.47**	**−0.16**	**−0.34**	**−0.21**	**−0.04**	**−0.26**	**−0.17**	**−0.29**	**−0.17**	**−0.21**	**−0.14**
(22) *Loan maturity (ln)*	**−0.20**	**−0.20**	**−0.09**	**−0.12**	**−0.10**	**0.21**	**−0.24**	**−0.09**	0.00	**−0.09**	**−0.09**	**−0.07**
(23) *Loan spread (ln)*	**0.19**	**0.15**	0.02	**0.20**	**0.11**	**0.26**	**−0.13**	**0.11**	**0.19**	**0.11**	**0.13**	**0.07**
(24) *Secured*	**0.22**	**0.18**	0.00	**0.25**	**0.17**	**0.21**	**−0.09**	**0.16**	**0.18**	**0.16**	**0.16**	**0.08**
(25) *Nr of banks per package*	**−0.28**	**−0.27**	**−0.09**	**−0.22**	**−0.15**	**−0.03**	**−0.09**	**−0.12**	**−0.14**	**−0.12**	**−0.14**	**−0.09**

(continued on next page)

TABLE 2 (continued)

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
(1) *Risk factor*												
(2) *Asset volatility*												
(3) *R&D / Lagged Assets*												
(4) *ln(SD ROA)*												
(5) *Nr of low performance-sensitivity covenants*												
(6) *Nr of high performance-sensitivity covenants*												
(7) *Nr of medium performance-sensitivity covenants*												
(8) *% low performance-sensitivity covenants*												
(9) *Nr of financial covenants*												
(10) *% Current low performance-sensitivity covenants*												
(11) *% Superseded low performance sensitivity*												
(12) *% Incremental low performance-sensitivity covenants*												
(13) *% Persistent low performance-sensitivity covenants*	**1.00**											
(14) *Nr of incremental covenants*	−0.02	**1.00**										
(15) *Nr of persistent covenants*	**0.17**	**−0.09**	**1.00**									
(16) *Nr of superseded financial covenants*	**0.14**	**−0.20**	**0.77**	**1.00**								
(17) *Nr of performance pricing*	**−0.08**	**0.07**	**0.11**	**0.09**	**1.00**							
(18) *Nr of sweep*	**−0.10**	**0.09**	**0.12**	**0.12**	**0.16**	**1.00**						
(19) *Dividend restriction*	**0.07**	**0.09**	**0.24**	**0.25**	**0.08**	**0.27**	**1.00**					
(20) *Probability of covenant violation*	**0.17**	**0.15**	**0.21**	**0.22**	−0.01	**0.17**	**0.19**	**1.00**				
(21) *Loan size (ln)*	**−0.12**	**−0.15**	**−0.23**	**−0.31**	**0.17**	−0.01	**−0.22**	**−0.25**	**1.00**			
(22) *Loan maturity (ln)*	**−0.06**	**−0.03**	0.01	**0.02**	**0.13**	**0.13**	**0.09**	**−0.05**	**0.26**	**1.00**		
(23) *Loan spread (ln)*	**0.08**	**0.13**	**0.14**	**0.19**	**−0.11**	**0.36**	**0.23**	**0.36**	**−0.36**	**0.06**	**1.00**	
(24) *Secured*	**0.13**	**0.12**	**0.14**	**0.21**	**−0.03**	**0.37**	**0.35**	**0.32**	**−0.34**	**0.11**	**0.57**	**1.00**
(25) *Nr of banks per package*	**−0.08**	**−0.07**	**−0.11**	**−0.17**	**0.19**	**−0.08**	**−0.14**	**−0.15**	**0.64**	**0.13**	**−0.33**	**−0.28**

This table presents the pairwise correlation matrix among selected variables. Boldfaced coefficients indicate statistical significance (two-sided) at the 0.10 level. All variables are defined in Appendix A.

TABLE 3

Performance-Sensitivity Covenant Classification and Validation Tests

Panel A: Performance-Sensitivity Covenant Classification Test

Covenant Metric (Covenant Category)	**Interest Coverage Ratio (High Performance-Sensitivity Covenants)**	**Net Worth (Med Performance-Sensitivity Covenants)**	**Current Ratio (Low Performance-Sensitivity Covenants)**
	(1)	**(2)**	**(3)**
Performance	86.372***	41.644***	−3.599
	(22.97)	(9.64)	(−1.37)
Observations	22,905	22,905	22,905
Adjusted R^2	0.095	0.022	0.000

*, **, *** Indicate statistical significance (two-sided) at the 0.1, 0.05, and 0.01 levels, respectively.
This panel presents the estimation results from the following regression model:

$$Covenant\ Metric_{i,t} = \beta_0 + \beta_1 Performance_{i,t} + \varepsilon_{i,t}$$

for each firm *i* and year *t*. *Performance* is ROA (EBIT scaled by total assets). *Covenant Metric* is either interest coverage ratio (high performance-sensitivity covenants), net worth (medium performance-sensitivity covenants), or current ratio (low performance-sensitivity covenants). Each metric is computed following Demerjian and Owens (2016). As in Li (2016), all dependent variables are standardized to facilitate coefficient comparisons. Standard errors are calculated based on clustering by borrower. t-statistics are in parentheses.

Panel B: Relation between Different Covenant Types

	Nr of low performance-sensitivity covenants		
	(1)	**(2)**	**(3)**
Nr of high performance-sensitivity covenants	**−0.025***** **(−4.72)**	**−0.041***** **(−7.63)**	**−0.037***** **(−6.43)**
Nr of medium performance-sensitivity covenants	0.042*** (4.53)	0.030*** (3.37)	0.022** (2.51)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Firm controls	No	Yes	Yes
Loan controls	No	No	Yes
Observations	8,956	8,956	8,956
Adjusted R^2	0.188	0.235	0.268

*, **, *** Indicate statistical significance (two-sided) at the 0.1, 0.05, and 0.01 levels, respectively.
This panel presents the estimation results from regressing *Nr of low performance-sensitivity covenants* on other groups of financial covenants with different performance-sensitivities (*Nr of high performance-sensitivity* and *Nr of medium performance-sensitivity*). Column (1) reports the estimation results with no additional controls besides fixed effects, whereas column (2) and (3) report the estimation results after including controls on borrower and other loan characteristics, respectively. Industry (two-digit SIC code) and year fixed effects are included but not tabulated to save space. Standard errors are calculated based on clustering by borrower. t-statistics are in parentheses.
All variables are defined in Appendix A.

consistent with our theoretical screening framework. Notably, these results are also not a prediction of the incomplete contracting framework commonly used in prior literature examining covenant heterogeneity (e.g., Christensen and Nikolaev 2012)—under incomplete contracting, different types of covenants can serve different purposes, but they are not necessarily substitutes.[22] For example, Christensen and Nikolaev (2012, 86) note that "many contracts rely on both P- and C-covenants, which implies that the contracting parties often care about both *ex ante* interest alignment and *ex post* control transfers."

[22] This does not imply that our predictions or theoretical framework are inconsistent with incomplete contracting; rather, we believe that both frameworks help foster a greater understanding of covenant heterogeneity.

IV. EMPIRICAL RELATION BETWEEN COVENANTS AND FUTURE RISK PROFILE

Research Design

We next examine whether different covenants convey different information about borrowers' future risk profile. If covenant mix acts as a useful screening mechanism, different types of covenants should exhibit different relationships with borrowers' future risk profile. We test this prediction by estimating the following empirical specification:

$$Risk_{i,t+1} = \alpha_0 + \alpha_1 \%Low\ sensitivity_{i,t} + \alpha_2 \#Covenants_{i,t} + \beta Controls_{i,t,t-1} + \gamma Risk_{i,t-1} + \varepsilon_{i,t} \quad (3a)$$

where *Risk* is one of our risk measures described in Section III and *%Low sensitivity* is the number of low performance-sensitivity covenants scaled by the number of total financial covenants in the loan contract. We control for the total number of financial covenants since borrowers with different risk profiles might also tend to agree to different numbers of covenants (e.g., Fu and Zhang 2011; Demerjian 2017). The coefficient α_1 captures the relation between the performance-sensitivity of borrowers' covenant mix and their future risk profile. We expect α_1 to be positive if borrowers that agree to less performance-sensitive covenant mixes tend to be riskier in the future. We also control for the borrower's observable historical risk profile (i.e., lagged dependent variable), the probability of covenant violation (following Demerjian and Owens 2016), and the same borrower- and contract-level controls as in Equation (2).[23] We measure future risk in the year after the contract's inception (i.e., time t+1), characteristics of the debt contract in the year of the contract's inception (i.e., time t), and all other variables in the year prior to the contract's inception (i.e., time $t-1$) to ensure lenders would have known this information when negotiating the contract.

As an alternative specification, we estimate following model that includes the number of each type of covenant simultaneously, rather than the percentage:

$$Risk_{i,t+1} = \alpha_0 + \alpha_1 \#Low\ sensitivity_{i,t} + \alpha_2 \#High\ sensitivity_{i,t} + \alpha_3 \#Medium\ sensitivity_{i,t} + \beta Controls_{i,t,t-1} + \gamma Risk_{i,t-1} + \varepsilon_{i,t} \quad (3b)$$

Similar to Equation (2), *#Low sensitivity*, *#High sensitivity*, and *#Medium sensitivity* are the number of low, high, and medium performance-sensitivity covenants in the loan contract, respectively. Based on our prediction that low and high performance-sensitivity covenants should have *opposite* relations with future risk, we expect α_1 and α_2 to be positive and negative, respectively.

Results

Table 4, Panels A and B presents results from estimating Equations (3a) and (3b), respectively. Column (1) reports results for our risk factor measure as the dependent variable, whereas columns (2) through (4) present results for each of our three underlying risk measures (asset volatility, R&D, and ROA volatility, respectively). For columns (2) through (4), to enhance the economic interpretability of our estimates, we multiply all of the coefficients by 100. In Panel A, consistent with our predictions, we find that borrowers' future risk is increasing in the proportion of low performance-sensitivity covenants in the loan contract borrowers' future risk (coefficients of 0.306, 5.66, 1.71, and 24.52 with t-statistics of 5.07, 3.20, 2.40, and 3.45 in columns (1) through (4), respectively).[24,25] To gauge the economic magnitude of this relation, the coefficient in column (1) implies that a one standard deviation increase in the proportion of low

[23] We include historical borrower risk (i.e., the lagged dependent variable), which would have been observable and should have been known to and considered by lenders when negotiating the new loan, because our objective is to assess whether the covenant mix in borrowers' debt contracts explain subsequent changes in borrowers' risk. As Armstrong et al. (2010) discuss, including the lagged dependent variable not only allows our coefficient estimates to primarily capture within-borrower (i.e., time-series) variation in risk, but also—and arguably equally importantly—imposes fewer constraints than does a change specification (i.e., it does not constrain the coefficient on the lagged dependent variable to be −1). In untabulated analyses, we omit the lagged dependent variable and use the change in or level of risk as the dependent variable. We find very similar inferences under these alternative specifications, suggesting that our tabulated results are not an artifact of including the lagged dependent variable as a control.

[24] We also examine the robustness of our findings using a propensity score matching approach, which assumes no functional form between borrowers' observable characteristics and future risk. Specifically, we estimate contract-level propensity scores for whether the contract includes at least one low performance-sensitivity covenant based on a probit regression using the control variables in Table 4, Panel A as predictors. We then use these estimated propensity scores to form a matched sample using nearest-neighbor matching (without replacement) and a caliper of 0.5, and re-estimate Equation (3a) using this matched sample. This obtained matched sample shows no significant differences between treated (contracts with at least one low performance-sensitivity covenant) and control (contracts without any low performance-sensitivity covenants) observations, and our inferences are robust to this alternative design (untabulated).

[25] We also examine an alternative specification in which we use *% high performance-sensitivity covenants* as the primary variable of interest and find our inferences are robust to this alternative model (untabulated).

TABLE 4

Associations between Debt Contract Provisions and Future Risk

Panel A: Percentage of Low Performance-Sensitivity Covenants

	Risk factor$_{t+1}$ (1)	*Asset volatility*$_{t+1}$ (2)	*R&D / Lagged Assets*$_{t+1}$ (3)	*ln(SD ROA)*$_{t+1}$ (4)
% ***low performance-sensitivity covenants***	**0.306*****	**5.657*****	**1.711****	**24.521*****
	(5.07)	**(3.20)**	**(2.40)**	**(3.45)**
Nr of financial covenants	−0.024***	−0.840***	−0.172***	−2.368***
	(−3.23)	(−3.59)	(−3.36)	(−2.74)
Size	0.017**	0.025	0.01	−1.869**
	(2.12)	(0.11)	(0.21)	(−2.00)
Book to market	0.000	0.805	−0.274***	−2.01
	(0.01)	(1.30)	(−3.00)	(−0.99)
Leverage	0.003	−12.827***	−0.899***	−16.830***
	(0.07)	(−7.13)	(−3.90)	(−3.29)
Z-score	0.031***	1.494***	−0.306***	2.964**
	(2.59)	(4.04)	(−4.00)	(2.41)
Cash flow to sales	0.003	−0.256	−0.235	−0.49
	(0.20)	(−0.33)	(−1.43)	(−0.46)
Stock return	−0.062***	−0.859**	−0.185**	−2.173
	(−4.83)	(−2.13)	(−2.27)	(−1.62)
Return on assets	−0.367***	−26.331***	0.105	2.052
	(−3.05)	(−6.49)	(0.11)	(0.20)
Nr of performance pricing	−0.006	−0.056	−0.041	−1.633*
	(−0.79)	(−0.27)	(−1.10)	(−1.88)
Nr of sweep	−0.018***	−0.435***	−0.026	−1.850***
	(−4.06)	(−3.39)	(−1.20)	(−3.60)
Dividend restriction	0.027**	0.632	0.065	0.6
	(1.98)	(1.52)	(0.81)	(0.37)
Probability of covenant violation	−0.023	0.094	−0.349***	1.984
	(−1.31)	(0.18)	(−3.13)	(0.92)
Loan size (ln)	−0.092***	−3.087***	−0.212***	−4.908***
	(−9.82)	(−10.98)	(−3.59)	(−4.45)
Loan maturity (ln)	−0.016	−1.504***	0.045	−0.289
	(−1.21)	(−3.49)	(0.62)	(−0.21)
Loan spread (ln)	0.028**	1.336***	0.107*	6.268***
	(2.17)	(3.50)	(1.67)	(4.13)
Secured	0.015	0.997**	−0.004	4.270**
	(1.00)	(2.30)	(−0.06)	(2.25)
Nr of banks per package	0.004***	0.155***	0.006	0.317***
	(3.80)	(5.02)	(0.93)	(2.79)
Lagged *Risk factor*	0.686***			
	(50.97)			
Lagged *Asset volatility*		38.971***		
		(17.33)		
Lagged *R&D / Lagged Assets*			63.352***	
			(17.94)	
Lagged *ln(SD ROA)*				64.244***
				(50.45)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

(continued on next page)

TABLE 4 (continued)

	Risk factor$_{t+1}$ (1)	*Asset volatility*$_{t+1}$ (2)	*R&D / Lagged Assets*$_{t+1}$ (3)	*ln(SD ROA)*$_{t+1}$ (4)
Observations	8,956	8,956	8,956	8,956
Adjusted R^2	0.729	0.540	0.667	0.642

Panel B: Number of High, Medium, and Low-Performance Sensitivity Covenants

	Risk factor$_{t+1}$ (1)	*Asset volatility*$_{t+1}$ (2)	*R&D / Lagged Assets*$_{t+1}$ (3)	*ln(SD ROA)*$_{t+1}$ (4)
Nr of low performance-sensitivity covenants	**0.075*****	**1.053**	**0.298***	**6.168****
	(3.15)	**(1.39)**	**(1.71)**	**(2.32)**
Nr of high performance-sensitivity covenants	**−0.048*****	**−1.546*****	**−0.243*****	**−4.503*****
	(−5.80)	**(−6.12)**	**(−4.05)**	**(−4.59)**
Nr of medium performance-sensitivity covenants	0.002	0.115	−0.112	−0.069
	(0.21)	(0.33)	(−1.46)	(−0.05)
Firm controls and lagged dependent variable	Yes	Yes	Yes	Yes
Loan contract controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	8,956	8,956	8,956	8,956
Adjusted R^2	0.729	0.542	0.666	0.643

Panel C: Probability of Covenant Violations and Percentage of Low Performance-Sensitivity Covenants

	Risk factor$_{t+1}$					
Threshold Used to Partition Loans into Low/High Probability of Covenant Violation	**20% (More Lenient)**		**50%**		**80% (Less Lenient)**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Low	**High**	**Low**	**High**	**Low**	**High**
% low performance-sensitivity covenants	0.235***	**0.390*****	0.206***	**0.424*****	0.200***	**0.499*****
	(2.86)	**(4.16)**	(2.74)	**(4.19)**	(2.87)	**(4.32)**
Difference in coefficients (High – Low)		**0.155**		**0.218***		**0.299****
[Probability (p-value)]		**[0.213]**		**[0.081]**		**[0.023]**
Nr of financial covenants	−0.018*	−0.034***	−0.017*	−0.033***	−0.017*	−0.037***
	(−1.73)	(−3.13)	(−1.84)	(−2.68)	(−1.95)	(−2.71)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,285	3,668	6,049	2,903	6,563	2,392
Adjusted R^2	0.749	0.707	0.748	0.699	0.75	0.684

*, **, *** Indicate statistical significance (two-sided) at the 0.1, 0.05, and 0.01 levels, respectively.
This table presents the estimation results from regressing borrower future risk on the covenant mix (*% low performance-sensitivity covenants*) and other borrower and loan contract characteristics, as specified in each panel. The main independent variable in Panel A and Panel C is the percentage of low performance-sensitivity covenants, whereas Panel B presents estimation results using the number of high, medium, and low-performance sensitivity covenants. Panel C presents results estimated after partitioning the sample according to each loan's probability of having a covenant violated (low versus high), as calculated by Demerjian and Owens (2016). Loans with more than 20 (50, 80) percent probability of violation are considered to have high probability of default in column (2) (column (4), column (6)). Difference in coefficients computes the difference between the *% low performance-sensitivity covenants* coefficients estimated in the Low and High partitions. Coefficients for columns (2), (3), and (4) in Panels A and B are multiplied by 100 to improve readability. Industry (two-digit SIC code), year fixed effects, and constant are included but not tabulated to save space. Standard errors are calculated based on clustering by borrower. t-statistics are in parentheses.
All variables are defined in Appendix A.

performance-sensitivity covenants corresponds to 0.05 standard deviation increase in our risk factor measure (obtained as $0.306 \times 0.14 / 0.94$). This economic magnitude is roughly comparable to that of a one standard deviation change in size (which corresponds to a 0.04 standard deviation increase in risk), which has been shown to be an important determinant of firms' risk profiles (e.g., Coles et al. 2006). Consistent with prior research, we also find that the number of covenants exhibits a significant negative relation with borrowers' future risk profile (Fu and Zhang 2011).

We find similar results when we use the *number* of covenants within each performance-sensitivity classification (Panel B). For example, in column (1), we find a coefficient of 0.075 (t-statistic of 3.15) for the number of low performance-sensitivity covenants and a coefficient of −0.048 (t-statistic of −5.80) for the number of high performance-sensitivity covenants. Overall, our findings in Table 4 are consistent with covenant mix reflecting borrowers' pre-contractual private information about their future risk profile.[26]

In addition, to distinguishing between borrowers according to their risk profiles, it is possible that covenant mix could also serve to separate borrowers with higher and lower future expected performance. For example, borrowers with higher expected performance might find high performance-sensitivity covenants less costly compared to borrowers with lower expected performance. Likewise, if borrowers with different risk profiles systematically differ in expected performance, a natural byproduct of sorting on risk would be to also sort borrowers according to these differences. That said, sorting on expected performance might be more easily and directly accomplished by altering (and inducing variation in) covenant thresholds for specific performance measures (e.g., Li et al. 2016). In contrast, it is more difficult to sort on risk using such variation in performance thresholds (or other contractual features) because there is no analogous readily contractable performance measure for risk (e.g., Smith and Warner 1979; Armstrong et al. 2010). In untabulated analyses, we test whether the covenant mix variables we consider are able to explain future performance in addition to risk. We find little evidence that covenant mix conveys information about future performance, as both low and high performance-sensitivity sets of covenants show either a positive or insignificant (in most cases) relation with future performance. These results, together with our results regarding risk, suggest that covenant mix is particularly useful for eliciting information about borrowers' future risk profile rather than performance.

Covenant Slack

We next examine whether the relations we find in Table 4 depend on the initial slack in these covenants. Our empirical predictions are based on the idea that the expected cost of covenant violations varies between different types of borrowers. Thus, covenants with a relatively high probability of violation are more likely to be useful for screening compared to covenants with a relatively low probability of violation. We therefore expect the relations between covenant mix and risk to be more pronounced among firms with higher probabilities of covenant violation.

We test this prediction by estimating a variation of Equation (3a) in which we split the sample according to different thresholds of the loan's probability of covenant violation—specifically, 20 percent, 50 percent, and 80 percent (measured following Demerjian and Owens 2016). Table 4, Panel C reports the results. We find a stronger relation between covenant mix and borrowers' future risk profile when the probability of covenant violation is higher (i.e., using 50 percent and, especially 80 percent thresholds), consistent with the importance of expected covenant violation costs and, specifically, tighter covenants allowing covenant mix to serve as a more effective screening mechanism for borrowers' future risk profile.

V. SCREENING VERSUS INCENTIVE EFFECTS

Our predictions are based on borrowers' covenant choices revealing pre-contractual information about their future risk profile. However, another potential explanation for our findings is that different covenant structures may provide borrowers with different incentives. For example, prior studies highlight how covenants might influence the actions (i.e., incentives) of borrowers even before violation (e.g., Nini et al. 2009, who examine borrowers' investment policies). In this section, we explore this possibility with respect to borrowers' risk. Specifically, covenants with high performance-sensitivity might discourage risk-taking because they penalize borrowers for negative outcomes. In contrast, covenants with low performance-sensitivity are unlikely to prevent—and may even *encourage*—risk-taking.[27]

[26] An alternative specification for Equations (3a) and (3b) would be to set the percentage (or number) of covenants as the dependent variable and include our future risk measures as independent variables. In untabulated analyses, we estimate this alternative specification and find very similar results, consistent with our prediction that different types of covenants convey contrasting information about future risk.

[27] For example, Keppo and Korte (2016) find evidence of this phenomenon at banks in response to the Volcker Rule. More broadly, covenants with low performance-sensitivity could encourage borrowers to increase risk due to limited liability (i.e., risk-shifting). Constraints on liquidity can limit investment *amount* (e.g., Fazzari and Petersen 1993; Lamont 1997; Rauh 2006; Adelino, Lewellen, and Sundaram 2015; J. Lewellen and K. Lewellen 2016), which could prompt borrowers to increase investment *risk*, assuming a positive relation between risk and expected return.

Superseded Loan Contracts

The first research design that we use to differentiate between the incentive and screening effects of covenant heterogeneity on risk relies on time-series variation in loan contracts. Borrowers and lenders frequently renegotiate their loan contracts, resulting in new (or amended) contracts that supersede the borrower's previous loan (Roberts and Sufi 2009a).[28] As a result, the mix of enforceable covenants in borrowers' loan contracts often changes over time.

We conduct two tests based on these time-series changes in borrowers' covenant mix. For our first test, we differentiate between covenants present in the borrower's current loan contract ("current" covenants), and covenants present in the borrower's previous loan contract ("superseded" covenants). This test is based on the idea that the superseded covenants have been replaced and are no longer being enforced, so they should have no effect on the borrower's future risk-taking incentives. In contrast, current covenants are still enforceable and are likely to capture a mix of screening and incentives.[29] Conditional on the covenants present in the borrower's current loan contract, any relation between superseded covenants and future risk should primarily reflect screening.[30] Based on this reasoning, we estimate the following model:

$$Risk_{i,t+k} = \alpha_0 + \alpha_1 \%\, Current\ low\ performance\ sensitivity_{i,t} + \alpha_2 \%\, Superseded\ low\ performance\ sensitivity_{i,t} + \beta Controls_{i,t,t-1} + \varepsilon_{i,t} \quad (4a)$$

for loan (package) i in year t and *Risk* is our risk factor measure described above. % *Current low performance sensitivity* is the number of low performance-sensitivity covenants in the borrower's current loan package, scaled by the total number of covenants in the current package, and % *Superseded low performance sensitivity* is the number of low performance-sensitivity covenants in the borrower's previous loan package, scaled by the total number of covenants in the previous package. Similar to Equation (3a), we also include controls for the total number of covenants in the current and superseded loan contracts. To allow a comparison between the coefficients α_1 and α_2, we standardize each sensitivity variable by subtracting the sample mean and dividing by the standard deviation. To avoid capturing shifts in borrower risk profile over time, we limit the temporal distance between contracts to three years. Similarly, we require at least one year between a borrower's successive loan contracts since we start measuring risk one year-ahead. To account for the possibility that the incentive effects of covenants may take time to manifest, we estimate Equation (4a) for risk measured one, two, and three years from the contract date. Finally, to rule out the possibility that our results reflect borrowers that are simultaneously subject to the provisions in both a new and an existing loan, our tests in this section exclude loans that DealScan explicitly codes as deals that are not refinancings, amendments, or renegotiations.

We report the results from estimating Equation (4a) in Table 5, Panel A. We find a positive and significant coefficient for α_2 (i.e., superseded contracts). Because these contracts have been replaced and are no longer in effect, they should not affect borrowers' current or future incentives. As explained further below, the most likely explanation for this finding is that these covenants capture borrowers' inherent risk profiles. This finding also helps to differentiate our theoretical framework and results from the incomplete contracting framework examined in previous studies (e.g., Christensen and Nikolaev 2012). In particular, the incomplete contracting framework depends on the contract continuing to be enforceable and/or subject to renegotiation. Thus, our finding that covenants that are no longer in effect (and in many cases, have not been in effect for several years) continue to explain borrowers' future risk suggest that screening represents another important function of covenant heterogeneity, in addition to its role grounded in incomplete contracting.

[28] See Appendix B for examples of renegotiations and refinancings that result in superseded loan contracts.

[29] Superseded and current contracts might have similar screening effects. If that is the case, a significant relation between current covenants and future risk may primarily capture incentives, as screening will be "partialed out" by the inclusion of superseded contracts. Current contracts may also have a stronger screening effect than superseded contracts if these contracts reflect a more recent perspective on borrowers' future risk profile. In this case, the relation between current covenants and future risk is difficult to interpret, as it could capture either incentives or screening. Our identification strategy infers the presence screening effects, rather than incentives, by interpreting the % *Superseded low performance sensitivity* coefficient in Equation (4a).

[30] An important assumption for this design is that the screening implications for debt contracts are similar over time (e.g., for risk measured in $t+1$, a contract signed at $t-2$ has similar implications as a contract signed at t). To help validate this assumption, in untabulated analyses we estimate modified versions of Equations (3a) and (3b) where we measure risk at $t+2$ or $t+3$ instead of $t+1$. We continue to find a significant positive relation between the percentage (or number) of low performance-sensitivity covenants and future risk for these longer horizons, supporting the assumption that loan contracts signed several years in the past provide similar screening implications as more recently signed contracts.

TABLE 5

Screening versus Incentives: Evidence from Past Contracts

Panel A: Current versus Superseded Covenants

	Risk factor		
	***t*+1**	***t*+2**	***t*+3**
% *Current low performance-sensitivity covenants*	0.013	0.028	0.067***
	(0.83)	(1.47)	(3.12)
% ***Superseded low performance sensitivity***	**0.048*****	**0.075*****	**0.053*****
	(3.58)	**(4.61)**	**(2.94)**
Nr of current financial covenants	−0.026**	−0.035***	−0.031**
	(−2.21)	(−2.63)	(−2.07)
Nr of superseded financial covenants	0.004	0.003	0.006
	(0.39)	(0.28)	(0.41)
Firm controls and lagged dependent variable	Yes	Yes	Yes
Loan contract controls	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	4,268	4,268	3,957
Adjusted R^2	0.700	0.652	0.641

Panel B: Incremental versus persistent Covenants

	Risk factor		
	***t*+1**	***t*+2**	***t*+3**
% *Incremental low performance-sensitivity covenants*	0.005	0.022**	0.042***
	(0.66)	(1.98)	(3.67)
% *Persistent low performance-sensitivity covenants*	0.042***	0.066***	0.082***
	(3.59)	(4.89)	(5.49)
Nr of incremental covenants	−0.013	−0.023	−0.031
	(−0.71)	(−1.11)	(−1.43)
Nr of persistent covenants	−0.026**	−0.036***	−0.028*
	(−2.36)	(−2.65)	(−1.79)
Difference between coefficients	**[0.037***]**	**[0.044***]**	**[0.040**]**
Firm controls and lagged dependent variable	Yes	Yes	Yes
Loan contract controls	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	4,268	4,268	3,957
Adjusted R^2	0.698	0.651	0.638

*, **, *** Indicate statistical significance (two-sided) at the 0.1, 0.05, and 0.01 levels, respectively.
This table presents the estimation results from regressing future risk (*Risk factor*) on the covenant mix found in new and superseded loan contracts. Panel A reports results using the percentage of low performance-sensitivity covenants in new and superseded loan contracts (% *Current low performance-sensitivity covenants* and % *Superseded low performance sensitivity*, respectively). Panel B reports results using the number of low performance-sensitivity covenants common to both superseded and new loan contracts, divided by the number of financial covenants in the new contract (% *Persistent low performance-sensitivity covenants*) and the percentage of covenants only found in the new contract (% *Incremental low performance-sensitivity covenants*). Firm and Loan contract controls are the same as those used in Table 4, Panel A. Industry (two-digit SIC code) and year fixed effects are included but not tabulated to save space. Standard errors are calculated based on clustering by borrower. t-statistics are in parentheses.
All variables are defined in Appendix A.

It is important to recognize that the existence of a new loan represents a choice by the borrower and lender, which could reflect a variety of changes in circumstances. However, we do not believe these considerations significantly limit or affect the interpretation of this test, as superseded covenants were established prior to the realization of any

circumstances that could have prompted a refinancing or renegotiation. Thus, although a loan contract may not have been exogenous at the time it was signed, it becomes increasingly "exogenous" with respect to the current contracting environment as time passes and information unfolds.[31]

To help alleviate this concern, we estimate the tests in Table 5 after limiting our sample to loans for which the loan stated purpose (e.g., supplying working capital or repaying debt) is the same for both the new and previous (i.e., superseded) contracts. We continue to find the same inferences within this sample, which eliminates—and, thus, indicates our results are not attributable to—renegotiations or refinancings for which there is an observable change in the borrower's intended use of the loan proceeds.

Our findings in Table 5 also show that the relation between the current covenant mix and future risk strengthens as the time horizon increases and becomes significant in year t+3, suggesting that the risk-taking incentives from covenants may take some time to appear in our risk profile measure. However, we do not believe this delayed incentive explanation is responsible for our findings with respect to superseded contracts, as coefficients for superseded contracts are similar at each time horizon considered. Although a significant coefficient for superseded covenants at any particular horizon could be explained by an incentive effect with respect to previously taken actions, this relation would likely diminish over time as the superseded contract becomes increasingly distant. Thus, our finding of a constant coefficient over time for superseded contracts suggests that incentives are unlikely the primary driver of the relation between superseded covenant mix and risk.[32]

Another potential concern with our analysis in Table 5, Panel A is that there is a high correlation between current and superseded covenant structures (about 64 percent in our sample), which could lead to spurious correlations. That said, there are three reasons we do not believe this high correlation is responsible for our findings. First, a variance inflation factor (VIF) test does not indicate that multicollinearity is a cause for concern in our analyses.[33] Second, if this high correlation introduced bias or excessive noise into our estimates, we would expect attenuation for both the current and superseded coefficients, rather than a systematic effect for only one of the two. Finally, as discussed below, we estimate an alternative specification (in Table 5, Panel B) that does not suffer from this issue and yields very similar inferences.

Our second design differentiates between covenants present in both the borrower's current and previous contract ("persistent" covenants), and covenants that are present only in the borrower's current contract ("incremental" covenants). We then examine the relation between persistent and incremental covenants and borrowers' future risk.

The intuition for this design is that a borrower's "type" (i.e., its innate risk-taking intentions) is unlikely to change radically in the short-run (one to three years, for our tests), and therefore the relation between persistent covenants and borrowers' future risk could capture both incentives (if the covenants affect borrowers' behavior) and screening (if different types of borrowers tend to select different types of covenants). However, the screening component of the relation between covenant mix and borrowers' risk profiles should be relatively sticky over time. Therefore, changes in the covenant mix (i.e., incremental covenants) most likely represent a change in borrowers' incentives.[34] Thus, the *difference* in the relation between the borrower's persistent and incremental covenant mix and future risk should capture screening. Based on this reasoning, we estimate the following model:

$$\begin{aligned} Risk_{i,t+k} = {} & \alpha_0 + \alpha_1 \%\, Incremental\ low\ performance\ sensitivity_{i,t} \\ & + \alpha_2 \%\, Persistent\ low\ performance\ sensitivity_{i,t} + \beta Controls_{i,t,t-1} + \varepsilon_{i,t} \end{aligned} \tag{4b}$$

for loan (package) i in year t. *Risk* is our condensed measure of risk taking (*Risk factor*). % *Incremental low performance sensitivity* is the number of incremental low performance-sensitivity covenants (i.e., covenants present in the new contract but not in the superseded one), scaled by the total number of covenants in the loan package. % *Persistent low performance sensitivity* is the number of persistent low performance-sensitivity covenants (i.e., covenants present in both the new and the superseded loan contracts), also scaled by the total number of covenants in the package. Similar to

[31] This notion that previously signed contracts become increasingly exogenous with respect to current conditions as time passes is also common in the executive compensation literature (e.g., Shue and Townsend 2017). We also note that renegotiation is very common in debt contracting, occurring in nearly two-thirds of loan contracts (Roberts and Sufi 2009b). Hence, we believe it is reasonable to characterize refinancings and renegotiations as routine events that often result in changes in borrowers' covenant structures, rather than unusual occurrences typically triggered by significant changes in borrowers' condition or expectations.

[32] To further address this issue, we also separately estimate Equation (4a) with R&D, rather than our risk factor measure, as the dependent variable. As noted above, compared to the other two components of our risk factor, R&D more directly captures current risk-taking actions, as opposed to risk profile more broadly. We continue to find a positive and significant coefficient for superseded contracts for each year from t+1 to t+3 (untabulated), which provides additional evidence that our results in Table 5, Panel A are not purely capturing the delayed effects of the borrower's actions while the superseded contract was still in effect.

[33] The VIFs for our current and superseded contract measures are approximately 2.3, which is significantly smaller than many other variables in the regression (e.g., firm size has a VIF of 6.6) and the common rule of thumb that a VIF over 10 indicates cause for concern.

[34] The intuition for this research design is similar to that of the analysis that Nini et al. (2009) use to attempt to isolate the incentive effect of capital expenditure covenants.

Equation (4a), we include controls for the total number of incremental and persistent covenants in the loan contract, and we standardize each covenant performance sensitivity variable by subtracting the sample mean and dividing by the standard deviation. Likewise, we also continue to limit the temporal distance between contracts to three years, require at least one year between a borrower's successive loan contracts since we start measuring risk one year-ahead, and estimate Equation (4b) for risk measured one, two, and three years from the contract date.

We report the results from estimating Equation (4b) in Table 5, Panel B. As discussed above, the coefficient α_1 captures primarily the incentive effect, whereas the coefficient α_2 captures both incentive and screening effects. The difference $\alpha_2 - \alpha_1$ therefore measures the relation between borrowers' covenant mix and future risk attributable to screening effects. In each of the three years following the contract signing, we find that α_2 is significantly positive, consistent with our previous results that borrowers with a greater proportion of low performance-sensitivity covenants tend to take more future risk. In contrast, α_1 is not significantly different from 0 in year t+1 but becomes increasingly positive and significant in subsequent years. This finding is consistent with our inference from Panel A that covenants may also affect borrowers' risk-taking incentives but that this effect may take some time to materialize. Finally, we find that the difference $\alpha_2 - \alpha_1$ is significant and positive in each year, consistent with screening effects explaining a substantial portion of the overall relation between covenant mix and future risk profile in our previous results. Overall, the results in Panel B provide additional evidence that screening is a significant factor explaining our previous findings of a positive relation between borrowers' mix of low performance-sensitivity covenants and future risk profile.[35]

To provide additional evidence that our findings in Table 5, Panel B reflect screening, we also examine how the relation between incremental and persistent covenants and borrowers' future risk varies with the length of the time between the previous and current loan contract. The idea behind this test is that the monitoring function of covenants should not vary with this time lag between contracts, as covenants provide incentives regardless of when they are implemented. However, older contracts are likely less informative about the borrower's future risk profile (or type) due to greater potential scope for changes in borrower type since the contract was signed. Therefore, if persistent covenants primarily provide incentives rather than screening, the relation between borrowers' risk profile and persistent covenants should be independent of the time lag between contracts. In contrast, if the relation also reflects screening, the relation should diminish as the time between contracts grows larger.

In untabulated analyses, we find that, consistent with a nontrivial screening component for persistent covenants, the relation between borrowers' future risk and persistent covenants becomes significantly weaker as the time between the current and previous contract grows larger. In addition, consistent with incremental covenants primarily capturing incentives, we find that the relation between borrowers' future risk profile and incremental covenants does not vary with the length of time between the current and previous loan contract.[36]

Post-Contractual Covenant Slack

Our third set of tests uses variation in post-contractual covenant slack (i.e., the difference between the covenant threshold and the borrower's actual value of the accounting ratio underlying the covenant) as an alternative way to isolate the importance of incentives compared to screening in explaining the relation between covenant mix and future risk. The intuition is that covenants should only provide meaningful incentives to the extent that they impose binding constraints on borrowers. Thus, tighter covenants should provide stronger incentives than looser covenants. Notably, as time passes from the signing of the contract, variation in post-contractual covenant slack tends to become more exogenous to the risk profile that borrowers had at the signing of the contract, as the precise evolution of the accounting metric underlying each covenant is hard to foresee. Thus, post-contractual slack can help isolate an incentive effect of loan covenants on risk-taking intentions.

Specifically, we examine whether financial covenants that become tight in the years following the loan contract signing exhibit a similar relation with borrowers' future risk, compared to financial covenants that are relatively loose. Evidence of a similar relation for both tight and loose covenants would suggest that incentives are unlikely to fully explain the relation between covenant mix and future risk. Conversely, a finding that the relation between covenant mix and risk intensifies when covenants become tighter would support an incentive role of covenants. Given that we are

[35] Similar to our analysis of current and superseded covenants above, we also estimate an alternative specification of Equation (4b) in which we use R&D, rather than our risk factor measure, as the dependent variable (untabulated). We continue to find a positive and significant coefficient for persistent covenants but no statistically significant relation for incremental covenants. This finding persists through year t+3, suggesting that this pattern of results does not simply reflect covenant-based incentives taking time to materialize in observable actions.

[36] We perform a similar analysis in our design based on current and superseded contracts. Based on the reasoning above, the relation between borrowers' future risk profile and superseded covenants should decrease as the length of time between the current and superseded contract increases, whereas the relation between risk and current covenants should be independent of this time gap. The results (untabulated) are consistent with these predictions.

interested in the differential effect that low and high performance-sensitivity covenants have on future risk, we examine the variation in post-contractual covenant slack for each group of covenants. To minimize measurement error and keep the analysis tractable, we only focus on the two extremes of our continuum of covenants: coverage covenants and liquidity covenants (i.e., high- versus low-sensitivity covenants).[37] Moreover, to ensure that the variation in the post-contractual covenant slack would have been largely unanticipated by borrowers, we exclude years in which borrowers initiate new loans. This exclusion ensures that there is at least a two-year gap between when the covenants take effect and when we measure borrowers' risk-taking decisions, which is similar to the timing convention used by studies in the executive compensation literature (e.g., Shue and Townsend 2017).

We start by measuring post-contractual slack for each covenant. We follow Demerjian and Owens (2016) to compute the accounting measure underlying each covenant ratio and data from DealScan on initial and final covenant threshold values to determine covenant thresholds.[38] We then classify each covenant as having either high, medium, or low post-contractual slack based on the difference between the actual value and the covenant threshold.[39] One potential concern with our strategy is that borrowers may change their risk in response to changes in the fundamental value of the measure on which each covenant is based (e.g., the interest coverage ratio), rather than in response to changes in covenant slack. In this case, the fundamental value of the measure would represent an omitted variable that causes changes in *both* covenant slack and borrowers' risk and would therefore result in biased estimates. To address this concern, we employ a matching procedure similar to Demiroglu and James (2010) in which we match borrowers based on the *future* realized value of the measure on which each covenant is based. Specifically, we first sort each borrower-year observation into "ratio terciles" according to the actual value of their underlying contractual measure (e.g., high, medium, or low actual current ratio for current ratio covenants). Then, within each industry-year-ratio tercile, we classify covenants as high, medium, or low slack according to whether their slack is in the top, middle, or bottom third of observations in that industry-year-ratio tercile.

After classifying each covenant as having high, medium, or low post-contractual covenant slack, we estimate the following model:

$$Risk_{b,t+1} = \alpha_0 + \beta covenant\ post\text{-}contractual\ slack_{i,t} \otimes covenant\ type_i + \gamma Controls_{j,t,t-1} + \varepsilon_{j,t} \quad (5)$$

for borrower b, loan (package) i in year t. To avoid including superseded contracts, we only include the newest contract that each borrower has in a given year. Therefore, our unit of measurement is at the borrower-year level. *Covenant post contractual slack* is a vector that contains three indicator variables: high, medium, and low post-contractual slack. *Covenant type* is a vector of indicator variables that identify liquidity (low performance-sensitivity) or interest coverage (high performance-sensitivity) covenants. $\otimes$ is the Cartesian product of the two variables, which yields six ($=3 \times 2$) main independent variables of interest. *Controls* is the usual vector of controls plus the value of the accounting ratio on which each covenant is based.

We report the results in Table 6, column (1). We find a significant negative (positive) relation between high (low) performance-sensitivity covenants and future risk even among covenants with the greatest post-contractual slack (*High covenant post-contractual slack*), consistent with these covenants conveying information about borrowers' future risk even in the absence of incentives. We also find that that these relations become stronger as covenant slack decreases, suggesting that our previous findings are not *entirely* due to screening (i.e., different types of covenants also affect borrowers' behavior in different ways).

An important assumption for this analysis is that high-slack covenants have little effect on borrowers' incentives. To the extent that high-slack covenants do still alter borrowers' incentives, this research design could mistakenly attribute these incentive effects to screening. Thus, to provide additional support for the validity of our inferences, we also estimate an alternative specification of Equation (5) in which we differentiate between deciles, rather than terciles, of covenant slack. Although it is possible that even relatively loose covenants (e.g., top-tercile slack) may still influence

[37] Specifically, for these tests we define *Low performance-sensitivity covenants* as current ratio covenants or, if a contract has no current ratio covenants, as quick ratio covenants. Similarly, we define *Low performance-sensitivity covenants* as interest coverage covenants, interest cash coverage covenants (if a contract has no interest coverage covenant), and fixed charge coverage covenants (if a contract has neither of the prior two covenants).

[38] We assume linear changes over the contract term. For example, the threshold for a liquidity covenant that has an initial ratio of 2 and a final ratio of 4 with a maturity of four years is assumed to increase by 0.5 each year. We exclude from our sample covenants that DealScan reports as having "fluctuating" thresholds.

[39] We consider covenants where the covenant threshold is greater than 100 percent of the actual value of the accounting ratio as violated and, therefore, providing no incentives. Accordingly, we set these observations to 0.

TABLE 6

Screening versus Incentives: Evidence from Covenant Slack

Post-Contractual Slack Partition	*Risk factor*$_{t+1}$		Difference from High Slack	
	Terciles (1)	Deciles (2)	Terciles (3)	Deciles (4)
Low performance-sensitivity covenants				
High covenant post-contractual slack	**0.053****	**0.050***	—	—
	(2.03)	**(1.72)**		
Medium covenant post-contractual slack	**0.115*****	**0.281*****	[0.062*]	[0.231***]
	(3.28)	**(4.01)**		
Low covenant post-contractual slack	**0.186*****	**0.260****	[0.133***]	[0.21*]
	(3.77)	**(2.39)**		
High performance-sensitivity covenants				
High covenant post-contractual slack	**−0.056*****	**−0.041***	—	—
	(−2.72)	**(−1.90)**		
Medium covenant post-contractual slack	**−0.089*****	**−0.110*****	[−0.03***]	[−0.07***]
	(−4.20)	**(−4.21)**		
Low covenant post-contractual slack	**−0.107*****	**−0.110*****	[−0.05***]	[−0.07**]
	(−4.73)	**(−3.35)**		
Other controls				
Coverage Ratio	0.015*	0.014*		
	(−0.38)	(−3.89)		
Liquidity Ratio	0.676***	−0.026		
	(4.06)	(−0.58)		
Firm controls and lagged dependent variable	Yes	Yes		
Loan contract controls	Yes	Yes		
Industry FE	Yes	Yes		
Year FE	Yes	Yes		
Observations	10,785	10,785		
Adjusted R^2	0.717	0.718		

*, **, *** Indicate statistical significance (two-sided) at the 0.1, 0.05, and 0.01 levels, respectively.
This table presents the estimation results from regressing future risk (*Risk factor*$_{t+1}$) on a set of Low and High performance-sensitivity covenants with post-contractual slack with different degrees of tightness (high, medium, and low), along with other borrower and loan contract characteristics, as specified in the table. Columns (1) and (2) report the regression results. Column (3) reports in brackets the difference between the coefficients for high slack and medium and low slack in column (1). Column (4) reports in brackets the difference between the coefficients for high slack and medium and low slack in column (2). Those differences in coefficients are computed from the *High covenant post-contractual slack*, which acts as the baseline. Firm and Loan contract controls are the same as those used in Table 4, Panel A. Industry (two-digit SIC code) and year fixed effects are included but not tabulated to save space. Standard errors are calculated based on clustering by borrower. t-statistics are in parentheses. All variables are defined in Appendix A.

borrowers' incentives, it is less likely for these covenants to provide incentives as slack becomes increasingly loose (e.g., top-decile).

We report results from this alternative specification in Table 6, column (2).[40] We find very similar inferences from this specification: namely, there are significant relations between covenant type and future risk profile even among the loosest covenants, and significantly stronger relations as covenant slack tightens. The magnitude of the coefficient for the loosest covenants is also similar in both specifications. Although we cannot completely rule out that there is still an incentive effect even when covenants are least binding (i.e., top-decile slack), these findings provide some additional assurance that our results are not simply capturing incentive effects from relatively loose covenants.

[40] For parsimony, we only report coefficients for deciles 1, 5, and 10 of covenant slack, which we label as high, medium, and low slack, respectively. The remaining deciles are also included in the model but not tabulated.

Taken as a whole, the results in this section provide consistent evidence that screening is an important factor explaining the different relations we find between different covenant types and borrowers' future risk profiles. However, screening is unlikely to be solely responsible for these relations, as we also find evidence that different types of covenants affect borrowers' future risk-taking incentives in different ways. Collectively, our findings suggest that covenant heterogeneity can serve a valuable screening role for lenders evaluating prospective borrowers, in addition to the monitoring role of covenant heterogeneity that prior research examines.

VI. CONCLUSION

We provide evidence that a substantial amount of covenant heterogeneity arises from lenders' efforts to screen prospective borrowers based on their private information about their future risk profiles. Based on intuition from contract design models in the labor economics and insurance literatures, we argue and find evidence that riskier borrowers tend to agree to contracts with covenants that are less influenced by future performance, whereas safer borrowers tend to agree to covenants that are more performance-based. Given that these relations could arise from either screening or incentive explanations (or both), we conduct several tests to distinguish between these alternatives. Across multiple research designs and identifying assumptions, our findings indicate that screening accounts for a significant portion of the overall relation.

Our findings highlight how lenders can use different types of debt covenants—which manifests empirically as covenant heterogeneity—to elicit borrowers' pre-contractual private information about their future risk. Thus, in addition to the incentive-based explanations for covenant heterogeneity emphasized in prior empirical studies (e.g., Chava, Kumar, and Warga 2010; Demerjian 2011; Christensen and Nikolaev 2012), covenant heterogeneity also appears to provide a screening mechanism for lenders (or other parties) to identify differences in borrowers' risk profiles. Collectively, our findings answer recent calls in the debt-contracting literature for an explanation behind the observed heterogeneity in financial covenants and its role in improving loan contract efficiency (Skinner 2011, 206; Christensen et al. 2016).

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APPENDIX A

Variable Definitions

Variables	Definition
Nr of banks per package	Number of banks participating in the loan syndication.
Risk factor	The first factor from a principal component factoring of *Asset volatility*, *R&D / Lagged Assets*, and *ln(SD ROA)*.
Nr of financial covenants	Number of financial covenants measured at the loan package.
Nr of low performance-sensitivity covenants	Number of financial covenants with low performance-sensitivity, defined as covenants based on "Min. Quick Ratio" or "Min. Current Ratio."
Nr of high performance-sensitivity covenants	Number of financial covenants with high performance-sensitivity, defined as covenants based on coverage ratios, ("Min. Cash Interest Coverage," "Min. Debt Service Coverage," "Min. Fixed Charge Coverage," and "Min. Interest Coverage"), debt-to-EBITDA ("Max. Debt to EBITDA" and "Max. Senior Debt to EBITDA"), or minimum EBITDA.
Nr of medium performance-sensitivity covenants	Number of financial covenants with medium performance-sensitivity, defined as covenants based on "Max. Debt to Equity," "Max. Loan to Value," "Max. Debt to Tangible Net Worth," "Max. Loan to Value," "Max. Leverage ratio," "Max. Senior Leverage," "Min. Net Worth to Total Asset," "Max. Long-Term Investment to Net Worth," "Max. Net Debt to Assets," "Min. Equity to Asset Ratio," "Net worth," or "Tangible Net Worth."
Nr of sweep	Number of sweep provisions contained in the debt contract.

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APPENDIX A (continued)

Variables	Definition
Nr of performance pricing provisions	Number of PPP contained in the debt contract.
% low performance-sensitivity covenants	Ratio of # low performance-sensitivity covenants to # financial covenants.
Asset volatility	Annualized standard deviation of daily stock returns during the year multiplied by the firm's equity-to-value ratio (Schwert 1989).
Book to market	Book value of total assets divided by total debt plus market value of equity.
Cash flow to sales	Operating cash flow scaled by sales.
Current % non-performance-based	Proportion of nonperformance-based covenants to total (i.e., nonperformance- and performance-based) financial covenants in the current (i.e., enforceable) contract
Dividend restriction	Indicator variable equal to 1 if the contract contains a dividend restriction and 0 otherwise.
Leverage	Long-term debt divided by long-term debt plus market value of equity.
ln(SD ROA)	The natural logarithm of the standard deviation of the year-over-year change in quarterly ROA computed over the 12 quarters from year t to year t+2, where ROA is EBIT scaled by total assets (Ljungqvist et al. 2017).
Loan maturity (ln)	Natural logarithm of loan package maturity measured in months. We measure the loan package maturity as the weighted average of the maturity of all the facilities within each loan package, using each facility amount as weights.
Loan size (ln)	Natural logarithm of the loan amount in U.S. dollars.
Loan spread (ln)	Natural logarithm of loan package spread, computed as the weighted average of the facility spreads within each loan package, using each facility amount as weights. The facility spread is equal to the amount paid by the borrower in basis points above LIBOR for each dollar drawn down, including eventual annual fees.
R&D / Lagged Assets	Ratio of R&D expense to lagged total assets.
Return on assets	Income before extraordinary items scaled by average total assets.
Secured	Indicator variable equal to 1 if any of the loan facilities within each package is secured and 0 otherwise.
Size	Natural logarithm of the market value of the firm's equity.
Stock return	Stock return over the prior year.
Z-score	Altman's Z-score index, computed as (3.3 × pretax income + sales + 0.25 × retained earnings + 0.5 × working capital) / total assets.
Standardized # of covenants	Number of financial covenants (as specified in each table) standardized by subtracting the sample mean and dividing by the sample standard deviation.
% Current low performance-sensitivity covenants	Number of low performance-sensitivity covenants in the borrower's current loan package, scaled by the total number of covenants in the current package.
Nr of superseded financial covenants	Number of financial covenants in the borrower's previous loan package.
% Superseded low performance sensitivity	Number of low performance-sensitivity covenants in the borrower's previous loan package, scaled by the total number of covenants in the previous package.
Nr of persistent covenants	Number of financial covenants found in both superseded and new loan contracts.
% Persistent low performance-sensitivity covenants	Ratio of low performance-sensitivity covenants found in both superseded and new loan contracts, scaled by the average number of financial covenants in the superseded and new package.
Probability of covenant violation	Probability of covenant violation taken from Professor Peter Demerjian's website: https://peterdemerjian.weebly.com/managerialability.html
Nr of incremental covenants	Number of financial covenants present in the new contract but not in the superseded one.
% Incremental low performance-sensitivity covenants	Ratio of low performance-sensitivity covenants present in the new contract but not in the superseded one, scaled by the total number of covenants in the new package.
High covenant post-contractual slack	An indicator variable that takes the value of 1 if post-contractual slack for the covenant falls in the top tercile of covenant slack within the industry-year-ratio tercile. Post-contractual slack is the difference between the covenant threshold and the borrower's actual value of the accounting ratio underlying the covenant. See Section V for more details on this variable.

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APPENDIX A (continued)

Variables	Definition
Medium covenant post-contractual slack	An indicator variable that takes the value of 1 if post-contractual slack for the covenant falls in the middle tercile of covenant slack within the industry-year-ratio tercile. Post-contractual slack is the difference between the covenant threshold and the borrower's actual value of the accounting ratio underlying the covenant. See Section V for more details on this variable.
Low covenant post-contractual slack	An indicator variable that takes the value of 1 if post-contractual slack for the covenant falls in the bottom tercile of covenant slack within the industry-year-ratio tercile. Post-contractual slack is the difference between the covenant threshold and the borrower's actual value of the accounting ratio underlying the covenant. See Section V for more details on this variable.

APPENDIX B

Examples of Loan Contract Renegotiations and Refinancings

Example 1

On March 3, 2017, Avis Budget entered into a loan contract that superseded a previous credit agreement dated as of October 7, 2016. The new contract specifies that the proceedings of the loan agreement will be used to extinguish in full the previous credit agreement from October 2016. Similarly, the credit agreement of October 2016 refinanced a credit agreement from October 3, 2014, and before that the loan contract was refinanced other two times.

Example 2

Panera Bread entered into a credit agreement on March 7, 2008 with Bank of America and other lenders to amend and restate an existing credit agreement from the same lenders dated November 27, 2007. The original credit agreement that Panera initiated on November 27, 2007 is not a refinancing, amendment, or renegotiation of an existing deal and therefore we exclude it from our sample for the tests in Section V.

APPENDIX C

Additional Analyses

Cross-Sectional Variation in Screening Value

Our predictions are based on the notion that expected cost of covenants rises as their performance-sensitivity increases, which may not apply across all firms. For example, liquidity covenants have low sensitivity to current performance but may be quite costly for smaller, younger firms. If borrowers perceive little difference in the cost of different types of covenants, covenant heterogeneity is unlikely to provide substantial screening value. To investigate this possibility, in additional analyses we examine whether the relation between the performance-sensitivity of borrowers' covenant mix and future risk profile varies based on six factors: age, asset tangibility, market-to-book ratio, Tobin's q, and level of investment. Specifically, we divide borrowers into two groups according to whether they are below or above the industry-year median for the variable of interest. We then re-estimate Equation (3a) in each subsample. The results (untabulated) indicate that for each measure, low performance-sensitivity covenants and borrower future risk profile continue to be negatively related in both subsamples, and the difference in the relation between these two subsamples is statistically insignificant. These findings suggest that covenant heterogeneity can serve as a useful screening mechanism across a wide range of different types of firms.

Changes in Covenant Use over Time

One long-term trend in covenant mix has been the declining use of covenants based on balance sheet measures (e.g., Demerjian 2011), especially for the current and quick ratio covenants that comprise our low performance-sensitivity

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APPENDIX C (continued)

classification. In the context of our theoretical framework, this change in covenant mix over time suggests a trend toward lower-risk borrowers. To investigate this possibility, for each year in our sample period, we compute the average proportion of low performance-sensitivity covenants and the average future risk factor for borrowers signing a new loan contract during the year. We then conduct several analyses to examine the long-term trends in both measures. We do not tabulate these results to save space.

Untabulated results show a significant decline in the riskiness of borrowers in the private debt market over time. This decline is strongly correlated (79 percent) with the decline in low performance-sensitivity covenant usage, consistent with our theoretical framework. This decline is also similar across all three of our individual risk measures (asset volatility, R&D, and ROA volatility), suggesting that this pattern reflects a general trend toward lower-risk borrowers in the private debt market rather than institutional changes affecting a specific risk measure (e.g., changes in accounting regulations leading to changes in reported earnings volatility).

We next investigate whether this decline in risk over time reflects the composition of borrowers changing over time or individual borrowers becoming less risky over time. Specifically, we regress our future risk factor measure on a linear year trend within two subsamples: (1) borrowers with only one loan contract in DealScan in our sample period, and (2) borrowers with at least ten loan contracts in DealScan (the top 5th percentile number of contracts) in our sample period. For the second subsample, we include firm fixed effects to isolate within-firm variation. The first subsample, by construction, relies solely on between-firm variation. In untabulated results, for both subsamples, we find a decreasing time trend in future borrower risk with comparable magnitude and statistical significance, suggesting that: (1) less risky borrowers are more likely to access the private debt market in more recent years, and (2) individual borrowers in the private debt market are becoming less risky over time. Collectively, these findings provide insight into the shifting composition of financial covenants over the past few decades.

Finally, we regress our future risk factor measure on the % *low performance-sensitivity covenants* within each year, to investigate if our findings still hold in recent years. In untabulated results, we find that the coefficient is significantly positive in 21 of the 22 years in our sample period, and, aside from a modest decrease immediately after the 2007/2008 financial crisis, the relation between future risk and the proportion of low performance-sensitivity covenants has remained similar over our sample period. Thus, although the average riskiness of private debt market borrowers has declined over time, our results indicate that covenant mix has remained informative about future risk and therefore a useful screening mechanism.