TWO ESSAYS ON CORPORATE FINANCE

A Dissertation

by

NAN YANG

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Chair of Committee,	Adam C. Kolasinski
Committee Members,	Shane A. Johnson
	Hwagyun Kim
	Dechun Wang
Head of Department,	Sorin M. Sorescu

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ABSTRACT

This dissertation includes two essays on corporate finance. The first essay investigates why bank debt contracts are frequently renegotiated outside default. I test empirical implications from several theories by looking at bondholder wealth effects in a sample of firms with both bank debt and public bonds in their capital structure. Based on a sample of 321 renegotiations, I find that bondholders react positively to renegotiations that result in relaxation of bank debt covenants. The evidence supports the theory that lenders loosen covenants due to new favorable information of firms' credit quality and is inconsistent with the hypothesis that relaxing covenants signals weakened bank monitoring due to low bargaining power of the banks. I also find insignificant bondholder reaction to renegotiated higher bank loan interest rates. This provides little support to the hypothesis that increased loan interest rate conveys unfavorable news that asset substitution cannot be avoided.

The second essay, coauthored with Shane Johnson and Jun Zhang, examines the relationship between CEO inside debt and the maturity of new corporate debt. Following recent theories of incentive alignment effect of CEO inside debt, we include both the magnitude and the maturity of CEO inside debt in empirical estimation. We classify firms as having "debt-biased CEOs" when the ratio of CEO's inside debt to equity compensation exceeds the company's leverage ratio, and "equity-biased CEOs" otherwise. Using a sample of corporate debt issuance during 2007-2012, we find that among firms with long-term inside debt, firms with debt-biased CEOs issue debt with longer maturity than do firms with equity-biased CEOs. Among firms with debt-biased CEOs, the maturity of new debt is longer if CEOs have long-term inside debt than if CEOs have short-term inside debt. In contrast, among firms with equity-biased CEOs, the maturity of new debt is shorter if a CEO has long-term inside debt than if a CEO has short-term inside debt. The results

provide support for the overall hypothesis that CEO inside debt affects firms debt maturity structure through its ability to ameliorate stockholder-debtholder conflicts.

DEDICATION

To my grandmother who passed away during the time I fought for the dissertation. To my wife, my daughter, and my parents.

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1. INTRODUCTION

Corporate finance has long been characterizing the firm as a nexus of contracts since (Jensen and Meckling (1976)). This view has motivated a great amount of research on understanding and characterizing different contractual issues among firms' owners, managers, and their investors. For example, the conflicts between a firm's stockholders and debtholders, the allocation of control rights via bank loan covenants, to name but two. The ultimate purpose of these analyses is to come up with efficient contracting devices that help better align interests among various economic agents. In this dissertation, I examine two of these contracting mechanisms by understanding the economic mechanism underlying the renegotiation of bank debt contracts that occurs outside of states of distress or default and by investigating the incentive alignment effect of CEO debt-like compensation.

In the first essay, "Bank Debt Renegotiation and Bondholders' Wealth", I uses bondholder wealth effects to test several theories of why bank debt contracts are renegotiated using a sample of firms with both bank debt and public bonds in their capital structure. These theories postulate several potential explanations for bank debt renegotiation, and have empirical implications for the impact of a renegotiation on bond returns. Gârleanu and Zwiebel (2009) argue that initially strict covenants that can be later relaxed upon revelation of good information enable "good-type" firms to reduce ex ante financing frictions associated with asymmetric information. Their theory thus suggests that bond returns should be positively correlated with loosening covenants in bank debt. I find that bond value increases 34 basis points when renegotiated loan covenants are loosened, strongly supporting Gârleanu and Zwiebel (2009) and casting doubt on the alternative hypothesis that such loosening typically signals a weakening bank monitoring. The model of gorton00 asserts that a bank debt renegotiation that increases the interest rate conveys unfavorable news that asset substitution cannot be avoided. Hence, Gorton and Kahn (2000) imply that there should be a negative relation between bond value changes and an increased renegotiated bank debt interest rate. I find little evidence of the negative relation. Further tests show that this is explained by firms' more conservative investment decision after renegotiation.

In the second essay, "CEO Inside Debt and the Maturity of Corporate Debt Issues", co-authored with Shane Johnson and Jun Zhang, we examine the association between CEO inside debt and the maturity of new corporate debt issues. We incorporate into the estimation both the magnitude and the maturity of CEO inside debt, as theory (Edmans and Liu (2011)) emphasizes that the incentive alignment effect of CEO inside debt relies critically on the two dimensions. In a sample of 4,399 new corporate debt issues during 2007-2012, we find support for this theoretical claim. Among firms with long-term inside debt, firms whose CEOs have debt-biased inside debt levels issue debt with a maturity of approximately one year longer than firms with equity-biased debt. Given a sample median maturity of 5 years, the effect of debt bias is an approximately 20% increase in the maturity. Among firms with debt-biased levels of inside debt, firms whose CEOs have long-term inside debt issue corporate debt with more than a half year longer maturity than do firms whose CEOs have short-term inside debt. Finally, among firms with equity-biased levels of inside debt, we find significantly one-year shorter maturity of new issues for firms with long-term inside debt compared to those with short-term inside debt. The findings are more pronounced for firms with higher market-to-book ratio and are robust to unobserved time-invariant heterogeneity at firm level. The results provide support for the overall hypothesis that CEO inside debt affects firms' debt maturity structure through its ability to ameliorate stockholder-debtholder conflicts.

2. BANK DEBT RENEGOTIATION AND BONDHOLDERS' WEALTH

This chapter uses bondholder wealth effects to test several theories of why bank debt contracts are renegotiated using a sample of firms with both bank debt and public bonds in their capital structure. These theories postulate several potential explanations for bank debt renegotiation, and have empirical implications for the impact of a renegotiation on bond returns. Gârleanu and Zwiebel (2009) argue that initially strict covenants that can be later relaxed upon revelation of good information enable "good-type" firms to reduce ex ante financing frictions associated with asymmetric information. Their theory thus suggests that bond returns should be positively correlated with loosening covenants in bank debt. I find that bond value increases 34 basis points when renegotiated loan covenants are loosened, strongly supporting Gârleanu and Zwiebel (2009) and casting doubt on the alternative hypothesis that such loosening typically signals a weakening bank monitoring. The model of Gorton and Kahn (2000) asserts that a bank debt renegotiation that increases the interest rate conveys unfavorable news that asset substitution cannot be avoided. Hence, Gorton and Kahn (2000) imply that there should be a negative relation between bond value changes and an increased renegotiated bank debt interest rate. I find little evidence of the negative relation. Further tests show that this is explained by firms' more conservative investment decision after renegotiation.

The motivation for examining the interaction between loan agreement renegotiations and bondholders' wealth comes from the recent empirical evidence that bank loan renegotiation is not peculiar to financial distress or (technical) default. It frequently takes place in the ordinary course of business and involves substantial modifications to amount, maturity, interest rate and covenants (Roberts and Sufi (2009b), Roberts (2015), Denis and Wang (2014)). While a rich set of theoretical models seek to explain why debt contract renegotiation happens, which of these economic mechanisms drives this phenomenon remains largely unexamined in the empirical literature. This study seeks to fill this void by examining bondholder wealth effects.

I focus my empirical design on bond price reactions because of a common feature among all the theories under examination: renegotiations are driven by the arrival of new information to the bank about credit quality. Furthermore, much of this new information is likely to be known only to the bank prior to the renegotiation, since it is well-established in the literature that banks possess considerable private information about credit quality that is not available to the holders of bonds and other securities.[1] Hence bond price reactions to renegotiations are likely to reflect the banks new credit-related information that resulted in the renegotiation.[2] In contrast, stock price reactions are a less precise indicator of new information about credit quality revealed during renegotiation, since stock prices are driven by many factors other than credit quality. In addition, any observed renegotiated contractual change is voluntary and hence favored by stockholders, provided that managers act in stockholders interests (Roberts and Sufi (2009b)).[3] Hence stock price reactions are likely to be positive for all renegotiations, making it difficult to use stock price reactions to test different theories.[4] In contrast, bondholders have no say in these renegotiations, so bondholder wealth effects could be positive or negative ex ante, depending on which theory of renegotiation is more empirically relevant.

In particular, theory suggests that the loosening of bank debt covenants could lead to

[1]See, for instance, Kane and Malkiel (1965), Fama (1985), Sharpe (1990), and Rajan (1992) for theory. On the empirical side, James (1987), Lummer and McConnell (1989), Slovin, Johnson, and Glascock (1992), Best and Zhang (1993), Billett, Flannery, and Garfinkel (1995), and Maskara and Mullineaux (2011), among others, study loan announcement effect in the equity market. Dass and Massa (2011) examine the possibility that banks exploit its informational advantage in the equity market.

[2]It would be interesting to study loan price reaction around these renegotiations. However, secondary market loan pricing data is not readily available on a large-sample basis.

[3]I exclude renegotiations when firms experience covenant violation in the same year. As covenant violation typically is very costly to the managers, banks probably have dominant influence in these renegotiations.

[4]Nevertheless, stock price reactions can provide additional insights into one of my hypotheses. See Section 2.3.4 for detail.

either positive or negative bond returns. On the one hand, banks' rent extraction of the borrower due to their information monopoly depends on the relative bargaining power of banks vs. borrowers (Sharpe (1990), Rajan (1992)). This still holds for firms with access to public debt, as Johnson (1997) shows that this group of firms still systematically use bank debt and use it in the same manner as the average firm in his sample. Banks could plausibly be willing to relax covenants in states where their bargaining power declines in exchange for retaining the lending relationship and associated future rents. Indeed, Allen and Peristiani (2007) provide hard evidence consistent with the anecdotes that "Banks are using loans like a loss leader, a teaser product to entice corporations into giving the bank more lucrative stock-and-bond underwriting or merger advisory business."[5] Relaxing covenants, however, is costly to bondholders because of increased default risk and reduced recovery rate by weakened monitoring of loosening covenants (Smith and Warner (1979), Rajan and Winton (1995), Zhang (2009), Demiroglu and James (2010)). The incentive to increase loans' risk could be even amplified by the limited liability of the lead arrangers granted in the loan agreements (Ivashina (2007)). As bondholders do not benefit from any rents that banks extract, bondholders are expected to react negatively to renegotiations that relax covenants.

On the other hand, Gârleanu and Zwiebel (2009) propose that strict ex ante bank debt covenants and ex post renegotiation offer an optimal contracting mechanism to overcome the adverse selection effect in the loan market. Their model posits that lenders are willing to transfer control rights back to the firm upon acquiring favorable information on the credit quality of the firms. Hence their model implies that a firm's bondholders should react positively to bank debt renegotiations that relax covenants.

This chapter contributes to the relatively young empirical literature on the renegotiation

[5] Jonathan Sapsford, "Banks Give Wall Street a Run for its Money", January 5, 2004.

of bank loan agreements outside of financial distress or default.[6] Roberts and Sufi (2009b) are the first to document the prevalence of renegotiations in the U.S. bank loan market that typically result in substantial modifications to amount, maturity, and interest rate in a debt contract. Roberts (2015) takes a dynamic view and focuses on the effect of information asymmetry in the lending relationship over the life of the contract. Denis and Wang (2014) complement Roberts and Sufi (2009b) by documenting that bank debt covenants are also frequently renegotiated, most of which are likely to get loosened instead of tightened. They further show that firms' post-renegotiation investment and financing activities are strongly associated with how the covenant is renegotiated. This literature, however, is largely silent on the value consequences of these voluntary renegotiation of bank debt contracts.[7] To the best of my knowledge, this paper is the first to systematically examine value effect of voluntary bank debt renegotiations, from the perspective of a firm's bondholders. The study also provides some of the first empirical tests of several recent theories on the renegotiation of debt contracts.

This chapter is related to the literature on the determinants and implications of covenant design in debt contracts. A large body of research finds that strict covenants help mitigate agency and informational problems over the investment and financing policies of the firm (see, e.g., Bradley and Roberts (2004), Drucker and Puri (2009), Zhang (2009), and Demiroglu and James (2010) on private debt, and Billett, King, and Mauer (2007) on public debt). Recently, Murfin (2012) shows that the strictness of the loan contract that a borrower receives is partly determined by supply-side considerations. These studies

[6]Most prior empirical research on debt contract renegotiation focuses on states of either default, financial distress or bankruptcy. (Beneish and Press, 1993, 1995), Chen and Wei (1993), Smith (1993), Chava and Roberts (2008), Nini, Smith, and Sufi (2009), Nini, Smith, and Sufi (2012), and Roberts and Sufi (2009c) examine the consequence of technical default. Gilson (1990), Gilson, John, and Lang (1990), Asquith, Gertner, and Scharfstein (1994), and Benmelech and Bergman (2008) study the renegotiation outcome in payment default and bankruptcy. Also see Roberts and Sufi (2009a) for a survey in empirical financial contracting research.

[7]In contrast, the value consequence of renegotiations triggered by bank debt covenant violations is well documented by Nini, Smith, and Sufi (2012).

only measure covenant strictness at loan origination. I complement this line of research by tracking the dynamic evolution of covenant strictness over time. More importantly, I explore the underlying reasons why lenders are willing to loosen covenants during the life of the loan.

The chapter is also related to the long-standing literature on the uniqueness of bank loans with respect to having access to borrowers' inside information that is otherwise not available to other securities holders (Kane and Malkiel (1965), Fama (1985), Sharpe (1990), Rajan (1992)), and on views that banks are better screeners that reduce ex ante information asymmetries and on their comparative monitoring advantage (Diamond, 1984, 1991a). Starting from James (1987), the extant related empirical work dominantly focuses on equity price response to bank loan announcements (See, among others, Lummer and McConnell (1989), Slovin, Johnson, and Glascock (1992), Best and Zhang (1993), Billett, Flannery, and Garfinkel (1995), and Maskara and Mullineaux (2011)). The closest work to mine is Datta, Iskandar-Datta, and Patel (1999), who find that the existence of bank debt significantly reduces at-issue yield spreads for firms' first public straight bond offerings. My study extends theirs by examining banks' post-issuance monitoring effect in the secondary bond market. By doing so, I provide evidence of a specific channel through which banks execute the combined screening and monitoring functionality, as recently proposed by Gârleanu and Zwiebel (2009).

The rest of the chapter proceeds as follows. In Section 2.1, I develop testable hypotheses, focusing on the implications of renegotiated loan term changes. In Section 2.2, I discuss my sample, variables, and summary statistics. In Section 2.3, I present the main results and robustness tests. Section 2.4 concludes.

2.1 Hypothesis development

In this section, I use debt contract renegotiation models developed in prior financial contracting research to discuss testable predictions for the wealth effect of bank loan renegotiation on firms' bondholders, highlighting the implications of interest rate changes and the relaxation of financial covenants.

2.1.1 Banks' rent extraction and ex post renegotiation

A bank acquires privileged inside information of the borrower in the process of lending (see Fama (1985), Sharpe (1990), and Rajan (1992)), which creates the information asymmetries between lending banks and other potential lenders and makes it costly for the borrower to switch lenders. This information monopoly of the lending bank allows it to extract rents from borrowers. The rents could come from directly charging a higher loan interest rate (Schenone (2010)). It could also come from nonlending channels, including a share of project profits (Houston and James (1996), Johnson (1997)), or security underwriting and M&A advisory fees (Puri (1996), Allen, Jagtiani, Peristiani, and Saunders (2004), Drucker and Puri (2005), Yasuda (2005)). Moreover, if banks have equity stake in the borrowers through, e.g., affiliated institutional investors, they can also extract rents by exploiting the inside information in the equity market (Dass and Massa (2011)).

The theories also suggest that rent extractions depends on the relative bargaining power of banks vs. borrowers. When borrowers wish to "go outside the deal", which is the typical motivation for renegotiations that I study (Roberts and Sufi (2009b)), banks would consent to a renegotiation that makes the terms of loan contract more favorable to borrowers, such as a reduced loan interest rate, or loosened covenants. In return, they retain the lending relationship and thereby keep some remaining rents.

Banks' willingness to concede is certainly higher the weaker their bargaining power becomes. However, these actions are costly. Lowering the loan interest rate reduces banks' revenue, and covenant relaxations reduce monitoring intensity, which increase borrowers' default risk and lower creditors' recovery rates (Smith and Warner (1979), Rajan and Winton (1995), Zhang (2009), Demiroglu and James (2010)). Therefore, the bank would be willing to accept such an increased default risk via loosening of covenants as long as the associated rents from lending relationship still outweigh the costs. As empirical evidence already shows that banks are willing to offer below-market rates in order to capture merger advisory business (e.g., Allen and Peristiani (2007)), it is not implausible that banks might be willing to loosen covenants and to accept increased credit risk in the exchange of a lucrative business relationship with a borrower. Bondholders, however, do not benefit from the bank's rents, so a loosening of covenants would hurt bondholders. I can thus state my first formal hypothesis about covenant loosening:

Hypothesis 1a: Bank loan renegotiations that loosen bank covenants result in negative abnormal bond returns, particularly in situations where bank bargaining power is low.

2.1.2 Asymmetric information and ex post renegotiation

Gârleanu and Zwiebel (2009) analyze an optimal contracting mechanism in a setting where managers have an information advantage over lenders about the potential for future wealth transfers, and the lenders can learn this information over time. The equilibrium solution is a combination of strict ex ante covenants that are often relaxed as lenders ex post favorably update their priors about a firm's credit quality. That is, uninformed lenders protect their interest from future transfer by obtaining strong ex ant decision rights when initiating the loan. Subsequently upon acquiring information on the quality of the firms, lenders will in turn give up these excessive rights back to managers whose firms are revealed to pose little threat of wealth transfer. It is worth pointing out that the unconditional effect of renegotiation on bond price might be trivial and even negative under this theory. Only the loosening of covenants and the transfer of some control rights back to managers is good news to bondholders.

The Gârleanu and Zwiebel (2009)'s renegotiation model thus implies the following testable hypothesis:

Hypothesis 1b: Bank loan renegotiations that relax covenants should be associated with positive abnormal bond returns, ceteris paribus.

2.1.3 Two-sided moral hazard and ex post renegotiation

Gorton and Kahn (2000)'s model has empirical implications for how bank loan interest rate changes can impact bondholders' wealth. The model assumes that the firm can engage in asset substitution, and the bank can threaten to liquidate the firm's project during renegotiation as in Sharpe (1990) and Rajan (1992). If the bank receives favorable information about project quality, there is no renegotiation. With moderately unfavorable information, renegotiation takes place, and the bank lowers the interest rate so as to reduce the firm's likelihood of engaging in asset substitution. With the most unfavorable news, the bank's threat to liquidate is credible and the firm will allow the bank to extract a higher interest rate in exchange for asset substitution.

Consequently, a renegotiated higher interest rate is unambiguously bad news for bondholders. This is because it represents that, not only has the bank received a truly negative signal about the firm, but costly asset substitution is also allowed to occur. Moreover, raising the rate reduces the cash and other assets available to cover principal and interest payments on the firm's outstanding bonds. Thus, I state the following hypothesis:

Hypothesis 2: Bank loan renegotiations that raise interest rate should be associated with negative abnormal bond return, ceteris paribus.

A renegotiated lower interest rate could be bad news for bondholders as it conveys a bad signal about the firm's credit quality. On the other hand, if the signal was already observable (though nonverifiable) to bondholders as suggested by moral hazard model, a reduced interest rate is good news for bondholders, as it means that the firm is less likely to engage in asset substitution. A reduced loan interest rate also means that there is more cash left over to meet obligations on the firm's outstanding bonds. In summary, the theory provides no clear prediction for how bond prices should change in response to a renegotiation that lowers the loan interest rate.

2.2 Sample construction, variables, and descriptive statistics

2.2.1 Sample construction

My research strategy is to use standard event study methods to assess bond investors' immediate reaction to loan renegotiation announcements. Following Bessembinder, Kahle, Maxwell, and Xu (2009) and Bao and Pan (2013), I rely on the recently available Trade Reporting and Compliance Engine (TRACE) databset to calculate bond return. As TRACE starts in July 2002, I focus on non-financial public firms in Standard & Poor's Compustat over the 2002 to 2012 period that also have qualified publicly traded bonds in Enhanced TRACE dataset.[8] Specifically, I use bond-level information from the Mergent Fixed Investment Security Database (FISD) and keep bonds that have fixed- and nonzero-coupon rate, are in the form of either non-convertible debentures or medium term notes, have non-missing information on bond rating, issue size, and maturity date (See, e.g., Bessembinder, Kahle, Maxwell, and Xu (2009)). The requirement of having publicly traded bonds dramatically reduces my sample size, but it is necessary for my event study analysis. Next, I keep firms that can be matched with loan deals from Reuters Loan Pricing Corporation's DealScan database. I further require that each deal has information on the loan amount, the

[8]The TRACE Enhanced provides several improvements for research purpose over TRACE Standard Market data: (1) it includes transactions that were reported to TRACE, but were not subject to public dissemination; (2) it reports transaction volumes for all transactions, instead of putting caps on larger ones; (3) it reports historical buy-sell side information; (4) it reports transaction date and time. However, its availability is delayed by 18 months. See Dick-Nielsen (2009, 2013) for introduction to the TRACE dataset and guidance for cleaning the TRACE Enhanced.

interest spread, and the maturity of all tranches in the deal. For loan deals initiated before the year 2006, I keep the ones that have matched private credit agreements collected by Nini, Smith, and Sufi (2009) from SEC 10-Q, 10-K, and 8-K filings.[9] For the loan deals issued since 2006, I employ Nini, Smith, and Sufi (2009)'s text-search algorithm and keep the ones for which I can identify associated private credit agreements from SEC filings.

For each contract in this set of loans, I examine the 10-K, 10-Q and 8-K filings of the borrowing firm from the loan origination to the earlier of the maturity of the loan or the end of the year 2012 to identify, if any, its first renegotiation that happened in and after July, 2002.[10] I drop renegotiations whose SEC filings contain confounding events that can also affect bond returns.[11] These steps result in an initial sample of 599 renegotiations. The bond event study procedure introduced below in Section 2.2.2.2 and the requirement of having nonmissing firm-level control variables from Compustat quarterly make my benchmark sample consist of 321 loan renegotiations and 807 public bonds for 243 unique firms (Table A.1).

For the 321 loan renegotiations, I collect information for each original loan contract from DealScan database, including amount, maturity, interest spread over LIBOR, the number of tranches, and the number of lenders. As Dealscan has missing value on covenants for a subset of loans (Drucker and Puri (2009)), I hand-collect financial covenant information from original loan contracts provided in SEC filings. Given the facts that covenant thresholds are often dynamically changing through time (Wittenberg Moerman, Vasvari, and Li (2012)) and that Dealscan does not provide detailed information on this aspect, I collect from the original loan contracts the covenant thresholds applicable to the

[9]I thank Amir Sufi for generously making this dataset available online (http://faculty.chicagobooth.edu/amir.sufi/data.html). I refer readers to Nini, Smith, and Sufi (2009) for more details on these contracts and their text-search algorithm.

[10]SEC requires public firms to file material contracts and all their amendments.

[11]Confounding events in the same filing include: other loans or other loans' amendments, covenant violations, M&As, asset sales/purchases, new bond issuances, share repurchases, DIP financing, default, and bankruptcy.

period when the renegotiation takes place. Lastly, I identify changes via renegotiation (if any) to the loan amount, the interest spread, the maturity, and the financial covenants from either Dealscan or the renegotiation documents in SEC filings.[12]

2.2.2 Key variables

2.2.2.1 Contractual term changes

I follow Roberts and Sufi (2009b) and measure amount, spread, and maturity at the deal level, with maturity and spread averaged across all tranches within a deal, weighted by the amount of each tranche. I then calculate the percentage change for each of the three terms via renegotiation and denote them by ΔAmount, ΔSpread, and ΔMaturity.

In order to measure the change of covenant strictness (ΔCovenant strictness), I first follow Murfin (2012) and compute an aggregate measure of covenant strictness per deal that incorporates not only the number of covenants, but also the slack allowed for each covenant and the covariance of the changes in covenant variables.[13] This measure gauges covenant strictness as the ex ante probability of creditor control upon covenant violation. Therefore, the change of covenant strictness is defined as the probability of violating covenant after renegotiation minus the probability of violating covenant before renegotiation. The other commonly used measures of covenant strictness in the literature – the number of covenants (Bradley and Roberts (2004) for bank loans and Billett, King, and Mauer (2007) for public debt), and slacks of only a subset of covenants (Drucker and Puri (2009) and Demiroglu and James (2010)) – are unable to fulfil the purpose here. The former fails to capture the change of covenant strictness if there are either changes to existing covenant thresholds or to the types of covenants included in the deal, but the total number

[12]Dealscan's amendment file contains useful information on renegotiation outcomes. The other reason why Dealscan can be used for extracting renegotiation information is due to the fact that renegotiated loan contracts are often recorded by Dealscan as an independent new observation (Roberts (2015) and Denis and Wang (2014)).

[13]I thank Justin Murfin for sharing a program to calculate loan contract strictness.

of covenants remains the same throughout the renegotiation. The latter is also problematic because it fails to incorporate the effect of the rest covenants that are modified. To be self-contained, the calculation of Murfin (2012)'s measure is described in detail in Appendix C.

2.2.2.2 Abnormal bond returns

I compute short-run abnormal bond returns for all 321 renegotiations in my sample, using an event window [-5,5] around the event date, which is defined as the earlier of the date of the SEC filing that reports the renegotiation information, or the press release date. I closely follow the event study procedure in Bessembinder, Kahle, Maxwell, and Xu (2009) and start with the construction of daily bond prices using the "trade-weighted price, all trades" approach of Bessembinder, Kahle, Maxwell, and Xu (2009). This approach utilizes all trades on a given day and calculates the daily price as the trade-weighted average price.[14] Bessembinder, Kahle, Maxwell, and Xu (2009) have shown that statistical tests based on daily abnormal returns estimated with this approach are better specified and more powerful than those on returns computed with end-of-day prices. This is because this approach puts more weight on the large institutional trades that have lower execution costs and thus more accurately represents the true bond price.[15] A potential disadvantage is that the daily price will reflect prices throughout the day and not necessarily at market close. However, this problem is mitigated by examining the change of bond price from the last day before to the first day after Day 0 within a tight event window.

To control for the well-known illiquidity of bond market, but at the same time to preserve my sample size, I require that a bond trades on at least three days over the [-20,-1]

[14] Alternatively, Bessembinder, Kahle, Maxwell, and Xu (2009) find that their "trade-weighted price, trade$\geq$100k" method, which employs trade-weighted prices using only trades of $100,000 or more, is even more powerful than the "trade-weighted price, all trades" method. However, it leads to fewer observations due to the elimination of days with only trades of less than $100,000.

[15] Edwards, Harris, and Piwowar (2012) show that corporate bond transaction costs are much lower for institutional-sized transactions than for a small retail trade.

period prior to Day 0 to be included in the sample. I am aware that this is less than the ten-day requirement used in Bessembinder, Kahle, Maxwell, and Xu (2009). I will examine this issue in Section 2.3.5. Furthermore, I require that a bond trades for at least one day within the five-day (inclusive) window on both sides of Day 0 to ensure that event period returns reflect observable movements of prevailing market prices. However, this may induce a potential sample selection bias if the likelihood of trading is positively associated with the informativeness of the renegotiation. As a result, this requirement would bias the sample toward renegotiations that contain more new information and overestimate the effect of loan renegotiations. I will also address this potential sample selection bias in Section 2.3.5.

Excess bond returns are computed as the difference between a bond's total return and the value-weighted total return on a rating- and maturity-matched bond portfolio, where the weights are based on the bond market value on the last trading day within five days prior to Day 0. Following Bao and Pan (2013),[16] the raw bond return around Day 0 is calculated as:

$$BR_{t=0} = \frac{BP_{t+1} + AI_{t+1} + C_{t-1,t+1}}{BP_{t-1} + AI_{t-1}}, \tag{2.1}$$

where, BP_{t+1} is the bond clean price on the first trading day within five days after Day 0, and BP_{t-1} is the clean price for the same bond on the last trading day within five days prior to Day 0. AI_{t-1} is the accrued interest sine the last coupon payment until $t-1$, and $C_{t-1,t+1}$ is the coupon payment (if any) between day $t-1$ and day $t+1$.

To construct bond portfolios based on both rating and time-to-maturity, I use the entire TRACE database but exclude event bonds whose firms have renegotiated their bank loans over the window [t-30,t+30]. I drop bonds unrated or with a rating below Caa, and divide

[16] The formula for calculating bond return in Bessembinder, Kahle, Maxwell, and Xu (2009) (Page 4226) uses clean price (instead of dirty price) in the denominator. My results still hold based on abnormal bond returns calculated using their formula.

the remaining ones into seven rating groups: Aaa, Aa, A, Baa, Ba, B and Caa.[17] For Aa, Ba, B groups, the maturity cutoffs are 0 to 5 years and +5 years. For A and Baa groups, the cutoffs are 0 to 6 years and +6 years. These cutoffs are chosen to ensure that there is approximately the same number of bonds within each category. For the Aaa and Caa groups, the sample sizes are too small to be further divided based on maturity. Such a strategy results in a total of 12 rating- and maturity-based portfolios. When calculating total return for each bond in the portfolios, I also require matching on the windows of the available pricing data for each event bond. Denoting these matched portfolio returns by MPR_t, the excess return for each bond is:

$$ABR_{t=0} = BR_{t=0} - MPR_{t=0}. \tag{2.2}$$

When a firm has multiple bonds, the firm-level bond excess return and rating are calculated as value-weighted averages across individual bonds within a firm, where the weights are based on the market value of each bond on the last trading day within five days prior to Day 0. The advantages of the firm-level approach are that it does not suffer from a cross-correlation problem arising from using multiple observations per event; and it also precisely captures the full impact of the renegotiation on the value of a firm's bondholders. All the abnormal bond returns are expressed in basis points (bps).

2.2.2.3 Abnormal stock returns

In addition to examining abnormal bond announcement returns, I also analyze the effect of loan renegotiation on the value of shareholders in Section 2.3.4. Abnormal stock returns are calculated using the Carhart Four-Factor model on a daily basis. The estimation period for the model coefficients is 255 trading days, ending 30 days before the announcement date. I then calculate cumulative abnormal returns (CAR) over the same

[17] When a bond is rated by more than one rating agency, I choose to use S&P over Moody's over Fitch.

event window as used in the bond event study.[18]

2.2.3 Descriptive statistics

Table A.2 reports the summary statistics for the sample of 321 bank loan renegotiations by 243 borrowers for which I am able to compute abnormal bond return. The first set of statistics describes the borrowers' characteristics in the quarter prior to the renegotiation. Firms in my sample on average are large, with mean book assets (market capitalization) around $6 billion ($3.5 billion). This is consistent with the fact that firms having access to public debt markets are typically larger (Faulkender and Petersen (2006)). Approximately two thirds of these firms are speculative-graded. An average firm owns about 2.7 bonds, which have an average remaining maturity of 7 years.

The average loan size in my sample is $1,046 million, has a stated maturity of 4.5 years, and has an average spread over LIBOR of 177 basis points. The average number of facilities within a deal is 1.6 and on average there are 14.6 lenders participating in a syndicated loan. To facilitate discussion, I follow Nini, Smith, and Sufi (2009) and group financial covenants into the following groups: coverage ratio covenants (interest coverage, fixed charge coverage, and debt service coverage), debt to cash flow ratio covenants (debt to cash flow ratio, senior debt to cash flow ratio), debt to balance sheet covenants (debt to total capitalization, debt to total net worth, debt to tangible net worth), net worth covenants (total net worth, tangible net worth), liquidity covenants (including current ratio, quick ratio covenants), minimum cash flow covenants, and capital expenditure restrictions. The most frequently used covenant group is coverage ratio covenants, appearing in 72% of my sample, followed by debt to cash flow covenants (60%) and debt to balance sheet covenants (24%). Consistent with Nini, Smith, and Sufi (2009), capital expenditure restriction is commonly used in loan contracts, accounting for 21% of my sample.

[18] If a firm has multiple bonds, the starting (ending) date of the event window for calculating stock CAR is the earliest (latest) date among the event windows for these bonds.

Table A.3 reports renegotiation outcomes for my sample loans. Panel A shows that among all the 321 loan renegotiations, 67% of the sample loans have modified at least one of the following items in their first renegotiation: amount, maturity, spread, or financial covenants. Amount, maturity, and spread are equally likely to be modified, accounting for about 41% of the sample. Among financial covenants, debt to cash flow covenants is most likely to be modified, accounting for 15.6% of the sample, followed by coverage ratio covenants (9.4%), net worth covenants (5.0%), and capital expenditure restrictions (5.0%). As liquidity covenants do not experience any change in the renegotiation sample, I do not report them in the rest of Table A.3.

Panel B of Table A.3 reports the renegotiation outcomes conditional on whether an item is tightened or loosened.[19] Except for net worth covenants, a large majority of renegotiations relax the loan constraints. This pattern is largely consistent with Denis and Wang (2014). In particular, Murfin (2012)'s covenant strictness measure in the bottom of the panel shows that almost 75% renegotiations reduce the probability of being controlled by creditors via covenant violation.

Panel C of Table A.3 reports that renegotiations lead to substantial changes in existing loan amount, maturity, spread, and financial covenants, while panel D reports that these large changes exist for both renegotiations that tighten previous terms and renegotiations that relax previous terms. For example, for renegotiations that relax contractual terms (i.e. right part of panel D), on average, the absolute values of changes range from 18% to 100%. The similar magnitude of changes is reported by Denis and Wang (2014) for covenant limits, which ranges from 30% to over 80%, and by Roberts and Sufi (2009b) for changes of the existing maturity, amount, and interest spread, which range from 40% to 64%. Such substantial relaxation to loan terms and financial covenants lifts restrictions imposed on

[19]For some financial covenant categories, the total number of covenants renegotiated could be greater than the number of corresponding loans shown in panel A of Table A.3, due to the fact that a covenant category could contain more than one type of specific covenant.

managers, enabling them to make significant changes in corporate investment and financing policies (Denis and Wang (2014)), which could in turn affect firms' bondholders. This question is examined in the following section.

2.3 Empirical results

In this section, I first report the univariate analysis of short-run abnormal bond returns. I then discuss the regression specifications used to formally test my hypotheses and report the results. Lastly, I report a battery of robustness tests.

2.3.1 Univariate analysis of excess bond returns

Panel A of Table A.4 compares the sample distributions among unwinsorized and winsorized bond abnormal returns. The purpose is to provide cautions and guidance for conducting the following univariate analysis and for the regression methods used later on. The first row reports the distribution of unwinsorized bond abnormal returns. It has extremely large standard deviation, high skewness and kurtosis. Winsorizing at 1% and 99% dramatically mitigates these issues and winsorizing at 5% and 95% further reduces the dispersion and brings the kurtosis close to three, the kurtosis level of the normal distribution. Accordingly, my univariate analysis in panel B of Table A.4 is based on bond excess returns winsorized at 5% and 95%.

Bessembinder, Kahle, Maxwell, and Xu (2009) show that nonparametric testsfor example, the Wilcoxon signed rank test and the sign testhave more power than the parametric t-test; and they suggest that both parametric and nonparametric test statistics should be examined. Therefore, I present both parametric and nonparametric tests when assessing the significance levels of abnormal bond returns. Specifically, the significance level of the mean and the significance level of the difference in means are based on t-test, and I assume unequal variance across groups when assessing the mean difference between subsamples. The significance of the median is based on two tests: a Wilcoxon signed-rank test and a sign test. The significance level of the difference in medians is based on both a Wilcoxon rank-sum test and a nonparametric equality-of-medians test.

Based on the first row of panel B of Table A.4, bank loan renegotiations in my sample experience insignificant abnormal bond return of -2.22 bps at mean and -0.6 bps at median, based on t-test, nonparametric signed-rank test or sign test. The remaining rows of panel B of Table A.4 compare bond abnormal returns based on a variety of grouping criteria. I first report the returns for investment-grade firms versus speculative-grade firms. The sign test shows that while bondholders of investment-grade firms experience significant abnormal return (16.15 bps), there is a marginally significant and negative response from bondholders of speculative-grade firms to bank loan renegotiations, with a magnitude of -5.50 bps at median. The difference in bondholders' median returns between investment-grade and speculative-grade firms is statistically significant based on both the Wilcoxon rank-sum test and the nonparametric equality-of-medians test; the difference of mean returns is also significant based on the t-test.

The rest of the groupings are based on whether the four contractual terms–covenant, spread, maturity, and amount–are renegotiated. The abnormal bond return when renegotiation loosens covenant strictness is insignificantly positive, while the abnormal bond return when covenants are tightened is larger in magnitude and is significantly negative based on the sign test. The differences in mean and median are both economically and statistically significant different from zero.

Second, loan spread increase triggers negative but insignificant abnormal bond returns at both the mean (-21.44 bps) and median (-15.59 bps), while loan spread decrease does not have a strong impact on bondholders. The difference of mean abnormal returns between the two subgroups is marginally significant at 12%. This seems to be consistent with the prediction of Gorton and Kahn (2000) that bank loan renegotiations that raise interest rate should be associated with more negative news of the firm. Lastly, while clear empirical predictions on how the change of maturity and amount affect bond prices are lacking, I examine the returns of the two groups and, and no interesting pattern is found.

While the univariate analysis is informative, it is possible that they are driven by correlations among contractual term changes, and by firm's characteristics (such as credit risk). To segment these different effects on bond returns and provide cleaner tests on my hypotheses, regression analysis is conducted in the following sections.

2.3.2 Regression analysis of abnormal bond returns

This section tests the hypotheses developed in Section 2.1. To deal with outliers, the existing finance literature has used median, robust, and ordinary least squares (OLS) regression.[20] I perform all three types, which generally yield qualitatively similar results. In particular, I run a simultaneous-quantile regression with estimates at 25%, 50%, and 75% quantiles and obtain standard errors by performing 1000 bootstrap replications. For the median and robust regressions, I use unwinsorized abnormal returns, while for OLS, I use abnormal returns winsorized at 5% and 95% as these returns have better distribution properties discussed above; and cluster standard errors by firm.

I estimate the following model for abnormal bond returns:

$$\begin{aligned} ABR_t &= \alpha + \beta_1 \Delta \text{Covenant strictness}_t + \beta_2 \Delta \text{Spread}_t + \beta_3 \Delta \text{Maturity}_t \\ &+ \beta_4 \Delta \text{Amount}_t + \Gamma \text{Firm\_controls}_{t-1} + \Xi \text{Macro\_controls}_t \\ &+ Y + FF12 + \varepsilon_t, \end{aligned} \tag{2.3}$$

[20]Median regression minimizes the sum of absolute deviations rather than the sum of squared deviations as in OLS. More introduction of median regression is in Koenker and Bassett (1982). Robust regression conducts an initial screening based on regression results and eliminates gross outliers, and it uses the remaining observations and an iterative method that minimizes a weighted sum of squared errors to perform regression. For more technique details on robust regression, see Li (1985) and Street, Carroll, and Ruppert (1988). In Stata 12, *rreg* implements it. These two estimation techniques are used by, for example, Hall and Liebman (1998), Aggarwal and Samwick (1999), Jin (2002), Drechsler and Yaron (2011), and Li and Srinivasan (2011).

where the dependent variable is abnormal bond return introduced in Section 2.2.2.2. The key independent variables are ΔCovenant strictness, ΔSpread, ΔMaturity, and ΔAmount, capturing separately the effect of the change of covenant strictness, spread, maturity and amount via loan renegotiation. To facilitate interpretation, I multiply ΔCovenant strictness by negative one so that now the positive value of this variable represents the reduction of the ex ante probability of lender control, which in turn makes positive value of estimated β_1 directly capture the effect of loosening covenant strictness. Furthermore, to make it easier to assess relative importance of each variable, I standardize the four contract change variables conditional on being modified. This takes into account the fact that not all renegotiations in my sample experience change on either covenant, spread, amount, or maturity (as shown in panel A of Table A.3), which would have biased bondholder wealth effect of renegotiations downward had I standardized them across the whole sample. However, I standardize all continuous control variables unconditionally, which are introduced next.

I control for firm characteristics, all of which are one quarter lagged relative to the renegotiation to avoid any mechanical associations (Roberts and Sufi (2009b)). Specifically, I use a speculative-grade dummy and natural logarithm of book assets as proxies for credit quality. The dummy captures the overall credit risk of the firm and book assets capture the firm's ability to secure or collateralize its debt, as well as proxy for the liquidation value in distress. I also control for market-to-book ratio, which measures future investment opportunities of the firm.

I use a set of macroeconomic factors to represent borrowers outside options (Roberts and Sufi (2009b)). I use quarterly GDP growth to measure aggregate productivity. I use bank leverage, an aggregate-level proxy for the financial health of the banking industry, which is calculated as the ratio of total liabilities to total book assets for commercial banks in the United States based on data from Federal Deposit Insurance Corporation (FDIC). I use the quarterly CRSP value-weighted index return as a measure of the attractiveness of equity financing. In addition, I use an aggregate-level proxy that measures the degree of competition that a bank faces in a quarter from other banks or nonbank lenders. This variable is constructed from Senior Loan Officer Opinion Survey on bank lending practices, i.e. on reasons for easing lending standard or loan terms (Liu (2013)).[21] All nominal variables are deflated to 1996 by the All-Urban Consumer Price Index (CPI). Appendix B provides detailed definition and data sources for these variables.

I also include year and Fama and French 12-industry fixed effects. The former controls for any contemporaneous effect of macroeconomic fluctuations, while the latter takes into account the possibility that renegotiation may be triggered by industry-wide shock. The industry fixed effect also helps capture the industry-segmented institutional structure of syndicated lending that may affect the outcome of loan renegotiations (Roberts and Sufi (2009b)).

Panel A of Table A.5 reports the results. First and foremost, the coefficient estimate for the change of covenant strictness (ΔCovenant strictness) is consistently positive and statistically significant across all the three estimation techniques. This evidence provides strong support for Hypothesis 1b over Hypothesis 1a, as it implies that loosening covenants are welcomed by bondholders, who are expecting that improved credit quality of the firm would enhance the bond value. The effect is economically significant, too. It implies that holding everything else constant, one standard deviation decrease in the ex ant probability of lender control via covenant violation on average increases bond return by almost 34 bps, according to the most conservative estimate from OLS. Next, the coefficient estimate for ΔSpread is primarily negative across the three estimation techniques, and is statistically significant at 5% in robust regression. However, the overall effect of renegotiated spread–the sum of the estimated intercept and coefficient on ΔSpread–is not statistically

[21] I thank Yan Liu for generously sharing this hand-collected data. See Liu (2013) for more detailed description on this data. I use an aggregate measure since individual bank-level survey results are not publicly available.

different from zero, according to untabulated Wald tests. The coefficient estimates for both ΔMaturity and ΔAmount are small in magnitude and are statistically insignificant. Consistent with univariate analysis, the speculative-grade dummy has a significant and negative coefficient estimate, implying that bondholders' response at risky firms is not as positive as their counterparts at firms with high credit quality. Lastly, there is little evidence that the macroeconomic factors, which represent borrowers outside options, have any significant effect on bondholders' wealth.

It is possible that the bondholder wealth effect of renegotiated loan term changes differs between investment-grade firms and speculative-grade firms, since the two sets of firms are fundamentally different. I examine this possibility by interacting the speculative-grade dummy with each of the loan term change variables. Unreported results find insignificant coefficient estimates on these interactive terms, implying that there is no obvious heterogeneous effect of loan contractual term changes via renegotiation across the two groups of firms.

2.3.3 Individual-level bargaining power proxies

Aggregate-level macro measures for borrowers' outside options overlook the heterogeneity of bargaining power across individual observations, potentially resulting in low power for my former statistical tests. To alleviate the concern, I follow Murfin (2012) and employ three individual-level proxies for the relative bargaining power of banks v.s borrowers: lender capitalization, the number of lender relationships, and a commercial paper issuer dummy.

Lender capitalization is the ratio of shareholder equity to total assets held by the lead arranger(s) in the last quarter prior to renegotiation.[22] The rational is that healthy

[22]I measure it at ultimate parent firm level and take care of bank mergers and acquisitions. The DealScan lender names is hand-matched to Compustat, and quarterly data are extracted from either Banks, North America, and Global. I use the average if there is more than one lead arranger.

banks with high capitalization are willing to grant loans with looser covenants (Murfin (2012)), suggesting that well-capitalized banks have more flexibility than otherwise poor-capitalized banks in retaining the lending relationship with firm by relaxing covenants.[23] The number of lender relationships is the number of banks used over the last four transactions prior to the renegotiation, scaled by the number of prior transactions used in the calculation as some firms have less than four prior transactions. It captures the breadth of a borrower's outside bank choices and the extent of hold-up problems caused by exclusive bank-borrower relationships. Lastly, commercial paper market is viewed as a close substitute for bank borrowings (Kashyap, Stein, and Wilcox (1993)) and I therefore set the commercial paper issuer dummy to be one if the short-term ratings is at least A-2, and zero otherwise.[24]

Panel B of Table A.5 reports robust regression results on a specification that extends the one in panel A by adding the three bargaining power proxies one at a time and their interaction with the renegotiated change of covenant strictness. The results are similar when using OLS and median regressions. According to Hypothesis 1a, the negative impact of relaxing covenants on bondholders, if any, is expected to be stronger when borrowers have relative stronger bargaining power. In fact, the coefficient sign for the interaction terms with lender capitalization and with the number of lender relationships is negative, but it is only significant when the number of lender relationship proxy is used. Moreover, unreported Wald tests show that the magnitude of these coefficients is so small that the net effect of covenant relaxation is still positive and significant for firms that have more outside bank choices or whose lenders are well-capitalized. In addition, the coefficient

[23] Alternatively, according to Murfin (2012), "limited liability for bank shareholders may induce gambling when the bank is undercapitalized." Banks may loosen covenant strictness with larger losses in bad states in exchange for higher interest rates or lucrative business (e.g. underwriter or M&A advisor fee) in good state of the world. The relation between lender capitalization and renegotiated covenant strictness change is eventually an empirical question.

[24] Due to the availability of these measures, the sample size is reduced. In unreported analysis, I confirm that the main results in panel A of A.1 holds for these smaller samples.

estimates for all the three proxies are not significant at all. The coefficient estimate for ΔSpread is significantly negative across all the three specifications, but untabulated Wald test shows that the overall effect of renegotiated spread, i.e. the sum of the estimated intercept and coefficient on ΔSpread, is not statistically different from zero. Overall, there is little evidence supporting either Hypothesis 1a that bank loan renegotiations that loosen bank covenants is associated with negative abnormal bond returns; or Hypothesis 2 that bank loan renegotiations that increase loan spread is associated with negative bondholders' reaction.

2.3.4 Further investigation of Hypothesis 2

I conduct two tests in this section to investigate why I fail to find on average a sizable and significant negative bondholders' reaction to bank loan renegotiations that raise interest rate spread as predicted by Hypothesis 2. According to Gorton and Kahn (2000), when the most unfavorable news arrives, because the banks threat to liquidate is credible, firms will allow the bank to extract a higher interest rate in exchange for asset substitution. This would imply a positive shareholder reaction to renegotiations that increase spread if the asset substitution effect outweighs the effect of bad news. Therefore, in place of abnormal bond return. Panel A of Table A.6 examines stock cumulative abnormal return (CAR) in the same specification (2.3).[25]

The coefficient for ΔSpread is positive and statistically significant for five out of six estimates; and the magnitude is also economically large. Based on the OLS estimate, one standard deviation increase of loan spread is associated with 1.6% cumulative abnormal stock return over a [-5,5] window. This seems to be consistent with the asset substitution story. In addition, there is some evidence that loosening covenants via renegotiation is

[25]Two renegotiations are dropped as there is no sufficient stock return data for the event study. In unreported analysis, the main findings for abnormal bond returns in Section 2.3.2 still holds for the remaining 319 observations.

associated with positive stock reaction, which is significant for OLS and robust regression, while is insignificant at traditional levels for simultaneous-quantile regressions.

There may be, however, an alternative explanation to the positive shareholder reaction to renegotiations that increase loan spread. That is, as the firm's equity can be viewed as a call option on the firm's total assets (Merton (1974)), that firms delay a default by compensating their lenders for additional loan risk exposure is equivalent to extending the expiration date of that call option, which effectively increases the value of the option. To differentiate the two possible explanations, I next compare the relation between firms' quarterly investment and stock volatility within the four quarters after renegotiation conditional on the change of loan spread. Eisdorfer (2008) has shown both theoretically and empirically that the risk-shifting incentive can weaken and even reverse the expected negative relation between stock volatility and investment. Consequently, I am expecting that, if Gorton and Kahn (2000)'s model holds, the post-renegotiation relation between investment and volatility is less negative (or even positive) for the subset of renegotiations that increase spread than for the subset of renegotiations that do not change spread. However, extending a call option's expiration date does not generate the same implication.

Motivated by Johnson (2003), I use a specification that allows the coefficient on stock volatility to change across subsamples based on whether and how spread changes. I do this by defining three zero-one dummy variables indicating whether spread is increased, unchanged, or decreased, and then time each dummy by stock volatility. That is,

$$\begin{aligned} I_t &= \alpha_0 + \alpha_1 \text{stock\_volatility}_{t-1,\Delta spread>0} \\ &+ \alpha_2 \text{stock\_volatility}_{t-1,\Delta spread=0} \\ &+ \alpha_3 \text{stock\_volatility}_{t-1,\Delta spread<0} \\ &+ \beta_1 \Delta \text{Covenant strictness}_t + \beta_2 \Delta \text{Spread}_t \end{aligned} \tag{2.4}$$

$$+ \quad \beta_3 \Delta \text{Maturity}_t + \beta_4 \Delta \text{Amount}_t + \Gamma \text{Firm\_controls}_{t-1}$$
$$+ \quad FF12 + Qtr + \varepsilon_t,$$

where the dependent variable is either the sum of the capital expenditure and R&D expense (Total investment), capital expenditure (Capex), or R&D. Note that α_1, α_2, and α_3 directly measure the relation between investment and stock volatility for each of the three subsets of renegotiations. I add the four continuous loan term change measures and include logged book assets, market-to-book ratio, book leverage, cash flow, and cash holding in Firm_controls, all of which are defined in Appendix B. I also control for Fama-French 12 industry and calendar quarter fixed effects, and cluster standard errors by firm and calendar quarter (Petersen (2009)).

Panel B of Table A.6 reports the results. First, note that the coefficient estimates on firm controls are consistent with the existing literature (e.g. Eisdorfer (2008)). Most importantly, in contrast to what the asset substitution problem would suggest, the investment and stock volatility relation is more negative for the subset of renegotiations that increase loan spread than for the subset of renegotiations that do not change spread. This result is mainly driven by the relation between capital expenditure and stock volatility, while the result for R&D is lacking statistical significance, probably due to the fact that only 20% of the sample reports non-zero R&D expense. Focusing on capital expenditure, the relation between investment and stock volatility for the subset of renegotiations that increase spread is significantly negative (-0.017); and based on unreported Wald tests, it is also significantly more negative at 5% level than the counterparts for the subset of renegotiations that either do not change or decrease loan spread. Overall, the combined evidence suggests that while increased loan spread reveals unfavorable information and reduces the available resource for bondholders, the firm becomes more conservative in making investment decisions. These two opposite effects explain why I fail to find any noticeable negative reaction from bondholders to renegotiations that increase spread, as what Gorton and Kahn (2000) predict.

2.3.5 Robustness check

2.3.5.1 Asymmetric effect

The discussion of Hypothesis 1b and Hypothesis 2 in Section 2.1 suggests that the effect of loosening covenant strictness (increasing loan spread) is likely to be different from the effect of tightening covenant strictness (decreasing loan spread). I seek to capture these asymmetric effects by decomposing the change of covenant strictness into a positive and negative component. I use the absolute value form of the two components in the regression analysis, since it allows the coefficient of each component to directly reflect any potential differential effect. I do the same to the change of loan spread.[26]

Panel A of Table A.7 reports the asymmetric effect of loosening covenants vs. tightening covenants. Results based on OLS, robust regression, and quantile regressions are consistent and show that the positive impact of covenant strictness change as documented in Table A.5 comes exclusively from loosening covenants, though the estimates at 25% and 75% are insignificant. The coefficient estimate for tightening covenants is small and insignificant. This might be due to the fact that there are only 17 renegotiations in my sample that tighten covenants (see panel B of Table A.3), which reduce the power of the test. Another possibility is that while tightening covenants benefits bondholders by increased bank monitoring, it is usually associated with the arrival of bad information of the firm, which hurts bondholders. As a result, the net effect could be small. In unreported Wald tests, I find that the difference of coefficient estimates between loosening and tightening covenants is marginally significantly different from zero in robust regression. In contrast,

[26] I focus on discussing the two term changes as these are the only ones where the theory says there might be a differential effect. In unreported analysis, I examine the asymmetric effect for changes of loan amount and maturity, and I find no effect.

I do not find any significant asymmetric effect of increasing vs. decreasing loan spread on bond abnormal returns as reported in panel B of Table A.7.

2.3.5.2 Bond illiquidity and sample selection issues

This section addresses two concerns related to the bond event study as mentioned in Section 2.2.2.2. The one is that, in order to preserve the sample size, I have imposed the requirement of three-day trades over the [-20,-1] period prior to Day 0, which is less stringent than the ten-day trades requirement in Bessembinder, Kahle, Maxwell, and Xu (2009). In untabulated analyses, I rerun the analysis in Table 4 using the ten-day trades requirement. It results in a much smaller sample of 229 renegotiations, which leads to a qualitative similar but less significant relation between abnormal bond returns and the change of covenant strictness.

The other issue is about a potential selection bias due to the requirement that bond price should be available on both sides of Day 0 within five-day event window. Following May (2010), I deal with this concern by examining the sample of bonds without imposing this requirement, as long as they meet the three-day liquidity requirement. This method assumes that, for a day where a bond does not trade, the bond's price did not change and the raw return only reflects accrued interest. This method produces a sample of 378 renegotiations, and in untabulated results, I repeat the analysis in Table A.5 using this sample and the results are similar to those reported in Table A.5.

2.3.5.3 Alternative explanations

The positive bondholders' reaction to renegotiations that relax covenants could be due to the fact that the increased risk taking upon covenant violation has been avoided upon loosening covenants. While Nini, Smith, and Sufi (2012)'s evidence seems to support the view that corporate governance via creditor control upon covenant violation increases the firm value, the literature also finds that risk-shifting activities increase after covenant violation. Specifically, Esmer (2010) finds that there is a positive relation between volatility and investment upon technical default, and the relation is much stronger for firms whose CEO has stronger risk-taking incentive (i.e. high compensation portfolio sensitivity to stock return volatility and high equity ownership). Esmer (2010) further finds a significant increase in firm risk in the year following the violation. Therefore, the positive coefficient on relaxing covenants might just be driven by the fact that relaxing covenants avoids covenant violation and subsequent risk shifting, which improve bondholders' wealth. To rule out this possibility, I exclude renegotiations that are followed by covenant violation in the upcoming year. These renegotiations are more likely to represents the set of firms which would have violated covenants in the absence of renegotiation. It reduces the sample size to 309. The results, as reported in panel A of Table A.8, are very similar to panel A of Table A.5.

Finally, I examine the possibility that the results might be driven by information released from earnings announcements. Easton, Monahan, and Vasvari (2009) find that bond price reacts significantly around earnings announcements. Therefore, I follow Klein and Zur (2011) and control for this type of event by including a dummy variable that is set to one if the firm had an earnings announcement in the event window and zero otherwise. For my renegotiation sample, there are 62 renegotiations which have earnings announcements within the [-5, 5] window. In panel B of Table A.8, I find that the earnings announcement dummy has insignificant coefficient, while the estimates for the rest variables are still similar to Table A.5.

2.4 Conclusion

In this study, I empirically examine why debt renegotiations happen in the context of bank loan renegotiations outside any sort of financial distress or default. I find a statistically and economically significant bondholder reaction to renegotiations that relax covenant strictness. This result supports the Gârleanu and Zwiebel (2009) model, where banks are willing to transfer substantial control rights back to firms when firms have less opportunities of wealth transferring from bondholders to stockholders. At the same time, this result reject the possibility that renegotiations when firms have strong bargaining power could hurt bondholders. I find little evidence that renegotiated increase of bank loan interest rate leads to negative bondholders' reaction as implied by Gorton and Kahn (2000). This is explained by the evidence that firms become more conservative in making investment decisions after such renegotiations, although increased loan spread usually indicates the deterioration of firms credit quality.

This study also provides guidance for future research. I provide strong support for the economic mechanism proposed in Gârleanu and Zwiebel (2009). That is, loosening strict covenant over time is a way that "good-type" firms use to mitigate financing frictions from asymmetric information between creditors and firms. However, it is still unclear what the nature of the friction is. In other words, is it due to asset substitution, debt overhang, or inefficient liquidation? For example, in Myers (1977), that renegotiation breakdowns generate debt overhang is central to his original analysis (see also Hart and Moore (1995), Bhattacharya and Faure-Grimaud (2001), and Tirole (2010)). Hence, it would be interesting to examine whether bank loan renegotiation helps mitigate underinvestment problems, and if so, to what extent.

3. CEO INSIDE DEBT AND THE MATURITY OF CORPORATE DEBT ISSUES

A large and rich literature focuses on the nature of conflicts between a firm's stockholders and its debtholders. If not resolved efficiently, these conflicts can distort investment and financing decisions and reduce firm value. Shortening debt maturity is prominent among the ways that firms can attempt to reduce the severity and costs of stockholder-debtholder conflicts. For example, Barnea, Haugen, and Senbet (1980) and Leland and Toft (1996) show that short debt maturity can mitigate managerial incentives to engage in risk shifting. Brockman, Martin, and Unlu (2010) find empirical evidence that firms choose shorter debt maturity when their CEOs have greater risk taking incentives. Rajan and Winton (1995) and Stulz (2000) emphasize that short-term debt can force managers to face regular monitoring by outsider creditors. Myers (1977) shows theoretically that shortening debt maturity can alleviate underinvestment problems; Johnson (2003) provides empirical support for the hypothesis.

Shortening debt maturity is not, however, without costs. Diamond (1991b, 1993) and Sharpe (1991) emphasize the liquidity and roll-over risks of short-term debt, and Johnson (2003) finds that the increased risk of shorter debt maturity negatively affects leverage. Almeida, Campello, Laranjeira, and Weisbenner (2012) finds that firms who have large portion of debt maturing right after the 2007 financial crisis dramatically reduce their investment than similar firms who otherwise have debt maturing after 2008. Liquidity risk stems from the possibility that firms experience negative shocks around the times they need to refinance, and also from the possibility of negative shocks that affect lenders such as the recent financial crisis. Thus, firms face a tradeoff of greater risk when they attempt to reduce the severity and costs of shareholder-debtholder conflicts by shortening debt maturity.

A growing set of recent studies focus on the role of CEO inside debt in mitigating stockholder-debtholder conflicts. CEO inside debt includes defined-benefit pensions and deferred compensation arrangements, and thus resembles other debt that firms owe. The basic idea originated with Jensen and Meckling (1976). Edmans and Liu (2011) develops the idea more formally, and demonstrates theoretically that inside debt can reduce asset substitution problems (and similar stockholder-debtholder conflicts). Empirical studies find inside debt to be an important and prevalent feature of modern executive compensation in the United States (Bebchuk and Jackson (2005), Sundaram and Yermack (2007), and Wei and Yermack (2011)). There is also evidence that CEO inside debt is related to more conservative corporate investment and financing decisions (e.g. Sundaram and Yermack (2007), Wei and Yermack (2011), Cassell, Huang, Sanchez, and Stuart (2012), Liu, Mauer, and Zhang (2014), Liu, Mauer, and Zhang (2012)). The evidence is consistent with the notion that CEOs compensated (at least in part) with debt-like instruments have some degree of incentive alignment with debtholders.

We join the literature on how debt maturity can reduce stockholder-debtholder conflicts with the literature on how CEO inside debt can reduce those conflicts to hypothesize that firms with greater levels of CEO inside debt can employ longer maturity corporate debt structures. If a firm can reduce the severity of stockholder-debtholder conflicts via the use of inside debt compensation to its CEO, it can avoid having to shorten debt maturity and the associated risks and costs of doing so. The basic hypothesis is straightforward, but it requires refinement to generate testable hypotheses. The incentive alignment effect of CEO inside debt relies critically on the extent to which the payoffs to debt compensation resemble payoffs to risky corporate debt (i.e. unsecured debt) (Edmans and Liu (2011), Anantharaman, Fang, and Gong (2013)). If CEOs can withdraw their debt compensation before other corporate debt matures, i.e., if it has a shorter maturity than the maturity of the other corporate debt, it eliminates the risk that these CEOs will lose benefits if their firms go bankrupt after withdrawal. Consequently, inside debt with maturity shorter than that of corporate debt is effectively senior to that corporate debt if bankruptcy occurs in the short term, which renders the incentive-alignment effect of inside debt weak or even negligible for creditors whose claims mature after inside debt. Thus, we must differentiate between firms with short maturity inside debt and those with long maturity inside debt.

The second critical dimension for the incentive alignment effect of CEO inside debt relies on its magnitude relative to the CEOs equity holdings and the firm's overall leverage ratio. A CEO should be debt biased if she has a leverage ratio (her inside debt / her equity positions in the firm) that is greater than the firms debt to equity ratio (Edmans and Liu (2011)); this is termed a relative CEO leverage ratio greater than 1.0. Conversely, a CEO with a relative leverage ratio below 1.0 should be equity biased in her decision-making.

We test three specific hypotheses. First, we hypothesize that among firms with long-term inside debt, debt maturity for firms with debt-biased CEO relative leverage ratios is greater than for firms with equity-biased CEO relative leverage ratios; this hypothesis captures the debt vs. equity bias dimension of inside debt among firms for which inside debt maturity is long enough to matter. Second, we hypothesize that among firms with debt-biased CEO relative leverage ratios, debt maturity for firms with long-term inside debt is greater than for firms with short-term inside debt; this hypothesis captures the importance of the inside debt maturity dimension among the set of firms whose CEOs should have a debt bias. Third, we hypothesize that among firms with equity-biased CEO relative leverage ratios, debt maturity for firms with long-term inside debt is less than for firms with short-term inside debt; this hypothesis captures the point that stockholder-debtholder conflicts should be greater for firms with long-term inside debt levels that are equity biased.

Using a sample of 4,399 new debt issues by firms between 2007 and 2012, we find support for all three hypotheses. Among firms with long-term inside debt, firms whose

CEOs have debt-biased inside debt levels issue debt with a maturity of approximately one year longer than firms with equity-biased debt. Given a sample median maturity of 5 years, the effect of debt bias is an approximately 20% increase in the maturity. Among firms with debt-biased levels of inside debt, firms whose CEOs have long-term inside debt issue corporate debt with more than a half year longer maturity than do firms whose CEOs have short-term inside debt. Finally, among firms with equity-biased levels of inside debt, we find significantly one-year shorter maturity of new issues for firms with long-term inside debt compared to those with short-term inside debt. The results provide support for the overall hypothesis that CEO inside debt affects firms debt maturity structure through its ability to ameliorate stockholder-debtholder conflicts.

We next turn to additional tests to examine whether the relation between corporate debt maturity and CEO inside debt is stronger among firms for which the amelioration of stockholder-debtholder conflicts is expected to be large. Specifically, we sort the sample on firms' market-to-book ratios, and re-estimate the regressions for high and low market-to-book firms relative to the sample median. Risk shifting should be easier when choosing among new investments than assets already in place, so the effect between CEO inside debt and corporate debt maturity should be stronger for high market-to-book firms. Moreover, high market-to-book firms should have greater underinvestment problems, which also predicts a stronger effect for these firms between CEO inside debt and corporate debt maturity. Consistent with the view that stockholder-debtholder conflicts drive the three relations we discuss above, we find that the relations hold only among firms with high market-to-book ratios. Firms with low market-to-book ratios are expected to have less severe stockholder-debtholder conflicts, which is consistent with our finding of no reliable relation between CEO inside debt and corporate debt maturity for these firms.

We also employ a bias-corrected nearest neighbor matching approach, and obtain matched firm, difference-in-difference estimates for firms that either change their incentive bias while holding incentive horizon type the same, or change their incentive horizon type while holding incentive bias unchanged. This approach control for observed and unobserved firm heterogeneity. We find statistically and economically strong evidence for our first hypothesis that among firms with long-term inside debt, debt maturity for firms with debt-biased CEO relative leverage ratios is greater than for firms with equity-based CEO relative leverage ratios.

This chapter makes several contributions. First, Our paper contributes to the burgeoning research on the economic consequences of managerial debt compensation.[1] Sundaram and Yermack (2007) find that Merton's (1974) distance to default is greater when the CEO's pension value increases relative to his equity value. In a follow up, Wei and Yermack (2011) examine security holders' reactions when firms were first required to report CEO inside debt positions following a 2007 SEC disclosure reform. They find an increase in bond prices, a decrease in equity prices, and a drop in overall firm value. Both studies suggest that CEOs with large inside debt positions incline to manage their firms more conservatively. Subsequent research finds evidence that is consistent with the implication. Cassell, Huang, Sanchez, and Stuart (2012) find that larger CEO inside debt holdings are associated with lower firm stock return volatility, R&D expenditures, and leverage, and with greater corporate diversification and liquidity. Liu, Mauer, and Zhang (2012) find that larger CEO inside debt is directly related to value-destroying diversifying acquisitions that decrease overall firm volatility. Related, Phan (2013) documents a positive (negative) relation between CEO inside debt holdings and M&A announcement abnormal bond (stock) returns. Liu, Mauer, and Zhang (2014) find that corporate cash balances increase with CEO inside debt and the marginal shareholder value of these higher cash balances decreases in CEO inside debt, especially for firms with poor governance. Chen, Dou,

[1] Sundaram and Yermack (2007), Gerakos (2007), Cen (2010), and Liu, Mauer, and Zhang (2012) examine the determinants of CEO inside debt and its pension and deferred compensation components.

and Wang (2011) and Anantharaman, Fang, and Gong (2013) find that larger CEO inside debt holdings are associated with lower costs of public and bank debt and fewer restrictive covenants.[2] Anantharaman, Fang, and Gong (2013) is closely related to our analysis in the sense that they also emphasize different incentive horizons of CEO inside debt components. We distinguish ourself by focusing on firms' maturity decision of new debt issues. To the best of our knowledge, we are the first to examine the influence of inside debt on corporate debt maturity decisions, emphasizing the importance of the incentive horizon in understanding how CEO inside debt affects corporate financial policies.

In fact, our finding on the role of CEO inside debt's incentive horizon deepens the understanding on the heterogeneity of the incentive effect provided by different components of inside debt, i.e. deferred compensation and pension. On the one hand, Liu, Mauer, and Zhang (2014) find that the positive relation between firms' cash holdings and CEOs' deferred compensation is two to three times larger than the positive relation between firms' cash holdings and CEOs' pension. On the other hand, Anantharaman, Fang, and Gong (2013) find that the effect of inside debt on bank loan contract design is driven by a specific type of pension plans – Supplemental Executive Retirement Plans (hereinafter, SERPs). The underlying reason is that deferred compensation entitles executives to flexible withdrawal schedules which often start before retirement (Anantharaman, Fang, and Gong (2013)). While the withdrawal flexibility of deferred compensation makes CEOs with large deferred compensation want to save a great amount of cash as a buffer, such flexibility causes great uncertainty for outside creditors to evaluate any potential incentive-alignment effect from deferred compensation. SERPs, on the contrary, is usually unsecured and unfunded, and CEOs can only start to withdraw its balance at or

[2]Different from these studies, Campbell, Galpin, and Johnson (2015) examine the impact of CEO inside debt level change on equity value from an optimal contracting view and find that equity value increases as firms move towards the predicted optimal CEO inside debt level, consistent with the theoretical predictions in Edmans and Liu (2011).

after retirement, which effectively guarantees outside creditors that CEOs would behave conservatively in a relatively long period of time.

This chapter also adds to the literature of how executive compensation incentives influence corporate capital structure and debt maturity structure. Berger, Ofek, and Yermack (1997) find that firms with weak managerial incentive avoid debt. Novaes (2003) shows that the optimal level of leverage for shareholders differs from that chosen by entrenched managers. Datta, Iskandar-Datta, and Raman (2005) find that managerial stock ownership is inversely related to debt maturity. Benmelech (2006) theoretically and empirically documents that managerial entrenchment is positively associated with a higher portion of long-term debt. The article that is closely related to ours is Brockman, Martin, and Unlu (2010). They find a significantly positive (negative) relation between CEO portfolio vegas (deltas) and the proportion of short-term debt, consistent with the view that short-maturity debt mitigates agency costs of debt related to asset substitution. However, unlike our analysis, Brockman, Martin, and Unlu (2010) do not study the relation among CEO debt compensation incentive, associated incentive horizon, and corporate debt maturity decision. We follow Brockman, Martin, and Unlu (2010) and control for any impact of CEO equity compensation incentives throughout our analysis.

Next, our study contributes to the literature on debt maturity structure. Barclay and Smith (1995) find that growth options and firm size are negatively related to debt maturity. Stohs and Mauer (1996) document a series of findings: large firms with less risk and longer-term asset maturities have longer-term debt; firms with more positive earnings surprises use more short-term debt; and there is a non-monotonic relation between debt maturity and bond rating, with high or very low rated firms having shorter-term debt. Using data on new public issues, Guedes and Opler (1996) find that large and highly rated firms borrow at both ends of the maturity range while risky firms borrow in the middle of the maturity range. Barclay, Marx, and Smith (2003) and Johnson (2003) explicitly account for the potential simultaneity between leverage and maturity in the simultaneous equations model. Barclay, Marx, and Smith (2003) find that both leverage and debt maturity are negatively related to growth opportunities. Johnson (2003) identifies an attenuation effect of short-term debt on the negative effect of growth opportunities on leverage.[3] Billett, King, and Mauer (2007) account for the endogenous choices of covenant structure, leverage, and maturity, and find that short-term debt and covenants are substitutes in controlling stockholder-bondholder conflicts over the exercise of growth options. Recently, Saretto and Tookes (2013) find that firms with traded credit default swap (CDS) contracts on their debt have higher leverage and longer debt maturities, consistent with the idea that suppliers' ability to hedge risk through CDS boosts the supply side of credit markets. In addition, Benmelech, Kroszner, and Ram (2000) finds that debt maturity increases in asset liquidation value, which is measured by asset salability in nineteenth-century American railroads. Following Guedes and Opler (1996), we examine the maturity of incremental debt issuances. Our paper adds to the debt maturity literature by showing how and when CEOs' debt compensation incentives affect firms' debt maturity.

Finally, in a broad perspective, our empirical results add to the literature on managerial incentive horizon. Johnson, Ryan, and Tian (2009) find that already-vested stock is related to corporate fraud. Gao (2010) finds that old CEOs and CEOs with a higher amount of restricted stock and options that become vested during a given year have higher abnormal returns at acquisition announcements, are less likely to use equity to pay for the transactions, and experience inferior post-merger stock performance in the long run. Edmans, Fang, and Lewellen (2013) document a negative relation between the imminent vesting of a CEO's equity and corporate investment in R&D. Chi, Gupta, and Johnson (2011) estimate the overall vesting horizon of managers' equity incentive compensation and provide

[3]Johnson (2003) confirms Barclay, Marx, and Smith (2003)'s finding that leverage is negatively related to growth opportunities, but he did not find the negative relation between debt maturity and growth opportunities, which he attributes to the multicollinearity problem in the maturity regression.

the first empirical evidence of a link between the time horizon of firms' managerial compensation incentives and their firms' information environment quality.[4] While all these studies focus on the horizon of CEO equity incentive, we look at the horizon of CEO debt compensation and its relation to firms' financial policies.

The remainder of the chapter is organized as follows. We review the literature that motivates our analysis and develop our hypotheses in Section 3.1. Section 3.2 describes the data. Section 3.3 presents results of our main tests and robustness analysis. Finally, Section 3.4 concludes.

3.1 Prior literature and hypotheses

Equity-based compensation aims at aligning the interests of managers with those of shareholders. However, these compensation mechanisms may exacerbate stockholder-debtholder conflicts, raising agency costs of debt that are eventually born by stockholders (Jensen and Meckling (1976)). Existing empirical studies find evidence that is consistent with the view that CEO incentives derived from equity-based compensation, option pay in particular, increase firm risk. Coles, Daniel, and Naveen (2006) document that the resulting increase in the vega of a CEO's compensation motivates him to pursue riskier investment and financing policies. Employing different empirical designs to address the endogeneity issues, a series of recent papers (i.e. Chava and Purnanandam (2010), Gormley, Matsa, and Milbourn (2013), Shue and Townsend (2013)) find causal effect of managerial option pay on risk taking.[5] As a result, managerial option ownership raises the agency costs of debt.[6]

Literature has shown that short-term debt can be a prominent instrument for mitigating

[4]Also see Gopalan, Milbourn, Song, and Thakor (2014).

[5]An exception is Hayes, Lemmon, and Qiu (2012), who find that options do not affect risk taking.

[6]Empirical evidence includes: Ortiz-Molina (2006) documents a positive relation between credit spreads and managerial stock and option ownership. Daniel and Martin (2004) find a positive relation between credit spreads and the volatility sensitivity (vega) of CEO compensation. Billett, Mauer, and Zhang (2010) find that stock price (bond price) drops (rises) in the change in delta and rises (drops) in the change in vega.

the severity and costs of stockholder-debtholder conflicts. Barnea, Haugen, and Senbet (1980) show theoretically that short-term debt can reduce the severity of asset substitution problems because it is less sensitive to changes in firm risk than long-term debt. Leland and Toft (1996) show that short-term debt can increase incentive compatibility between stockholders and debtholders and minimize the agency costs of asset substitution. Stulz (2000) and Rajan and Winton (1995) point out that short-term debt can force managers to face regular monitoring by market participants, such as investors and underwriters, which may also prevent managers from taking on risk. Brockman, Martin, and Unlu (2010) provide empirical support for these theories. Specifically, using CEO compensation portfolio vegas (deltas) as the proxies for CEOs' risk taking (dis)incentives, they find that the proportion of short-term debt is positively (negatively) related to CEO compensation portfolio vegas (deltas). In addition, they find that short-term debt attenuates the higher cost of debt induced by CEO portfolio vegas.

Shortening debt maturity is not, however, without costs. Diamond (1991b, 1993) and Sharpe (1991) develop models in which too much debt maturing in the short term creates a risk of suboptimal liquidation because lenders ignore the full value of control rents. Increasing the risk of suboptimal liquidation can be viewed as increasing expected bankruptcy costs, which is predicted to reduce optimal leverage. Consistently, Johnson (2003) finds that the increased liquidity risk of shorter debt maturity negatively affects leverage, which in turn limits firms' ability to use short debt maturity to reduce the underinvestment problems. Liquidity risk stems from the possibility that firms experience negative shocks around the times they need to refinance, and also from the possibility of negative shocks that affect lenders such as the recent financial crisis. Thus, firms face a tradeoff of greater risk when they attempt to reduce the severity and costs of stockholder-debtholder conflicts by shortening debt maturity.

Recent development in agency theory argues that adding debt-like compensation (i.e.

inside debt) in executive compensation package discourages managers from taking excess risks and mitigates stockholder-debtholder conflicts. The basic idea originated with Jensen and Meckling (1976) and has been formally theorized by Edmans and Liu (2011). By considering simultaneously agency costs of debt and equity, Edmans and Liu (2011) show that debt-like components in executive compensation are more effective in aligning managers' incentive with those of firms' debtholders than salaries and bonuses (i.e. cash compensations). This is because, for inside debt arrangements, a firm promises to pay executives fixed amounts at a later point in time (e.g. upon their retirement). These promised future payments are unsecured and typically underfunded, and hence resemble risky debt claims against the firm. As a result, their value not only depends upon the incidence of bankruptcy as cash compensations do, but also links to the value of assets in bankruptcy, which renders managers' objectives similar to debtholders'. In other words, inside debt effectively aligns managers' interests with debtholders'.

Linking the literature on how debt maturity can reduce stockholder-debtholder conflicts to the literature on how CEO inside debt can reduce those conflicts, we posit that firms with greater levels of CEO inside debt can employ debt with longer maturity in corporate capital structures. If a firm can reduce the severity of stockholder-debtholder conflicts via the use of inside debt compensation to its CEO, it can avoid having to shorten debt maturity and the associated risks and costs of doing so. The basic hypothesis is straightforward, but it requires refinement to become testable.

First and foremost, the positive relation between debt maturity and inside debt hinges on the incentive horizon of inside debt compensation. If CEOs can withdraw their debt compensation before other corporate debt matures, i.e., if it has a shorter maturity than the maturity of the other corporate debt, it eliminates the risk that these CEOs will lose benefits if their firms go bankrupt after withdrawal. Consequently, inside debt with maturity shorter than that of corporate debt is effectively senior to that corporate debt if bankruptcy occurs in the short term, which renders the incentive-alignment effect of inside debt weak or even negligible for creditors whose claims mature after inside debt. As a result, long-term debtholders perceive short maturity CEO inside debt as having little incentive alignment effect (even if it is unfunded), and as a result, we must differentiate between firms with short maturity inside debt and those with long maturity inside debt.

Furthermore, the incentive alignment effect of a CEO's inside debt relies on its magnitude relative to the CEO's equity holdings and the firms overall leverage ratio. Edmans and Liu (2011) show that, when an executive's compensation includes both debt-like claims and equity-like claims on the firm, his incentives vary with the relative importance of debt- versus equity-based compensation in his pay package. Specifically, a CEO should be debt biased if she has a leverage ratio (her inside debt / her equity positions in the firm) that is greater than the firms debt to equity ratio (Edmans and Liu (2011)); this is termed a relative CEO leverage ratio greater than 1.0. Conversely, a CEO with a relative leverage ratio below 1.0 should be equity biased in her decision-making.

Taking into consideration the two important dimensions of inside debt, we first hypothesize that among firms with long-term inside debt, debt maturity for firms with debt-biased CEO relative leverage ratios is greater than for firms with equity-biased CEO relative leverage ratios, which captures the debt vs. equity bias dimension of inside debt among firms for which inside debt maturity is long enough to matter. Second, we hypothesize that among firms with debt-biased CEO relative leverage ratios, debt maturity for firms with long-term inside debt is greater than for firms with short-term inside debt. As noted above, inside debt with shorter maturity than that of corporate debt is effectively senior to the claims of outside creditors, which mutes incentive-alignment effect of inside debt for long-term lenders and limits firms' ability to borrow long-term debt. This hypothesis captures the importance of the inside debt maturity dimension among the set of firms whose CEOs should have a debt bias. Third, we hypothesize that among firms with equity-biased

CEO relative leverage ratios, debt maturity for firms with long-term inside debt is less than for firms with short-term inside debt; this hypothesis captures the point that stockholder-debtholder conflicts should be greater for firms with long-term inside debt levels that are equity biased. To summarize:

Hypothesis 1: Among firms with long maturity inside debt, the maturity of corporate debt issues is longer for firms with debt-biased CEOs than for firms with equity-biased CEOs.

Hypothesis 2: Among firms with debt-biased CEOs, the maturity of corporate debt issues is longer for firms with long-term CEO inside debt than for firms with short-term CEO inside debt.

Hypothesis 3: Among firms with equity-biased CEOs, the maturity of corporate debt issues is shorter for firms with long-term CEO inside debt than for firms with short-term CEO inside debt.

3.2 Sample construction and description statistics

3.2.1 Sample construction

We rely on four data sources: Thomson One, Standard and Poor's ExecuComp, Compustat, and CRSP databases. We obtain CEO compensation and ownership information from the ExecuComp database for the period over year 2006 to year 2011. The ExecuComp database covers firms in the S&P 500, S&P Midcap 400, S&P SmallCap 600, and other firms that are not currently in the S&P indexes but that were previously in one of the indexes. The sample period starts in 2006 because SEC started to require firms to disclose the present value of benefits accrued under pension plans and other deferred compensation plans in 2006. We extract information of new debt issues from Thomson One from year 2007 to year 2012. Financial accounting data come from Compustat annual files and monthly stock return information is from CRSP. We match each debt issue with its corresponding firm's financial and compensation information at the latest fiscal year end before the debt issuance date. Moreover, to construct our inside debt maturity proxy as discussed below, we hand-collect data from proxy statements on the existence of lump-sum options for SERPs. Following Anantharaman, Fang, and Gong (2013), we identify lump-sum payout options when the firm discloses that its CEO either has the option or is required to claim benefits as a lump sum under SERPs.

We start with identifying the CEO for each firm in ExecuComp from 2006 to 2011. We require firms to have non-missing values for CEOs' inside debt, stock ownership, and complete compensation data necessary to calculate the price and volatility sensitivities of the CEO's compensation portfolio. We then match the sample to Compustat and CRSP and require sufficient data in the Compustat and CRSP to calculate the dependent and control variables as discussed below. We exclude firms in the financial service industries (Standard Industrial Classification (SIC) codes 6000-6999). For each firm, we then obtain information of new debt issues from Thomson One. We winsorize all continuous variables at 1% and 99% of each variable's sample distribution to mitigate the impact of outliers. The final sample includes 4,399 new debt issues by 892 unique firms, including 43 Rule 144A issues, 196 private non-Rule 144A issues, 1,530 public issues, and 2,630 syndicated issues.

Rather than using the maturity of all the debt on a firm's balance sheet, we follow Guedes and Opler (1996) and examine the maturity of corporate debt issues at the margin. This incremental approach is well-suited to our study for a couple of reasons.[7] First, our predictions rely on whether creditors are able to perceive the incentive-alignment effect of inside debt. As Brockman, Martin, and Unlu (2010) argue, it is the incremental approach that "allows us to take the perspective of a prospective creditor who analyzes the firm char-

[7]Other studies using the incremental approach include Jung, Kim, and Stulz (1996), Hovakimian, Opler, and Titman (2001), and Denis and Mihov (2003).

acteristics that will determine the maturity structure of new lending." Second, Guedes and Opler (1996) emphasize that, "Another advantage of the incremental approach is that it can identify the determinants of financing choices at all points of the maturity spectrum. This allows us to characterize which types of firms inhabit various parts of the debt maturity spectrum more precisely than can be done using cross-sectional debt maturity information from the COMPUSTAT tapes." Accordingly, we believe that the specific maturity of corporate debt issues better identifies the type of incentives underlying the CEO. By contrast, the widely used debt maturity proxies, such as the proportion of debt maturing within three years, are built upon accounting variables and reflect the accumulation of past investment and financing decisions, and so may contaminate our results.

In order to test our hypotheses, for the dependent variable, we measure the maturity of corporate debt issues in years. For the key variables of interest and other control variables, we now define them as follows.[8]

Debt compensation incentives: For a firm-year, we first use ExecuComp compensation data and compute CEO inside debt as the sum of pension value and deferred compensation. Pension value is the aggregate actuarial present value of the executive's accumulated benefit under the company's pension plans and deferred compensation is the aggregate balance in non-tax-qualified deferred compensation plans, both of which are measured at the end of a fiscal year. We then compute the value of the CEO's equity holdings, which is the sum of the value of the CEO's common stock holdings in the firm and the dividend-adjusted Black-Scholes value of option holdings, all measured at the end of the fiscal year. Both stock and option holdings include current year grants and all accumulated stock and option holdings. Finally, the CEO relative leverage ratio is the CEO's debt-to-equity ratio divided by the firm's debt-to-equity ratio, where CEO debt is the value of inside debt, CEO equity is the value of the CEO's equity holdings, the firm's debt is the sum of long-term debt plus

[8]We also provide detailed definitions of all variables and corresponding data source in Appendix E.

debt in current liabilities, and the firm's equity is the market value of equity. Our measure of CEO inside debt incentive is an indicator variable set equal to one if the CEO relative leverage ratio exceeds one and zero otherwise. Consistent with Edmans and Liu (2011), this variable delineates CEOs' compensation portfolio incentive between debt-biased CEO relative leverage ratios versus equity-biased CEO relative leverage ratios.

The maturity of inside debt: To examine the importance of CEO incentive horizon from inside debt, we need a measure that captures the horizons of both CEOs' pension and deferred compensation. The ideal measure would also capture the relative size of the incentives at each horizon, as the duration measure for managers' equity incentive in Chi, Gupta, and Johnson (2011) and Gopalan, Milbourn, Song, and Thakor (2014). Unfortunately, due to a lack of disclosure requirements, firms seldom disclose the withdrawal schedules for their CEOs' deferred compensation and there is not a machine readable database providing further detailed classification of pension plans.[9]

We operationalize the concept of the incentive horizon of CEO inside debt using a dichotomous variable (*Short*) classifying inside debt into short-term versus long-term. We call that the CEO has short-term inside debt if his age is greater than 52 and his SERPs, if any, has a lump-sum payout option (*Lumpsum* $= 1$). With respect to choosing age 52 as the cutoff, it is because we want our measure (*Short*) to be able to reflect collectively all the ex-ante expectations of outside creditors on the likelihood of CEOs' retirement. First, 62 and 65 are, respectively, the early and normal retirement age for claiming social security benefits in the U.S. More importantly, from reading SEC filings, we observe that it is often the case that firms allow their CEOs to claim pension benefits at an age as early as 55, albeit at reduced rates.[10] The lump-sum option allows a CEO to withdraw all her pension

[9]Anantharaman, Fang, and Gong (2013) provide a detailed discussion on the CEO debt compensation practice in the U.S.

[10]Our results are qualitatively similar when using alternative cuttoffs around the age of 52, for classification of short inside debt maturity.

under SERPs at retirement. The lump-sum payout option helps us exclude cases where the exiting CEO has a large pension to draw through a relatively long period of time even after retirement when defining short inside debt maturity. To reduce future risk for her wealth in the pension, the CEO can choose to stay on the firm's board after retirement or select a risk-averse successor when she retires. Such behaviors effectively lengthen the incentive horizon of inside debt. Anantharaman, Fang, and Gong (2013) show that, the lump-sum feature, by allowing a CEO to claim his SERPs benefits all at once, renders CEO interests aligned closer only with short-term bank loans whose claims happen before the CEO's. Therefore, we account for the lump-sum payout option in the SERPs when approximating the incentive horizon of CEO inside debt.

There is another reason for taking into account of the lump-sum payout option. Anantharaman, Fang, and Gong (2013) show that among all components of CEOs' inside debt compensation, it is pension, and in particular, SERPs that mainly drives the relation between inside debt and loan contract design. To the extent that it is also SERPs that drives the association between inside debt and corporate debt maturity, and as the ExecuComp database does not provide further detailed information on pension components, accounting for the lump-sum payout option in our inside debt maturity measure at least indicates which CEOs have SERPs in his debt compensation, which in turn reduce the noisiness of our incentive measure to some extent and increase the power of our tests.

Equity compensation incentives: Following (Core and Guay, 1999, 2002), and Edmans, Gabaix, and Landier (2009), we compute the CEO's portfolio price sensitivity (i.e. delta) as the change in the value of the CEO's stock and option portfolio due to a 1% increase in the price of the firm's common stock. We compute the CEO's portfolio volatility sensitivity (i.e. vega) as the dollar change in the value of the CEO's option grants and any option holdings for a 1% change in the annualized standard deviation of stock returns.[11]

[11] Core and Guay (1999)'s findings suggest that the CEO's combined stock and option portfolio vega can

Following Brockman, Martin, and Unlu (2010), we use natural logarithm transformations of CEO delta and vega in our empirical tests.[12]

Control variables: We define leverage as the sum of long-term debt and debt in current liabilities divided by the market value of the firm. We control for leverage because short-term debt increases liquidity risk, which makes firms with high leverage choose more long-term debt to avoid suboptimal liquidation (Diamond (1991b)). We also calculate the proportion of debt maturing in more than 3 years ($LT3$). In the robustness check, we will control for the maturity structure of existing debt in a firm's capital structure. It is possible that marginal financing choices are linked with prior financing decisions (Denis and Mihov (2003)).

As in Johnson (2003), we use net sales (in constant 2006 dollars) as a proxy for firm size and I also include its square as proxies for credit quality. Diamond (1991b) predicts an inverse U-shape relation between debt maturity and credit quality. Regarding credit quality, we also include three indicator variables. The first one is set equal to one if the firm has no existing S&P long-term debt ratings ($NotRated$), zero otherwise. Conditional on having S&P long-term debt ratings, we further differentiate between investment grade firms and speculative grade firms by adding an investment grade rating dummy ($InvestmentGrade$), which indicates whether or not the firms have an existing debt rating of BBB or higher. The third dummy variable ($Zscore\_Dum$) indicates whether Altman (1968)'s Z-score is greater than 1.81. Firms with long-term debt (especially investment grade) ratings and higher Z-Scores are likely to have higher credit quality and can afford to borrow long-term debt.

We include the book value-weighted measure of asset maturity ($Asset\_Mat$), defined by Stohs and Mauer (1996). The maturity of long-term assets is measured as gross prop-

be precisely estimated using the option portfolio vega since the stock portfolio vega is relatively small.

[12]Specifically, we define Log(delta)=Log(1+delta) and Log(vega)=Log(1+vega). We add one to each variable before taking logarithm since both measures can be zero.

erty, plant, and equipment (PP&E) divided by depreciation expense, while the maturity of current assets is measured as current assets divided by the cost of goods sold. Total asset maturity is the weighted sum of these measures where (gross PP&E/total assets) is the weight for long-term assets and (current assets/total assets) is the weight for current assets. Myers (1977) argues that underinvestment problems can be reduced by matching the maturity of assets to the maturity of liabilities, suggesting a negative relation between asset maturity and the maturity of debt issues. Myers (1977) also predicts that short-term debt should be positively related to growth opportunities. Hence we add market-to-book ratio (M/B) as a proxy for growth opportunities. The market-to-book ratio is defined as the market value of assets divided by book value of assets, where market value of assets is calculated by replacing book value of common equity with market value of common equity.

We define managerial stock ownership (*Own*) as the number of shares owned by the CEO scaled by total shares outstanding at the fiscal year end. Datta, Iskandar-Datta, and Raman (2005) document a negative relation between managerial stock ownership and debt maturity, supporting the view that managers whose incentives are aligned with those of stockholders are more willing to subject themselves to the frequent monitoring by short-term debt. We also include the regulated firm dummy (*Reg_Dum*) as Barclay and Smith (1995) argue that managers of regulated firms have less discretion over investment. As a result, regulated firms face less debt agency problems and can borrow longer-term debt.

Flannery (1986) argues that high quality firms can signal their private positive information and distinguish themselves from low quality firms by issuing short-term debt given the costly roll-over risk of short-term debt. We thus include the abnormal earnings measure (*Abn_Earn*), defined as the year-over-year change in the operating earnings per share divided by the previous year's share price, to test for signaling effects in debt maturity choices. Following Johnson (2003), Datta, Iskandar-Datta, and Raman (2005) and Brockman, Martin, and Unlu (2010), we also control for asset return volatility (*Std_Ret*) since it might be an alternative measure for credit risk. Johnson (2003) argues that as cash flows become more volatile, the probability of repaying debt decreases. While firms with highly volatile cash flows might prefer long-term debt, bondholders may only be willing to lend these firms short-term debt if bondholders perceive such risks. We follow Datta, Iskandar-Datta, and Raman (2005) and calculate our asset return volatility measure as monthly stock return standard deviation during the fiscal year multiplied by the ratio of the market value of equity to the market value of assets.

Brick and Ravid (1985) show theoretically that the tax-shield value of long-term debt is higher when the yield curve is upward sloping. This tax shield value is higher for firms with high marginal tax rates. Their analysis predicts a positive relation between term structure and the maturity of new debt issues and a negative relation between the maturity of new debt issues and the tax shield dummy. We follow Brockman, Martin, and Unlu (2010) and include a term structure measure (*Term*), calculated as the difference between the yield on 10-year government bonds and the yield on 6-month government bonds at the fiscal year end. We follow Johnson (2003) and include a net operating loss dummy variable (*NOL_Dum*).[13] Lastly, we control for the principal amount of each debt issue (in constant 2006 dollars).

3.2.2 Description statistics

Panel A of D.1 shows the number of debt issues by year and by issue type. The full sample includes 4,399 new issues over the 2007 to 2012 period, of which 2,630 (60%) are syndicated loans and 1,530 (35%) are public issues. Private placements, including both Rule 144A and Non-Rule 144A debt, account for only a little more than 5%. The heaviest

[13] We also control for the other tax dummy variable used in Johnson (2003), which indicates whether a firm has investment tax credits. It is never significant in all of our regressions and it does not affect our findings.

issue volume in our sample took place in 2010 and 2011, both of which are mainly driven by the increased syndicated loan issues. However, the number of syndicated loan issues drops dramatically from 739 in 2011 to 274 in 2012.

Panel B of D.1 shows that the average (median) maturity of new issues is about 7 (5) years. In comparison, the debt issues in Guedes and Opler (1996) have a mean (median) maturity of 12 (10) years. The difference in maturity is probably due to sample difference. While Guedes and Opler (1996)'s sample consists of only public issues, our sample includes public issues, private placements and syndicated loans. Moreover, there is significant variation of maturity across issue types. Rule 144A debt and syndicated loans have shorter maturity than Non-Rule 144a and public debt at both the mean and the median levels. In the bottom part of Panel B, pairwise mean and median maturity comparisons of new issues across issue types are all significantly different from zero except one (Non-Rule 144A versus Public issues). Finally, the mean (median) principal amount of new issues in our sample is \$629 (\$369) million. Among the four types of issues, the mean (median) principal amount for the Non-Rule 144A issue is the smallest, only around \$88 (\$65) million. The mean (median) principal amount is \$479 (\$332) million for the Rule 144A issue, \$585 (\$450) million for the public issue, and \$698 (\$334) million for the syndicated loans.

Panel A of Table D.2 provides descriptive statistics for CEOs' compensation and firm characteristics. CEO mean inside debt compensation is around \$9.6 millions and CEO mean equity compensation is about \$64.5 millions. In unreported results, CEO total inside debt accounts for 19.9% of the total CEO compensation (i.e., the total of CEO debt and equity compensation). With respect to the inside debt incentive measure (*DE*), there is 39% of the observations with a CEO relative leverage ratio above one, i.e., having a debt-biased CEO relative leverage ratio. This indicates that a larger proportion of sample firms have a CEO relative leverage ratio below one, consistent with the claim in Edmans and Liu (2011) that usually granting relatively more equity compensation (i.e. equity bias) to CEOs is needed to induce their effort. While it is not used in the empirical tests below, we report the sample distribution of the CEO relative leverage ratio (*DE_Ratio*) for completeness. We find that the mean (median) CEO-firm relative debt-to-equity ratio is 1.53 (0.59).[14] With respect to the maturity of inside debt, there is 21.4% of our sample having short-term inside debt. In addition, $Log(delta)$ has a mean of 5.83 and $Log(vega)$ has a mean of 4.27. CEO's stock ownership accounts for 1.1% of the total number of shares outstanding on average.

The firm in the sample has mean (median) sales revenue of $17897 ($4676) million, indicating that our sample contains very large firms.[15] In the following regression analysis, we use the natural log of sales to attenuate their effect. There is a high percentage (80%) of our sample having long-term S&P bond ratings, among which, 62.6% has investment grade rating. There is almost 82% of our sample with Altman (1968)'s zscore greater than 1.81, as shown by the variable *Zscore_Dum*. Collectively, on average, our sample firms are large and have great credit quality. In addition, the mean (median) leverage in the sample is 0.19 (0.16) and the mean (median) for the fraction of debt maturing beyond three years is 0.66 (0.71). For the average issuer, its asset matures in 12.26 years and it has a market-to-book ratio 1.71.

Panel B of Table D.2 reports Pearson correlation coefficients among debt maturity, inside debt, and other control variables. The correlation between debt maturity ($Maturity$) and *DE* and *DE_Ratio* are both significantly positive. The correlation between *DE* and *DE_Ratio* is 0.70, similar to what Cassell, Huang, Sanchez, and Stuart (2012) report. There is also a positive relation between debt maturity and delta, consistent with the result in Brockman, Martin, and Unlu (2010). In contrast, there is a positive correlation

[14] *DE_Ratio* has been winsorized at 5% and 95% due to the large number of extreme observations at the right tail of its distribution.

[15] For comparison, the rest of ExecuComp firms has mean (median) sales of $4,796 ($1,478) million. Moreover, restricting their firms to have debt issue data from the Fixed Investment Securities Database (FISD), Billett, King, and Mauer (2007) (Table V) report mean (median) sales of $4,504 ($1,419) million.

between debt maturity and vega, opposite to the result in Brockman, Martin, and Unlu (2010). CEO's stock ownership (*Own*) is negatively related to debt maturity, consistent with Datta, Iskandar-Datta, and Raman (2005). There is a significantly positive correlation between asset maturity ($Asset\_Mat$) and debt maturity, consistent with the notion that firms try to match the maturity of liabilities to their underlying assets. There is mixed evidence between firms' credit quality and debt maturity. While debt maturity is positively related to $Log(sale)$ and $InvestmentGrade$ and negatively related to Not_Rated and Std_Ret, it is negatively related to $Zscore\_Dum$. Finally, *Reg_Dum* is positively related to debt maturity, indicating regulated firms can borrow longer-term debt. Note that however, these univariate results should be interpreted with caution because we have not controlled for other factors that are known to affect firms' debt maturity choice.

3.3 Empirical results

In this section, we first discuss the empirical specification that we employ to test our hypotheses. We then report regression results under these specifications, examining the incentive effect on corporate debt maturity across groups based on CEO relative leverage ratio and the incentive horizon. We subsequently turn to subsample tests to examine whether the relation between corporate debt maturity and CEO inside debt is stronger among firms for which the amelioration of stockholder-debtholder conflicts is expected to be large. Lastly, we report robustness checks.

3.3.1 Empirical specification

To test the three hypotheses, we run several pooled cross-sectional OLS regressions using the following model:

$$Maturity_{i,t} = \beta_0 + \beta_1 DE_{i,t-1} + \beta_2 Short_{i,t-1} + \beta_3 DE_{i,t-1} * Short_{i,t-1} + \Theta_i X_{i,t-1} + \varepsilon_{i,t}, \tag{3.1}$$

where the dependent variable, $Maturity_{i,t}$, is the maturity of corporate debt issued by firm i in year t. Our variables of interest are the inside debt dummy $DE_{i,t-1}$, the incentive horizon of inside debt $Short_{i,t-1}$, and the interaction term between $DE_{i,t-1}$ and $Short_{i,t-1}$. $X_{i,t-1}$ contains the control variables as discussed in Section 3.2.1. $\varepsilon_{i,t}$ is the error term. All the right-hand side variables are measured at the last year before the year of debt issuances. For all specifications, $X_{i,t-1}$ includes year dummies that are employed to account for economy-wide shocks.Following the literature (see Brockman, Martin, and Unlu (2010)), we add issue type fixed effects in some specifications to alleviate the concern that any association between the maturity of corporate debt and inside debt is driven by the debt source consideration. Nonetheless, to the extent that short maturity debt heavily overlaps with a specific debt type, bank loans for example, issue type fixed effects would work against us finding any significant effect of inside debt on corporate debt maturity. Furthermore, all the t-statistics are computed based on robust standard errors that are adjusted for heteroscedasticity and clustered by firm.

There is a large fraction of our sample (16.7%) with zero CEO inside debt. It is possible that there are unobservable determinants of firms' self-selection into nonzero CEO debt compensation that would also affect firms' debt maturity choice. One potential factor, for example, is managerial power. Gerakos (2007) and Liu, Mauer, and Zhang (2014) document that CEOs in firms with weak corporate governance are associated with more debt compensation. Furthermore, the changes in SEC disclosure requirements in 2006 were motivated by the claim that pensions offer substantially greater opportunities for managerial rent extraction than other compensation mechanisms (e.g., Colvin (2001), Bebchuk and Jackson (2005)). Given that managerial power facilitates managerial entrenchment, which in turn is positively associated with the portion of long-term debt in a firm's capital structure (Benmelech (2006)), the OLS estimation could possibly suffer from an omitted variable problem.

To make sure that our OLS results are not driven by omitting private information that makes firms self-select nonzero CEO debt compensation, we examine specification (3.1) using the Heckman (1979) model to correct for the selection bias.[16] We employ the two-step estimation including a first-stage Probit debt compensation selection model and a second-stage debt maturity model, i.e. equation (3.1). In the first-stage, we model a firm's decision of granting its CEO debt compensation based on firm characteristics employed in Gerakos (2007), and Liu, Mauer, and Zhang (2014). Specifically, we model granting debt compensation as a function of firms' leverage, market-to-book ratio, R&D expenses, net sale, fixed asset, return on assets, a dummy variable indicating whether or not the firm has negative operating cash flow, a dummy variable indicating whether the firm has net operating loss carry-forwards on its balance sheet, a dummy variable indicating whether the CEO is the chair of the board, the G-index, and CEO age. The inverse Mills ratios obtained from the first-stage Probit model captures the unobservables that contribute to a firms decision on whether or not to have positive CEO debt compensation, which is included in the second-stage regression to correct for the selection bias.

3.3.2 Main results

Table D.3 reports the results from both the pooled cross-sectional regressions and the Heckman (1979) model. To directly gauge the statistical and economic importance of our multivariate findings, in Panel A we employ the estimated coefficients from the Heckman (1979) model (Panel B, Model (4)) and calculate the net effect on the maturity of corporate debt issues of inside debt across groups based on the CEO incentive bias, *DE*, and the incentive horizon of CEO inside debt, *Short*. First, among the set of firms with inside debt maturity long enough to matter (*Short* $= 0$), we find that debt maturity for firms with

[16]The survey by Prabhala and Li (2007) build the connection between econometric models of self-selection and private information models in corporate finance and claim that ".... models of self-selection represent one way of incorporating and controlling for unobservable private information that influences corporate finance decisions."

debt-biased CEO incentive ($DE = 1$) is greater than for firms with equity-biased CEO incentive ($DE = 0$), which is consistent with our Hypothesis 1. This difference is not only statistically significant at 5% level, but also economically meaningful. Firms whose CEOs have debt-biased inside debt levels issue debt with a maturity of approximately one year longer than firms whose CEOs have equity-biased inside debt level. Given a sample median maturity of 5 years, the effect of debt bias is an approximately 20% increase in the maturity of corporate debt issues.

Second, we show that, among firms whose CEOs have debt-biased incentive ($DE = 1$), debt maturity for firms with long-term inside debt ($Short = 0$) is more than a half year longer than for firms with short-term inside debt ($Short = 1$) and it is almost significant at 10% level. Based on the one-sided z test (unreported), we cannot reject the null that the difference is positive at 5% level. Therefore, the result is consistent with our Hypothesis 2 – the debt maturity for firms whose CEOs have long-term debt-biased incentive is greater than the debt maturity for firms whose CEOs have short-term debt-biased incentive. It emphasizes the importance of the inside debt maturity dimension in measuring the effectiveness of inside debt in mitigating stockholder-debtholder conflicts.

Third, we find that for firms whose CEOs have long-term inside debt level ($Short = 0$) that is equity-biased ($DE = 0$), their debt maturity on average is significantly one year less than the debt maturity for firms whose CEOs have short-term inside debt level ($Short = 1$) that is equity-biased ($DE = 0$). The results are consistent with our Hypothesis 3 and the underlying notion that stockholder-debtholder conflicts should be greater for firms with long-term inside debt levels that are equity biased.

To make sure the findings are not model specific, we now turn to OLS estimation results in Model (1)-Model(3) of Panel B.[17] Model (1) only includes inside debt dummy

[17] The difference in the number of observations between the OLS model and the Heckman model is due to missing values of G-index that is used in the first-stage of the Heckman model. We rerun OLS regressions on the Heckman's sample and obtain similar results. The results are available upon request.

(DE), incentive horizon of inside debt ($Short$), and their product ($DE * Short$). Model (2) adds to the three key variables other control variables that have been shown in the literature to influence firms' debt maturity choice. Model (3) further controls for issue type fixed effects. First, the coefficient on DE is positive and significant across all the three models, which is consistent with our hypothesis 1–for firms have long-term inside debt maturity, debt maturity is greater for firms with debt-biased CEO incentive ($DE = 1$), relative to firms with equity-biased CEO incentive ($DE = 0$). Second, the coefficient on $Short$, which represents the incremental impact of long-term equity-biased inside debt over short-term equity-biased inside debt, is highly significant at 1% level in the model (1) and weakly significant in Model (3) at 11% level. Lastly, for impact of long-term debt-biased incentive versus short-term debt-biased incentive, in unreported results, it is significant at 10% level based on one-sided z test once we control for the issue type fixed effects (model (3)), while we find this effect is significant at 5% level without issue type fixed effect(model (2)). As discussed above, adding issue type effect would attenuate our findings.

With respect to other right-hand-side variables, to facilitate discussion, we focus on Model (4) in Panel A. Unlike Brockman, Martin, and Unlu (2010), we do not find any significant relation between debt maturity and either $Log(delta)$ or $Log(vega)$, which might be due to different sample periods. The coefficient on $Asset\_Mat$ is significantly positive, which is consistent with Myers (1977)'s argument that firms try to match the maturity of their assets and liabilities so that they can reduce underinvestment problems. However, in terms of economic significance, its impact is relatively small. Also consistent with Myers (1977), firms with high market-to-book ratio use more short-term debt to mitigate the underinvestment problem. Utility firms can borrow longer-term debt since managers of regulated firms have less discretion over investment policy. Finally, *IssueAmount* is negatively and significantly related to the maturity of new debt issues.

In summary, we find support for all of our hypotheses, especially for hypothesis 1 that among firms with long-term inside debt, the debt maturity for firms with debt-biased CEO incentive is greater than the one for firms with equity-biased CEO incentive. We now turn to additional tests that should provide further support for our hypotheses.

3.3.3 Subsample analysis sorted on market-to-book ratio

In particular, we sort the sample on firms' market-to-book ratios, and re-estimate the regressions for high and low market-to-book firms. We expect that the effect between CEO inside debt and corporate debt maturity should be stronger for high market-to-book firms. First and foremost, managers are more able to take excessive risks when choosing among new investments than assets already in place. The second reason is that high market-to-book firms might have greater underinvestment problems, which can be mitigated if managerial incentives are aligned closer with debtholders. As such, the need for the use of short-term debt to solve the underinvestment problem is reduced. Collectively, we expect to find stronger evidence for the three hypotheses among firms with high growth opportunities than among firms with low growth opportunities.

Table D.4 presents the subsample results for high market-to-book firms versus for low market-to-book firms. Model (1) is the pooled cross-sectional regression with both year and issue type fixed effects. Model (2) is the Heckman (1979) model. Again, we focus on Panel A which uses the estimated coefficients from the Heckman (1979) model (Panel B, Model (2)) and calculates the net effect on the corporate debt maturity of inside debt across groups based on CEOs' incentive bias and their incentive horizon, just as in Table D.3 Panel A. Consistent with our expectation, we find that the results documented in Table D.3 hold only among firms with high market-to-book ratios. The net effects across different groups are in fact stronger than the counterparts based on the full sample as reported by Table D.3.

Specifically, among the set of firms with inside debt maturity long enough to matter (*Short* $= 0$), we find that the debt maturity for firms with debt-biased CEO incentive (*DE* $=$ 1) is almost one year greater than the debt maturity for firms with equity-biased CEO incentive (*DE* $= 0$). This is similar to what we find in Table D.3 and provides support for our hypothesis 1. Consistent with our Hypothesis 2, among firms with debt-biased CEO incentive (*DE* $= 1$), debt maturity for firms with long-term inside debt (*Short* $= 0$) is greater than debt maturity for firms with short-term inside debt (*Short* $= 1$) and it is significant at 5% level. In terms of economic significance, among firms with great growth opportunity, those whose CEOs have long-term debt-biased inside debt levels issue debt with a maturity of more than one year longer than those with short-term debt-biased inside debt level. Consistent with our Hypothesis 3, for firms with long-term equity-biased inside debt, their debt maturity on average is 1.66 years shorter than the debt maturity for firms with short-term equity-biased inside debt and this effect is significant at 5% level. Last but not least, in Model (1) where both year and issue fixed effects are controlled for in the pooled cross-sectional OLS estimation, these results also hold for firms with high market-to-book ratio, only except that the coefficient on *Short* is marginally significant based on two-sided t tests.

So far, the results from the two sections collectively provide strong support for our hypotheses. Our findings are consistent with the view that stockholder-debtholder conflicts fundamentally drive how incentive effect of inside debt and its incentive horizon interplay with corporate debt maturity.

3.3.4 Robustness check

3.3.4.1 Controlling for existing debt maturity structure

Because the existing debt maturity structure has been shown to be associated with many of the same firm characteristics that we include in our tests (e.g. Johnson (2003), and Brockman, Martin, and Unlu (2010)), and given that firms probably take existing debt maturity structure into account when deciding the maturity of new debt issues, we address this issue by controlling for the firm's existing debt maturity structure—the proportion of existing debt maturing in more than three years ($LT3$). We rerun the regression for each specification with $LT3$ added. We report the results in Table D.5. Panel A contains regressions on the full samples, which is similar to Table D.3. Panel B contains regressions conducted on subsamples sorted by mark-to-book ratio, comparable to Table D.4. The results are consistent with our earlier findings and are mainly driven by firms with high market-to-book ratio.

3.3.4.2 Bias-corrected nearest neighbor matching estimator

In this section, we examine the effect of incentive bias change on the maturity of new debt issues, while holding the incentive horizon type the same (or vice versa). We employ a matched firm, difference-in-difference approach. To illustrate the idea, take as an example firms whose managerial incentives switch from long equity bias to long debt bias. We call these firms the treatment group. Each firm in the treatment group is required to have at least one debt issue before and after the managerial incentive bias change, respectively. The potential set of control firms are those whose CEOs' incentive is always long equity-biased during the sample period. We match each firm in the treatment group with one firm from that set by nearest-neighbor matching and we match with replacement. The matching is performed on the last firm-year right before the managerial incentive of each firm in the treatment group changes. We match on firm- and CEO-level covariates (as well as two-digit sic code and year, if possible) that (1) determine the use of inside debt; and (2) determine the maturity of new debt issues. Eventually, we compare the difference in pre- and post-change debt maturity of each firm in the treatment group to that of corresponding matched control firm.

As matching on issue type and year would dramatically reduces the matched sample size, and as maturity varies widely across debt types, we address this issue by obtaining debt type- and year-adjusted maturity for each debt issue using the full sample. Next, I calculate the weighted maturity per firm-year as some firms have multiple debt issuances within a year. The weight is the principal amount of an issuance divided by the total principal amount issued by that firm in that year. With the weighted maturity measure, I keep one observation for each firm year. For the matching technique, we use the bias-corrected nearest neighbor matching estimator approach proposed by Abadie and Imbens (2007), which adjusts the difference of the outcome variable within matches for differences in the values of matching covariates to correct for the bias induced by inexact matching in finite samples.

The results on sample average treatment effect (SATE) are presented in Table D.6. The evidence strongly supports Hypothesis 1 that among firms with long maturity inside debt, the maturity of corporate debt issues is longer for firms with debt-biased CEOs than for firms with equity-biased CEOs. Specifically, when a firm switches from long-term equity-biased incentive to long-term debt-biased incentive, its new debt maturity on average increases by two years, relative to a firm that is always under long-term equity biased incentive. On the contrary, when a firm switches from long-term debt biased incentive to long-term equity biased incentive, its new debt maturity on average decreases by one and a half years, when comparing to a firm that is always under long-term debt biased incentive. However, for Hypothesis 2 and 3, although the firm-matched, difference-in-difference estimates have the predicted sign and the magnitudes are economically meaningful, none of them is statistically significant, probably due to very limited sample size.

3.4 Conclusion

On top of cash and equity compensation, CEOs in the United States are often compensated with debt, including deferred compensation and pension, or collectively inside debt. Built upon the literature on how debt maturity can reduce stockholder-debtholder conflicts with the literature on how CEO inside debt can reduce those conflicts, we examine the relation between CEO inside debt and corporate debt maturity. Theory on inside debt posits that inside debt aligns managerial incentives with those of debtholders when inside debt matures after corporate debt and when CEO personal leverage ratio is greater than firm leverage ratio. Employing these theoretical insights, we develop and test three hypotheses. We first hypothesize that among firms with long-term inside debt, debt maturity for firms with debt-biased CEO relative leverage ratios is greater than for firms with equity-biased CEO relative leverage ratios. We next hypothesize that among firms with debt-biased CEO relative leverage ratios, debt maturity for firms with long-term inside debt is greater than for firms with short-term inside debt. Lastly, we hypothesize that among firms with equity-biased CEO relative leverage ratios, debt maturity for firms with long-term inside debt is less than for firms with short-term inside debt.

Using a sample of 4,399 new corporate debt issued during 2007-2012, we find significant evidence for all the three hypotheses and the evidence is stronger especially for firms with high market-to-book ratio. These results are consistent with theory on when CEO debt-like compensation can reduce stockholder-debtholder conflicts. The results are also consistent with the notion that debtholders recognize not only this incentive alignment, but also when the alignment is effective to their claims.

While prior research pays great attention to the incentive horizon/duration of managerial equity compensation and to the level of managerial debt compensation, most academic studies are silent on the maturity effect of managerial debt compensation. Our study demonstrates the importance of taking into account inside debt maturity when studying its incentive alignment role. For future research, it would be interesting to study whether and how the incentive horizon of CEO inside debt is linked to other corporate policies.

4. CONCLUSION

In this thesis, I examine two contracting mechanisms that can possibly help overcome frictions among economic agents in corporate finance. In particular, I analyze the economic mechanism underlying the renegotiation of bank debt contracts that occurs outside of states of distress or default. I also investigate the incentive alignment effect of CEO debt compensation on the maturity choice of corporate debt issues.

In the first essay, I empirically examine why renegotiations of bank loan agreements occur voluntarily outside of any sort of default. I find a statistically and economically significant bondholder reaction to renegotiations that relax covenant strictness. This result supports the Gârleanu and Zwiebel (2009) model, where banks are willing to transfer substantial control rights back to firms when firms have less opportunities of wealth transferring from bondholders to stockholders. At the same time, this result rejects the possibility that renegotiations when firms have strong bargaining power could hurt bondholders. I find little evidence that renegotiated increase of bank loan interest rate leads to negative bondholders' reaction as implied by Gorton and Kahn (2000). This is explained by the evidence that firms become more conservative in making investment decisions after such renegotiations, although increased loan spread usually indicates the deterioration of firms' credit quality.

This study also provides guidance for future research. I provide strong support for the economic mechanism proposed in Gârleanu and Zwiebel (2009). That is, loosening strict covenant over time is a way that "good-type" firms use to mitigate financing frictions from asymmetric information between creditors and firms. However, it is still unclear what the nature of the friction is. In other words, is it due to asset substitution, debt overhang, or inefficient liquidation? For example, in Myers (1977), that renegotiation breakdowns generate debt overhang is central to his original analysis (see also Hart and Moore (1995), Bhattacharya and Faure-Grimaud (2001), and Tirole (2010)). Hence, it would be interesting to examine whether bank loan renegotiation helps mitigate underinvestment problems, and if so, to what extent.

In the second essay, co-authored with Shane Johnson and Jun Zhang, we investigate the incentive alignment effect of CEO's inside debt on corporate debt maturity choice. Theory on inside debt posits that inside debt aligns managerial incentives more with those of debtholders when CEO personal leverage ratio is greater than firm leverage ratio and when inside debt matures after risky corporate debt. In our empirical analysis, we take into account the two facets of inside debt. First, our estimates indicate that among firms with long-term inside debt, debt maturity for firms with debt-biased CEO relative leverage ratios is greater than for firms with equity-biased CEO relative leverage ratios; this captures the debt vs. equity bias dimension of inside debt among firms for which inside debt maturity is long enough to matter. Second, we find that among firms with debt-biased CEO relative leverage ratios, debt maturity for firms with long-term inside debt is greater than for firms with short-term inside debt; this evidence captures the importance of the inside debt maturity dimension among the set of firms whose CEOs should have a debt bias. Third, we find that among firms with equity-biased CEO relative leverage ratios, debt maturity for firms with long-term inside debt is less than for firms with short-term inside debt; this evidence captures the point that stockholder-debtholder conflicts should be greater for firms with long-term inside debt levels that are equity biased.

While prior research pays great attention to the incentive horizon/duration of managerial equity compensation and to the level of managerial debt compensation, the maturity effect of managerial debt compensation has received limited attention. Our study demonstrates the importance of taking into account inside debt maturity when studying its incentive roles in corporate policies.

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APPENDIX A

TABLES FOR SECTION 2

Table A.1: Sample construction

	N
Keep public non-financial firms over the 2002-2012 period that	
(1) have qualified publicly traded bonds in the TRACE Enhanced dataset; Bonds are qualified if they have fixed- and nonzero-coupon rate, are non-convertible debentures or medium term notes, with nonmissing information on bond rating, issue size, and maturity	
(2) have loan deals in Dealscan that have associated private credit agreements from SEC filings. Each deal needs to have information on the loan amount, the interest spread, and the maturity of all tranches in the deal; Pre-2006 private credit agreements sample is from Nini, Smith, and Sufi (2009) and the rest is collected using their text-search algorithm from SEC filings.	
Identify the first renegotiation for each loan agreement that happens since July, 2002 from 10-K, 10-Q and 8-K filings of the borrowing firms from the loan origination to the earlier of the maturity of the loan or the end of 2012.	
Drop renegotiations whose filings contain confounding events. Confounding events: other loans or other loans' amendments, covenant violations, M&As, asset sales/purchases, new bond issuances, share repurchases, DIP financing, default, and bankruptcy.	599
Bond event study requirements	
Liquidity–a bond trades on at least three of the twenty days prior to the renegotiation announcement date	418
Prices are available within a five-day window on both sides of the event date	352
Construct firm-level control variables	321
N. of firms	243
N. of loans	321
N. of bonds	807

Table A.2: Sample descriptive statistics

The table reports summary statistics on firm characteristics, including public debt issues that are used in bond event study, on loan contract characteristics included in my renegotiation sample, and on macroeconomic variables. Firm characteristics are computed as an average over the past four quarters before the loan renegotiation. The sample period is from 2002 to 2012. All variables are defined in Appendix B.

	Mean	Min.	Q1	Median	Q3	Max.	Std.Dev.	N
Firm characteristics								
Assets ($ Mil)	6,125	225	1,780	3,418	7,366	36,818	6,761	321
Market value of equity ($ Mil)	3,467	29	780	1,651	3,859	61,531	5,324	321
Book leverage	0.37	0.05	0.25	0.34	0.47	1.21	0.17	321
Market-to-book	1.23	0.65	0.97	1.13	1.37	4.73	0.42	321
Fraction of junk firms	0.65	0.00	0.00	1.00	1.00	1.00	0.48	321
Number of bonds per firm	2.69	1.00	1.00	2.00	3.00	16.00	2.51	321
Years to maturity	7.06	1.02	4.79	6.44	8.47	29.68	3.63	321
Bond rating	12.00	4.00	9.00	12.00	15.00	19.00	3.11	321
Loan characteristics								
Amount ($ Mil)	1,046	20	350	750	1,300	14,000	1,177	321
Stated maturity (years)	4.52	1.00	3.72	5.00	5.01	7.80	1.24	321
Spread over LIBOR (bps)	177.00	17.00	75.00	175.00	250.00	700.00	110.49	321
Number of tranches	1.55	1.00	1.00	1.00	2.00	5.00	0.83	321
Number of lenders	14.58	1.00	8.00	13.00	19.00	86.00	9.35	321
Covenant strictness	33.40	0.00	3.12	31.03	56.09	93.33	28.72	321
Coverage ratio covenant dummy	0.72	0.00	0.00	1.00	1.00	1.00	0.45	321
Debt to cash flow covenant dummy	0.60	0.00	0.00	1.00	1.00	1.00	0.49	321
Debt to balance sheet covenant dummy	0.24	0.00	0.00	0.00	0.00	1.00	0.43	321
Net worth covenant dummy	0.15	0.00	0.00	0.00	0.00	1.00	0.36	321
Liquidity covenant dummy	0.05	0.00	0.00	0.00	0.00	1.00	0.22	321
Minimum cash flow covenant dummy	0.02	0.00	0.00	0.00	0.00	1.00	0.15	321
Capital expenditure restrictions dummy	0.21	0.00	0.00	0.00	0.00	1.00	0.41	321
Macroeconomic factors								
Quarterly GDP growth	0.00	-0.02	0.00	0.01	0.01	0.02	0.01	321
Bank leverage	0.90	0.88	0.89	0.90	0.90	0.91	0.01	321
Quarterly stock market return	0.02	-0.26	-0.02	0.02	0.07	0.29	0.08	321
Bank competition	0.75	-0.64	0.40	1.03	1.18	1.49	0.64	321

Table A.3: Renegotiation outcomes

The table presents summary statistics on renegotiation outcomes for the 321 loans issued by 243 firms, focusing on amount, maturity, interest spread, and financial covenants. Panel A presents the distribution of loans based on items that are renegotiated. Panel B presents the distribution of the renegotiation outcomes for each item. Panel C presents summary statistics on the percentage change of each item via renegotiation. Except for covenant strictness, the percentage change is defined as the change of item value divided by the pre-renegotiation item value. For the covenant strictness measure, since its value can be close to zero, I use only the change of covenant strictness, defined as the difference of the covenant strictness after renegotiation and the covenant strictness before renegotiation. Following Denis and Wang (2013), if a new individual covenant is added, the percentage change is recorded as 100% if the covenant sets the lower bound, or -100% if the covenant sets the upper bound. If a covenant is removed, the percentage change is recorded as -100% if the covenant sets the lower bound or 100% if the covenant sets the upper bound. Panel D presents absolute value of the percentage change conditional on whether the item is tightened or loosened via renegotiation.

Panel A: Distribution of renegotiations		
	% of Loans	Number of Loans
The three terms or financial covenants	67.29	216
The three terms		
Amount	40.50	130
Maturity	42.06	135
Interest spread	43.93	141
Financial covenants		
Coverage ratio	9.35	30
Debt to cash flow	15.58	50
Debt to balance sheet	3.43	11
Net worth	4.98	16
Liquidity	0.00	0
Minimum cash flow	0.62	2
Capital expenditure	4.98	16
N. of loans	321	
N. of firms	243	

Table A.3 Continued

Panel B: Item renegotiation outcomes

	Item tightened		Item relaxed	
	Number	Percentage	Number	Percentage
Amount	53	40.77	77	59.23
Maturity	47	34.81	88	65.19
Interest spread	48	34.04	93	65.96
Coverage ratio	3	8.82	31	91.18
Debt to cash flow	13	22.41	45	77.59
Debt to balance sheet	6	54.55	5	45.45
Net worth	13	81.25	3	18.75
Minimum cash flow	1	50.00	1	50.00
Capital expenditure	4	25.00	12	75.00
Covenant strictness	17	25.37	50	74.63

Panel C: Percentage change of loan terms

	N	Mean	Min.	Q1	Median	Q3	Max.	Std.Dev
Amount	130	13.65	-92.94	-25.00	13.39	40.00	333.33	61.43
Maturity	135	16.67	-80.05	-4.38	1.64	33.30	299.27	47.53
Interest spread	141	19.14	-62.50	-30.00	-14.29	5.66	757.14	114.24
Coverage ratio	34	-32.58	-100.00	-100.00	-25.00	-9.09	100.00	56.30
Debt to cash flow	58	9.68	-100.00	5.26	12.92	28.57	100.00	53.82
Debt to balance sheet	11	6.19	-100.00	-16.67	-4.17	100.00	100.00	70.77
Net worth	16	76.14	-100.00	1.96	18.02	70.96	931.58	236.13
Minimum cash flow	2	0.00	-100.00	-100.00	0.00	100.00	100.00	141.42
Capital expenditure	16	12.33	-100.00	-10.00	23.70	50.00	100.00	64.09
Covenant strictness	67	9.87	-40.61	-0.65	8.56	23.47	47.40	19.69

Table A.3 Continued
Panel D: Percentage change in absolute value of loan terms by direction

	Item tightened				Item relaxed			
	Mean	Median	Min.	Max.	Mean	Median	Min.	Max.
Amount	37.93	32.31	0.21	92.94	49.15	33.33	2.60	333.33
Maturity	19.35	14.64	0.01	80.05	35.90	23.95	0.00	299.27
Interest spread	106.56	25.17	0.01	757.14	25.97	25.00	0.56	62.50
Coverage ratio	100.00	100.00	100.00	100.00	45.41	28.57	4.17	100.00
Debt to cash flow	64.62	100.00	6.06	100.00	31.15	15.38	4.35	100.00
Debt to balance sheet	39.99	13.33	4.17	100.00	61.61	100.00	3.45	100.00
Net worth	111.15	38.00	0.60	931.58	75.56	100.00	26.67	100.00
Minimum cash flow	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Capital expenditure	82.50	100.00	30.00	100.00	43.94	43.18	10.00	100.00
Covenant strictness	14.37	9.67	0.65	40.61	18.11	12.78	0.35	47.40

Table A.4: Abnormal bond returns around renegotiation announcement dates

The table presents the firm-level abnormal bond return (in basis points) for the full sample over the period 2002-2012 and for various groupings. Abnormal bond returns are calculated over the event window [-5,5] around the dates of renegotiation announcement. The firm-level bond abnormal return is value-weighted averages across individual bonds within a firm, where the weights are based on the market value of each bond on the last trading day within five days prior to the announcement day. Panel A presents the full sample distribution of both raw and winsorized abnormal bond returns. Winsorization is conducted at 1% and 99% as well as 5% and 95%. Panel B presents, for abnormal bond returns winsorized at 5% and 95%, means, medians, and the differences in means and medians across subsamples grouped by either firm credit rating or by whether one of the four terms is modified: covenants, interest spread, amount, and maturity. The significance level of the mean is based on t-test, the significance level of the difference in means is based on t-test, assuming unequal variance across groups. The significance of the median is based on two tests: a Wilcoxon signed-rank test and a sign test. The significance level of the difference in medians is based on a Wilcoxon rank-sum test and a nonparametric equality-of-medians test. *p-value* are reported for all the tests.

Panel A: Sample distribution								
	Mean	Q1	Median	Q3	Std.Dev.	Skewness	Kurtosis	N
Bond abnormal return	-31.67	-46.92	-0.60	48.12	322.95	-7.18	65.69	321
Bond abnormal return, w. 1%	-15.36	-46.92	-0.60	48.12	178.27	-3.02	18.89	321
Bond abnormal return, w. 5%	-2.22	-46.92	-0.60	48.12	90.68	-0.27	2.90	321

Table A.4 Continued
Panel B: Mean and median tests of bond abnormal returns, winsorized at 5% and 95%

	N	Mean	Median	t-test p-value	Signed-ranks(Rank-sum) p-value	Sign-test(Medians) p-value
Full sample	321	-2.22	-0.60	0.66	1.06	0.91
Subsample comparison						
Investment-grade	112	9.80	16.15	0.25	1.95	0.05
Speculative-grade	209	-8.67	-5.50	0.17	0.16	0.10
Difference		-18.46	-21.64	0.08	0.01	0.00
Covenant loosened	50	8.29	22.69	0.58	1.59	0.32
Covenant tightened	17	-43.10	-41.10	0.12	0.11	0.05
Difference		-51.39	-63.80	0.10	0.06	0.01
Spread increased	48	-21.44	-15.59	0.12	0.21	0.31
Spread decreased	94	4.51	0.47	0.62	1.38	1.00
Difference		25.95	16.06	0.12	0.18	0.29
Amount increased	77	3.96	0.46	0.67	1.34	0.82
Amount decreased	53	-7.61	-3.00	0.49	0.63	0.78
Difference		-11.57	-3.46	0.42	0.46	0.59
Maturity increased	88	-0.84	0.60	0.93	1.27	1.00
Maturity decreased	49	-12.39	-12.25	0.29	0.35	0.78
Difference		-11.55	-12.85	0.44	0.38	0.64

Table A.5: Regression analysis of abnormal bond returns

The table presents regression analysis of the abnormal bond returns in 321 bank loan renegotiations around the dates of renegotiation announcements over the period 2002-2012. The change of covenant strictness (ΔCovenant) is multiplied by negative one so that the positive coefficient estimate directly represents the effect of loosening covenants. Panel A reports results for three different estimation methods: OLS, robust regression, and simultaneous-quantile regressions with estimates at 25%, 50%, and 75% quantiles. The dependent variable is the firm-level abnormal bond return, expressed in basis points. For the median and robust regressions, abnormal bond returns are unwinsorized, and for OLS abnormal bond returns are winsorized at 5% and 95%. Panel B reports robust regression results for a specification that extends the one in panel A by adding three individual-level firm bargaining power proxies: lender capitalization, the number of lending relationships in the past four loans before renegotiation, and a dummy variable indicating whether the borrow has access to commercial paper markets. Each proxy is interacted with ΔCovenant. All continuous control variables are standardized over the full sample, except that the four contractual term change variables are standardized conditional on each being modified. All regressions control for year and Fama-French 12-industry fixed effects. For OLS, standard errors are clustered at firm-level. For quantile regression, standard errors are obtained by 1000 bootstrap replications. Variable definitions are in Appendix B. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Table A.5 Continued

Panel A: Dependent variable-abnormal bond returns

	OLS	Robust Regression	Simultaneous-Quantile Regression		
			p25	p50	p75
Loan term changes					
ΔCovenant strictness	33.822***	49.727***	41.087**	49.926***	39.619*
	(0.008)	(0.000)	(0.018)	(0.002)	(0.068)
ΔSpread	-7.806	-18.348**	1.282	-19.037	-23.891
	(0.491)	(0.021)	(0.949)	(0.242)	(0.194)
ΔMaturity	1.771	3.551	-0.505	3.639	10.936
	(0.797)	(0.644)	(0.962)	(0.674)	(0.300)
ΔAmount	8.144	7.942	16.447	5.452	5.004
	(0.246)	(0.316)	(0.116)	(0.499)	(0.621)
Firm characteristics					
Speculative-grade	-20.239*	-31.565***	-16.208	-30.863**	-42.286**
	(0.098)	(0.007)	(0.452)	(0.035)	(0.015)
Log of book asset	2.684	-2.370	11.241	-3.859	-5.388
	(0.660)	(0.666)	(0.251)	(0.606)	(0.527)
Market-to-book	-7.792	-8.343	-14.900	-1.997	-5.841
	(0.128)	(0.115)	(0.152)	(0.816)	(0.430)
Macroeconomic factors					
Bank leverage	17.308	13.119	14.863	-4.964	40.836
	(0.465)	(0.497)	(0.706)	(0.871)	(0.284)
Stock market return	5.022	3.272	3.903	-0.014	11.285
	(0.521)	(0.584)	(0.780)	(0.999)	(0.356)
GDP growth	-15.970**	-9.277	-5.280	-8.632	-21.593*
	(0.036)	(0.214)	(0.697)	(0.387)	(0.078)
Bank competition	2.337	9.055	8.857	2.056	-8.341
	(0.875)	(0.479)	(0.699)	(0.910)	(0.697)
Constant	-5.769	24.941	-52.670	80.821	4.099
	(0.920)	(0.555)	(0.622)	(0.291)	(0.977)
Observations	321	321		321	
(Pseudo) R^2	0.114	0.198		0.055	

Table A.5 Continued
Panel B: Individual-level bargaining power proxies

	(1)	(2)	(3)
Loan term changes			
ΔCovenant strictness	40.834***	44.080***	47.330***
	(0.000)	(0.000)	(0.000)
ΔSpread	-17.023**	-16.342**	-17.687**
	(0.034)	(0.045)	(0.030)
ΔMaturity	2.472	3.826	1.644
	(0.751)	(0.626)	(0.838)
ΔAmount	9.250	8.273	9.973
	(0.249)	(0.308)	(0.242)
ΔCovenant strictness interacted with			
N. of lender relationships	-15.245*		
	(0.097)		
CP issuer dummy		19.827	
		(0.443)	
Lender capitalization			-8.977
			(0.398)
Individual bargaining power proxy			
N. of lender relationships	0.222		
	(0.964)		
CP issuer dummy		-12.128	
		(0.349)	
Lender capitalization			4.243
			(0.439)
Firm characteristics			
Speculative-grade	-28.515**	-32.431**	-26.284**
	(0.017)	(0.012)	(0.035)
Log of book asset	-1.294	-1.553	-0.039
	(0.818)	(0.790)	(0.995)
Market-to-book	-7.874	-8.297	-7.420
	(0.142)	(0.126)	(0.175)
Constant	25.883	26.218	-0.306
	(0.544)	(0.545)	(0.994)
Macroeconomic factors	Yes	Yes	Yes
Observations	319	319	312
(Pseudo) R^2	0.175	0.189	0.178

Table A.6: Further analysis of the effect of spread change via loan renegotiation

Panel A repeats the analysis of panel A, Table A.5, but replaces abnormal bond returns by stock cumulative abnormal returns (CAR in %) over [-5,5] window as the dependent variable. Panel B reports OLS regressions of investment intensity on lagged stock volatility, conditional on the change of loan spread. The dependent variable in panel B is firm-level quarterly investment for the next four quarters after renegotiation, scaled by PP&E at the beginning of each quarter. Three types of investment are used: total investment (capital expenditure+R&D), capital expenditure (Capex), and research and development expense (R&D). In panel A, all continuous variables are standardized as in Table 4. All regressions in panel A control for Fama-French 12-industry and year fixed effects, while regressions in panel B control for Fama-French 12-industry and calendar quarter fixed effects. For OLS, standard errors are clustered by firm in panel A and clustered by firm and by calendar quarter in panel B. Variable definitions are in Appendix B. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Table A.6 Continued
Panel A: Dependent variable–Stock CAR (in %)

	OLS	Robust Regression	Simultaneous-Quantile Regression		
			p25	p50	p75
Loan term changes					
ΔCovenant strictness	1.226**	1.279*	1.119	0.787	1.513
	(0.034)	(0.059)	(0.158)	(0.376)	(0.125)
ΔSpread	1.601***	1.731***	1.756*	1.840*	1.415
	(0.001)	(0.001)	(0.081)	(0.063)	(0.193)
ΔMaturity	0.327	0.368	0.004	-0.207	1.064
	(0.498)	(0.454)	(0.997)	(0.816)	(0.152)
ΔAmount	0.062	0.137	-0.338	0.797	-0.063
	(0.877)	(0.789)	(0.677)	(0.286)	(0.919)
Firm characteristics					
Speculative-grade	-0.035	-0.241	-1.626	-0.222	0.120
	(0.959)	(0.746)	(0.183)	(0.826)	(0.895)
Market-to-book	-0.124	-0.014	-0.091	0.135	-0.070
	(0.720)	(0.967)	(0.881)	(0.799)	(0.888)
Log of book asset	-0.282	-0.242	-0.474	-0.123	-0.793
	(0.403)	(0.490)	(0.404)	(0.804)	(0.117)
Macroeconomic factors					
Bank leverage	-0.425	-0.344	-0.885	0.126	-0.456
	(0.726)	(0.782)	(0.671)	(0.943)	(0.773)
Stock market return	-0.048	0.006	0.028	-0.124	-0.201
	(0.895)	(0.987)	(0.961)	(0.820)	(0.747)
GDP growth	-0.669	-0.538	0.004	-0.219	-0.576
	(0.137)	(0.258)	(0.996)	(0.729)	(0.414)
Bank competition	-0.525	-0.081	-1.273	0.376	-0.968
	(0.514)	(0.922)	(0.362)	(0.754)	(0.410)
Constant	-0.521	-0.869	-3.601	-0.427	2.638
	(0.847)	(0.747)	(0.535)	(0.920)	(0.605)
Observations	319	319		319	
(Pseudo) R^2	0.162	0.133		0.070	

Table A.6 Continued
Panel B: Regressions of investment on stock volatility

	Total investment	Capex	R&D
Stock volatility			
(Spread increased group)	-0.024	-0.017*	-0.007
	(0.111)	(0.074)	(0.520)
Stock volatility			
(Spread unchanged group)	-0.007	-0.003	-0.006
	(0.632)	(0.771)	(0.553)
Stock volatility			
(Spread decreased group)	-0.011	0.004	-0.017
	(0.559)	(0.731)	(0.204)
ΔSpread	0.001	0.003**	-0.002
	(0.483)	(0.024)	(0.384)
ΔCovenant strictness	-0.000	-0.000**	0.000
	(0.497)	(0.035)	(0.360)
ΔMaturity	0.006	-0.002	0.008*
	(0.403)	(0.652)	(0.068)
ΔAmount	0.009*	0.010**	-0.002
	(0.061)	(0.012)	(0.248)
Log of book asset	-0.000	-0.002	0.002
	(0.954)	(0.231)	(0.261)
Market-to-book	0.037***	0.021***	0.016***
	(0.000)	(0.000)	(0.008)
Leverage	-0.024	-0.018	-0.004
	(0.148)	(0.124)	(0.746)
Cash flow	0.031***	0.032***	-0.005
	(0.001)	(0.000)	(0.196)
Cash holding	0.012**	-0.000	0.012**
	(0.043)	(0.963)	(0.024)
Constant	-0.013	0.022	-0.035*
	(0.603)	(0.209)	(0.058)
Observations	1137	1137	1137
R^2	0.366	0.455	0.284

Table A.7: Asymmetric effects of changes of covenant strictness and interest spread

The table presents coefficient estimates for asymmetric effects of the change of covenant strictness (Panel A) and the change of loan interest spread (Panel B) on firm-level abnormal bond returns (in basis points). Loosen (Tighten) covenant is the positive (negative) component of the change of covenant strictness, in absolute value form. Decrease (Increase) spread is the negative (positive) component of the percentage change of loan spread. OLS, robust regression, and quantile regressions with estimates at 25%, 50%, and 75% are reported. For OLS, standard errors are clustered by firm. For quantile regressions, standard errors are obtained by 1000 bootstrap replications. All firm-level continuous explanatory variables are standardized over the full sample. The four contract change variables are standardized conditional on each being modified. All regressions control for Fama-French 12-industry and year fixed effects. Variable definitions are in Appendix B. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Table A.7 Continued
Panel A: Loosen vs. tighten covenants

	OLS	Robust Regression	Simultaneous-Quantile Regression		
			p25	p50	p75
Loan term changes					
Loosen covenant	26.242*	40.462***	25.327	44.695**	32.953
	(0.093)	(0.002)	(0.281)	(0.011)	(0.172)
Tighten covenant	-0.847	1.371	-12.514	-3.739	22.172
	(0.970)	(0.951)	(0.755)	(0.937)	(0.675)
ΔMaturity	2.990	2.686	2.943	4.431	12.373
	(0.699)	(0.736)	(0.821)	(0.661)	(0.265)
ΔAmount	7.096	8.895	15.685	5.055	5.955
	(0.316)	(0.278)	(0.202)	(0.591)	(0.544)
ΔSpread	-7.065	-18.056**	7.461	-18.815	-15.027
	(0.536)	(0.027)	(0.728)	(0.249)	(0.426)
Firm characteristics					
Speculative-grade	-21.996*	-31.841***	-32.935	-36.568**	-36.777**
	(0.081)	(0.009)	(0.155)	(0.022)	(0.028)
Log of book asset	0.935	-2.345	7.338	-4.063	-4.575
	(0.882)	(0.676)	(0.484)	(0.592)	(0.607)
Market-to-book	-6.896	-6.910	-10.007	-2.827	-5.488
	(0.178)	(0.205)	(0.358)	(0.737)	(0.415)
Macroeconomic factors					
GDP growth	-15.568*	-9.907	-5.249	-3.262	-21.396*
	(0.051)	(0.201)	(0.706)	(0.746)	(0.076)
Stock market return	5.229	2.590	4.774	1.519	11.811
	(0.513)	(0.675)	(0.751)	(0.875)	(0.304)
Bank leverage	16.438	15.459	19.903	13.328	44.437
	(0.484)	(0.437)	(0.626)	(0.673)	(0.231)
Bank competition	-0.045	8.042	8.177	0.185	0.966
	(0.998)	(0.541)	(0.757)	(0.993)	(0.965)
Constant	-2.550	23.149	-52.424	42.858	16.714
	(0.965)	(0.595)	(0.648)	(0.577)	(0.907)
Observations	321	321		321	
(Pseudo) R^2	0.100	0.159		0.047	

Table A.7 Continued
Panel B: Increase vs. decrease spread

	OLS	Robust Regression	Simultaneous-Quantile Regression		
			p25	p50	p75
Loan term changes					
Decrease spread	-2.575	-7.325	-26.237*	-11.850	13.054
	(0.796)	(0.430)	(0.071)	(0.334)	(0.341)
Increase spread	-4.361	-15.476	-0.145	-15.614	-12.808
	(0.826)	(0.244)	(0.996)	(0.616)	(0.713)
ΔCovenant strictness	33.471***	48.750***	35.957**	47.569***	41.338*
	(0.008)	(0.000)	(0.032)	(0.004)	(0.061)
ΔMaturity	2.097	4.287	0.920	4.191	15.876
	(0.771)	(0.584)	(0.930)	(0.659)	(0.156)
ΔAmount	8.441	8.478	20.056*	5.441	1.238
	(0.230)	(0.290)	(0.061)	(0.499)	(0.902)
Firm characteristics					
Speculative-grade	-20.546	-33.407***	-25.757	-36.128**	-43.478***
	(0.102)	(0.005)	(0.249)	(0.016)	(0.009)
Log of book asset	2.074	-2.878	11.438	-3.750	-5.588
	(0.734)	(0.605)	(0.221)	(0.613)	(0.512)
Market-to-book	-7.904	-9.060*	-10.891	-5.674	-6.222
	(0.127)	(0.091)	(0.280)	(0.499)	(0.337)
Macroeconomic factors					
GDP growth	-16.069**	-9.745	-6.382	-4.870	-17.254
	(0.033)	(0.196)	(0.638)	(0.619)	(0.145)
Stock market return	5.155	3.492	-0.146	-0.184	3.135
	(0.511)	(0.563)	(0.991)	(0.985)	(0.791)
Bank leverage	18.929	16.078	-2.153	7.217	40.890
	(0.425)	(0.408)	(0.955)	(0.818)	(0.268)
Bank competition	2.781	10.101	6.535	9.200	-16.466
	(0.852)	(0.435)	(0.763)	(0.595)	(0.462)
Constant	-9.380	9.129	-22.177	50.960	-3.970
	(0.870)	(0.830)	(0.832)	(0.511)	(0.977)
Observations	321	321		321	
(Pseudo) R^2	0.112	0.178		0.052	

Table A.8: Further robustness tests

The table presents additional robustness tests. Panel A reports results for the subsample of bank loan renegotiations that are not followed by covenant violation in the upcoming year. Panel B reports results that control for earning announcements (if any) within the [-5,5] event window. All firm-level continuous explanatory variables are standardized over the full sample. The four contract change variables are standardized conditional on each being modified. All regressions control for Fama-French 12-industry and year fixed effects. For OLS, standard errors are clustered by firm. For quantile regressions, standard errors are obtained by 1000 bootstrap replications. Variable definitions are in Appendix B. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: No covenant violation in the upcoming year					
	OLS	Robust Regression	Simultaneous-Quantile Regression		
			p25	p50	p75
Loan term changes					
ΔCovenant strictness	40.036***	48.993***	42.190**	46.032***	37.089**
	(0.001)	(0.000)	(0.012)	(0.001)	(0.017)
ΔSpread	-10.632	-14.960*	-2.404	-22.596	-25.946*
	(0.391)	(0.066)	(0.896)	(0.144)	(0.099)
ΔMaturity	-1.820	0.243	-4.658	5.880	8.801
	(0.773)	(0.975)	(0.590)	(0.490)	(0.433)
ΔAmount	8.209	4.653	15.779	2.801	4.058
	(0.301)	(0.567)	(0.149)	(0.748)	(0.729)
Firm characteristics					
Speculative-grade	-18.381	-34.492***	1.033	-36.806**	-36.294**
	(0.142)	(0.004)	(0.961)	(0.013)	(0.033)
Log of book asset	4.143	-1.432	14.121	-6.039	-3.281
	(0.518)	(0.799)	(0.179)	(0.397)	(0.715)
Market-to-book	-8.556	-8.401	-12.263	-1.280	-5.286
	(0.103)	(0.123)	(0.254)	(0.881)	(0.422)
Macroeconomic factors					
Bank leverage	25.933	10.960	11.031	11.116	45.058
	(0.285)	(0.580)	(0.792)	(0.748)	(0.250)
Stock market return	5.743	4.491	4.821	2.653	10.588
	(0.490)	(0.466)	(0.712)	(0.778)	(0.393)
GDP growth	-16.458**	-9.317	-3.337	-5.776	-23.392*
	(0.035)	(0.221)	(0.803)	(0.566)	(0.089)
Bank competition	9.202	7.900	9.591	12.506	4.126
	(0.539)	(0.549)	(0.702)	(0.555)	(0.842)
Constant	-2.896	39.877	-73.332	65.855	2.638
	(0.962)	(0.363)	(0.552)	(0.332)	(0.984)
Observations	309	309		309	
(Pseudo) R^2	0.110	0.167		0.051	

Table A.8 Continued
Panel B: Control for earning announcements

	OLS	Robust Regression	Simultaneous-Quantile Regression		
			p25	p50	p75
Loan term changes					
ΔCovenant strictness	35.796***	50.411***	43.598**	50.511***	42.630**
	(0.003)	(0.000)	(0.015)	(0.002)	(0.045)
ΔSpread	-4.525	-8.069	1.937	-12.315	-16.031
	(0.675)	(0.312)	(0.911)	(0.374)	(0.314)
ΔMaturity	-0.081	3.176	-4.704	3.814	10.576
	(0.991)	(0.677)	(0.656)	(0.675)	(0.307)
ΔAmount	7.564	7.067	14.295	5.486	5.628
	(0.336)	(0.374)	(0.235)	(0.535)	(0.595)
Firm characteristics					
Speculative-grade	-19.332	-31.344***	-4.653	-31.297**	-45.470***
	(0.110)	(0.008)	(0.833)	(0.027)	(0.008)
Log of book asset	2.142	-2.564	12.993	-4.497	-5.857
	(0.721)	(0.646)	(0.181)	(0.515)	(0.507)
Market-to-book	-8.487	-9.871*	-13.024	-3.452	-8.486
	(0.110)	(0.066)	(0.188)	(0.669)	(0.173)
Earnings announcement dummy	14.699	14.621	-3.737	9.750	10.855
	(0.268)	(0.228)	(0.834)	(0.493)	(0.543)
Macroeconomic factors					
Bank leverage	18.461	16.090	7.007	3.832	50.878
	(0.435)	(0.410)	(0.859)	(0.903)	(0.164)
Stock market return	5.803	4.326	0.886	2.021	9.589
	(0.452)	(0.475)	(0.950)	(0.828)	(0.399)
GDP growth	-15.981**	-10.878	-8.475	-7.556	-22.342*
	(0.035)	(0.149)	(0.544)	(0.426)	(0.058)
Bank competition	2.419	7.871	6.245	4.922	-6.947
	(0.870)	(0.542)	(0.780)	(0.795)	(0.759)
Constant	-7.983	8.320	-52.337	67.210	-8.587
	(0.889)	(0.845)	(0.636)	(0.400)	(0.951)
Observations	321	321		321	
(Pseudo) R^2	0.120	0.182		0.055	

APPENDIX B

VARIABLE DEFINITIONS FOR SECTION 2

Loan-level variables	(Data source: Compustat quarterly, Dealscan, and SEC filings)
Number of tranches	the number of tranches within a deal
Number of lenders	the number of lenders in the loan deal
Amount	the sum of the total loan amount across all tranches within a deal
Amount/assets	amount scaled by book assets (data44)
Stated maturity	the value-weighted maturity across all tranches within a deal, with each tranche's amount as the weight
Interest spread	the value-weighted interest rate spread over LIBOR across all tranches within a deal, with each tranche's amount as the weight
Covenant strictness	the Murfin (2012)'s measure of the ex ante probability of lender control
ΔCovenant strictness	Covenant strictness based on new covenant thresholds after renegotiation - Covenant strictness based on applicable covenant thresholds before renegotiation
ΔSpread	(Interest spread after renegotiation - Interest spread before renegotiation) / Interest spread before renegotiation
ΔMaturity	(Stated maturity after renegotiation - Stated maturity before renegotiation) / Stated maturity before renegotiation

ΔAmount	(Amount after renegotiation - Amount before renegotiation) / Amount before renegotiation
Coverage ratio covenant dummy	one if the loan includes at least one of interest coverage, fixed charge coverage, or debt service coverage covenants, zero otherwise
Debt to cash flow covenant dumy	one if the loan includes at least one of debt to cash flow ratio, or senior debt to cash flow ratio covenants, zero otherwise
Debt to balance sheet covenant dummy	one if the loan includes at least one of debt to total capitalization, debt to total net worth, or debt to tangible net worth covenants, zero otherwise
Net worth covenant dummy	one if the loan includes at least one of total net worth, or tangible net worth covenants, zero otherwise
Liquidity covenant dummy	one if the loan includes at least one of current ratio or quick ratio covenants, zero otherwise
Minimum cash flow covenant dummy	one if the loan includes minimum cash flow covenant, zero otherwise
Capital expenditure restrictions dummy	one if the loan includes capital expenditure covenant, zero otherwise

Firm-level variables	(Data source: Compustat quarterly (annual data denoted by Adata), FISD, and TRACE Enhanced)
Assets	book assets (data44)
Market value of equity	data14*data61
Book leverage	(data45+data51)/data44
Market-to-book	(data54+Adata10-data52+(data14*data61))/data44
Capex	data90 / PP&E (data42) at the beginning of the quarter
R&D	research and development expense (data4) / PP&E (data42) at the beginning of the quarter
Total investment	(data90+data4) / PP&E (data42) at the beginning of the quarter
Cash flow	operating cash flow (data21) / PP&E (data42) at the beginning of the quarter
cash holding	cash (data36) / PP&E (data42) at the beginning of the quarter
stock volatility	annualized standard deviation of daily returns in the previous 365 days

Stock CAR	the sum of abnormal stock returns over the same event window as used in bond event study. If a firm has multiple bonds, the starting (ending) date of the event window for calculating stock CAR is the earliest (latest) date among the event windows for these bonds. Abnormal stock returns are calculated using the Carhart Four-Factor model on a daily basis. The estimation period for the model coefficients is 255 trading days, ending 30 days before the announcement date
Capital expenditure	rolling sum of the last four-quarter capital expenditure (use change of data90 to compute the capital expenditure for each quarter)
Current ratio	data40/data49
Cash flow	rolling sum of the last four-quarter operating income before depreciation (data21)
Net worth	data44-data54
Tangible net worth	data44-data54-data234-data235
Debt to tangible net worth	(data45+data51)/Tangible net worth
Debt to total net worth	(data45+data51)/Net worth
Debt to total capitalization	(data45+data51)/(data45+data51+Net worth)
Debt to cash flow	(data45+data51)/Cash flow

Fixed charge coverage	cash flow/(one-year lagged debt in current liabilities (data45) + rolling sum of the last four-quarter interest expense(data22))
Interest coverage	cash flow / rolling sum of the last four-quarter interest expense(data22)
Quick ratio	(data40-data38)/data45
Earning announcement	a dummy that is one if the [-5,5] event window contains quarterly earnings announcement (RDQ), zero otherwise
Speculative-grade indicator	value-weighted averages of individual bond rating for each firm, where the weights are based on the market value of each bond on the last trading day within five days prior to the announcement day. When a bond is rated by multiple agencies, I choose S&P over Moody's over Fitch. The S&P rating is coded as: AAA=1, AA+=2, AA=3, AA-=4, A+=5, A=6, ...
Number of bonds per firm	the number of publicly traded straight bonds used to calculate excess bond returns for each firm
Years to maturity	the number of years before the issue's principal is due

Abnormal bond return	firm-level value-weighted average excess bond return in [-5,5] surrounding the renegotiation announcement date, which is the earlier of the date of the SEC filing that reports the renegotiation information, or the press release date. The weights are based on the market value of each bond on the last trading day within five days prior to the announcement day. The abnormal bond return for each publicly traded bond is obtained as the difference of a bond's raw return and the return of a maturity- and rating-matched bond portfolio. See Section 3.2.3 for details.
Macroeconomic variables	
GDP growth	the quarterly GDP growth rate. (Data come from the Federal Reserve Economic Data (FRED))
Bank leverage	total Liabilities/total book assets for commercial banks in the United States. (Data come from Federal Deposit Insurance Corporation (FDIC))
Stock market return	CRSP value-weighted index quarterly return

Bank competition	the importance of competition from other banks or nonbank lenders being the reason for tightening or easing its credit standards or its terms for commercial and industrial loans or credit lines over the past three months. 1=not important, 2=somewhat important, 3=very important. (Data come from Senior Loan Officer Opinion Survey on Bank Lending Practices, Federal Reserve Board) See Liu (2013).
Bargaining power proxy	
Lender capitalization	total common/ordinary equity (data59) / (data44) in the last quarter prior to renegotiation. It is measured at ultimate parent firm level and takes care of bank mergers and acquisitions. The DealScan lender names is hand-matched to Compustat, and quarterly Compustat data are extracted from either Banks, North America, and Global. The average is used if there is more than one lead arranger for a deal
Number of lender relationships	the number of banks used over the last four transactions prior to the renegotiation, scaled by the number of prior transactions used in the calculation as some firms have less than four prior transactions

CP issuer dummy	one if the firm has access to commercial paper markets (spsticrm is A-2 or better), zero otherwise

APPENDIX C

ESTIMATION OF COVENANT STRICTNESS

For the sake of completeness, I reproduce in this appendix the methodology as introduced in Murfin (2012) on the estimation of his covenant strictness measure.

As mentioned above, this new metrics estimates the probability that the lender will receive contingent control upon a covenant violation by the borrower. To better illustrate the idea, consider a loan that contains only a single financial covenant that set a minimum threshold $\underline{r}$ on the underlying financial ratio r. r, after experiencing a normally-distributed shock $\varepsilon \sim N(0, \sigma^2)$ in the period after the origination of the loan, becomes

$$r' = r + \varepsilon.$$

When $r' < \underline{r}$, the covenant for r is violated, which allocates control to the lender. Therefore, the ex ante probability of lender receiving contingent control via a covenant violation is $Pr(r + \varepsilon < \underline{r})$, which leads to

$$p = 1 - \Phi(\frac{r - \underline{r}}{\sigma}),$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function. Now this basic framework can be generalized to a multivariate setting to incorporate cases where there are multiple covenants in a loan.

Specifically, assuming that there are N ($N >= 1$) financial covenants in a loan contract and the underlying financial ratio vector is denoted as $r' = r + \varepsilon$, where ε is N-dimensional shock that follows the multivariate normal distribution $N(0, \Sigma)$. Given the covenant threshold vector $\underline{r}$, the probability of having no technical default for a loan with N covenants is $Pr(r' > \underline{r})$, which is equal to the multivariate normal CDF evaluated at $r - \underline{r}$: $\Phi_N(r - \underline{r})$. Then the ex ante probability of lender control, i.e. convenant strictness, is just the complement of $\Phi_N(r - \underline{r})$: $1 - \Phi_N(r - \underline{r})$. Therefore, the contract strictness measure incorporates not only the number of covenants r, but also takes into account of the financial slack $r - \underline{r}$, and the variance-covariance matrix associated with the changes of financial ratios, Σ.

Two inputs are needed for the estimation of the covenant strictness measure: $r - \underline{r}$ and Σ. I use Compustat quarterly data to construct both inputs. Specifically, slack is measured as the absolute log difference between the observed ratio and the allowable covenant threshold. Because my goal is to measure the change of covenant strictness via loan renegotiation, the slack in the last quarter prior to the renegotiation and the slack in the first period after renegotiation are separately applied to the calculation. With respect to Σ, I estimate it for each one-digit SIC industry, using 10-year windows of backward-looking quarterly changes in the natural logged financial ratios of levered Compustat firms.

As Murfin (2012), I include the following covenants in the calculation of contract strictness: minimum cash flow to debt, current ratio, quick ratio, tangible net worth, total net worth, minimum cash flow, fixed charge coverage, interest coverage, debt to total capitalization, debt to tangible net worth, and capital expenditure. These covenants capture the majority of the DealScan loan database and the associated financial ratios are defined in Appendix B. Note that, for covenants that are related to cash flow or income measures, these are calculated on a rolling four-quarter basis.

APPENDIX D

TABLES FOR SECTION 3

Table D.1: Distribution of corporate debt issues

The sample contains 4,399 debt issues by firms in the ExecuComp database taking places between 2007 and 2012 and being reported by Thomson One. The sample contains four types of issues: Rule 144A debt, non-Rule 144A debt, public issues, and syndicated loans. Panel A report the distribution of debt issues across time and issue types. Panel B reports summary statistics for maturity and principal amount and pairwise comparison of maturity across issue types. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Distribution by year and debt type

		Issue Type			
Year	Number of Issues	Rule 144A	Non-Rule 144A	Public	Syndicated
2007	698	16	36	255	391
2008	641	9	35	240	357
2009	582	16	33	216	317
2010	906	2	26	326	552
2011	1059	-	38	282	739
2012	513	-	28	211	274
2007-12	4399	43	196	1530	2630

Table D.1 Continued

Panel B: Maturity and volume by debt type

	Maturity (years)		Amount ($ MM)	
	Mean	Median	Mean	Median
All Issues	7.119	5.008	629.451	369.291
(1) Rule 144A	7.721	7.104	478.843	331.943
(2) Non-Rule 144A	11.358	10.011	87.741	64.868
(3) Public	11.627	10.019	585.085	450.061
(4) Syndicated	4.171	5.005	698.095	334.155

Maturity	Dif. in Mean	Dif. in Median
(1)-(2)	−3.637***	−2.907***
(1)-(3)	−3.906***	−2.915***
(1)-(4)	3.550***	2.099***
(2)-(3)	−0.269	−0.008**
(2)-(4)	7.187***	5.006***
(3)-(4)	7.456***	5.014***

Table D.2: Descriptive statistics and correlations

This table presents descriptive statistics for sample observations (Panel A) and Pearson correlations for our variables of interest and the dependent variable (Panel B). In Panel B, p-values are provided in parentheses. The sample contains 4,399 new debt issues made by 892 firms in the ExecuComp database from 2007 to 2012 where data is available to compute CEO inside debt and compensation incentives and where accounting data is available on Compustat. The sample starts in 2007 because SEC started to require firms to report executive deferred compensation plans and pension benefits in 2006 and we match each issue with its corresponding firm's financial information in Compustat at the latest fiscal year end before the issue date. Financial firms are excluded from the sample. All continuous variables are winsorized at the 1st and 99th percentiles. Variables expressed in dollar value are deflated by the all-urban CPI (year 2006). All Variable definitions are provided in Appendix E.

Panel A: Descriptive statistics						
	Mean	Q1	Median	Q3	Std. Dev.	N
Inside debt($000s)	9587.628	354.031	3643.479	12353.053	14088.077	4,399
Pension($1000s)	5176.531	0.000	582.539	7560.122	8241.022	4,397
Deferred compensation($1000s)	4391.568	0.000	913.133	3522.067	8911.984	4,399
Equity holdings($1000s)	64480.624	9529.096	22801.854	50874.215	149490.623	4,399
Stock holdings($1000s)	44764.753	3795.891	9692.296	25342.973	141865.030	4,399
Option holdings($1000s)	18592.388	2383.998	8868.655	23608.357	26041.540	4,399
Cashcomp($1000s)	1191.238	738.268	949.967	1232.572	895.973	4,399
DE	0.392	0.000	0.000	1.000	0.488	4,399
DE_Ratio	1.526	0.048	0.589	1.977	2.257	4,399
Short	0.214	0	0	0	0.410	4,399
Log(delta)	5.827	4.958	5.870	6.806	1.445	4,399
Log(vega)	4.270	3.274	4.672	5.743	1.978	4,399
Own	0.011	0.001	0.002	0.006	0.033	4,399
CEO age	55.770	52.000	56.000	60.000	6.274	4,329
CEO tenure	7.279	3.000	6.000	9.000	5.963	4,398
Leverage	0.189	0.088	0.160	0.264	0.132	4,399
LT3	0.659	0.526	0.714	0.883	0.282	4,399
Sale ($ MM)	17897.055	1526.036	4676.281	14550.291	42488.871	4,399
M/B	1.710	1.194	1.472	1.987	0.767	4,399
Asset_Mat	12.256	3.559	8.518	17.575	11.230	4,399
Abn_Earn	0.013	-0.013	0.005	0.019	0.251	4,399
Std_Ret	0.054	0.031	0.048	0.068	0.032	4,399
Term	1.992	0.760	2.160	3.100	1.388	4,399
Reg_Dum	0.102	0.000	0.000	0.000	0.302	4,399
NOL_Dum	0.464	0.000	0.000	1.000	0.499	4,399
Not_Rated	0.200	0.000	0.000	0.000	0.400	4,399
Investment Grade	0.626	0.000	1.000	1.000	0.484	4,399
ZScore_Dum	0.815	1.000	1.000	1.000	0.388	4,399

Table D.2 Continued

Panel B: Correlations

Variables	Maturity	DE_Ratio	DE	Log(delta)	Log(vega)	Own
Maturity	1.00					
DE_Ratio	0.06	1.00				
	(0.00)					
DE	0.10	0.70	1.00			
	(0.00)	(0.00)				
Log(delta)	0.12	-0.02	0.02	1.00		
	(0.00)	(0.30)	(0.30)			
Log(vega)	0.11	0.12	0.17	0.59	1.00	
	(0.00)	(0.00)	(0.00)	(0.00)		
Own	-0.05	-0.15	-0.19	0.31	-0.11	1.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
CEO age	0.04	0.13	0.11	0.14	0.08	0.06
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Firm age	0.12	0.23	0.32	0.09	0.22	-0.20
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
IssueAmount	-0.07	0.10	0.11	0.23	0.22	-0.07
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log(sale)	0.20	0.22	0.25	0.49	0.51	-0.17
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
M/B	0.02	0.22	0.17	0.32	0.12	0.04
	(0.28)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
leverage	-0.01	-0.31	-0.22	-0.16	-0.09	-0.02
	(0.46)	(0.00)	(0.00)	(0.00)	(0.00)	(0.26)
LT3	0.09	-0.08	-0.03	0.09	0.03	-0.05
	(0.00)	(0.00)	(0.02)	(0.00)	(0.09)	(0.00)
Asset_Mat	0.13	-0.00	0.07	-0.12	-0.17	-0.04
	(0.00)	(0.80)	(0.00)	(0.00)	(0.00)	(0.01)
Reg_Dum	0.12	0.00	0.11	-0.18	-0.14	-0.08
	(0.00)	(0.93)	(0.00)	(0.00)	(0.00)	(0.00)
Abn_Earn	-0.01	-0.03	-0.03	-0.13	-0.07	-0.02
	(0.72)	(0.03)	(0.07)	(0.00)	(0.00)	(0.23)
Std_Ret	-0.12	-0.04	-0.12	-0.07	-0.15	0.15
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Not_Rated	-0.13	-0.04	-0.09	-0.21	-0.23	0.12
	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)
Investment Grade	0.06	0.03	0.03	0.14	0.12	-0.05
	(0.00)	(0.06)	(0.06)	(0.00)	(0.00)	(0.00)
Zscore_Dum	-0.04	0.17	0.16	0.23	0.18	0.04
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)

Table D.3: The association between the CEO inside debt and the maturity of corporate debt issues

This table presents regression results on the model $Maturity_{i,t} = \beta_0 + \beta_1 DE_{i,t-1} + \beta_2 Short_{i,t-1} + \beta_3 DE_{i,t-1} * Short_{i,t-1} + \Theta_i * X_{i,t-1} + \varepsilon_{i,t}$. Panel A presents the net effect on the maturity of corporate debt issues across firms grouped by CEO relative leverage ratio and the incentive horizon of inside debt. The calculations are based on the estimates from Model (4) in Panel B. In Panel B, Models (1)-(3) report OLS regressions. Model (4) reports the second-stage results from the Heckman (1979) model, where the Probit estimates from the first stage (unreported) corrects for firms' self-selection into nonzero CEO inside debt compensation. Each model includes year fixed effects and Models (3) and (4) further include issue type fixed effect. The sample is constructed as described in Table D.2 and covers the 2007 to 2012 period. All independent variables are based on the previous fiscal year. All variables are defined in Appendix E. p-value (in parentheses) are based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: The cross-group inside debt effect on debt maturity

Groups	Corresponding Coefficients	Predicted Sign	Estimate
Long-term debt bias − Long-term equity bias ($DE = 1$, $Short = 0$) − ($DE = 0$, $Short = 0$)	$(\beta_0 + \beta_1) - \beta_0 = \beta_1$	+	0.706** (0.019)
Long-term debt bias − Short-term debt bias ($DE = 1$, $Short = 0$) − ($DE = 1$, $Short = 1$)	$(\beta_0 + \beta_1) - (\beta_0 + \beta_1 + \beta_2 + \beta_3) = -(\beta_2 + \beta_3)$	+	0.558 (0.103)
Long-term equity bias − Short-term equity bias ($DE = 0$, $Short = 0$) − ($DE = 0$, $Short = 1$)	$\beta_0 - (\beta_0 + \beta_2) = -\beta_2$	−	-0.993** (0.021)

Table D.3 Continued

Panel B: Regression results based on the full sample

	(1) OLS		(2) OLS		(3) OLS		(4) Heckman	
	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
DE	1.774***	(0.000)	0.957***	(0.001)	0.512**	(0.043)	0.706**	(0.019)
Short	1.838***	(0.000)	0.377	(0.456)	0.592	(0.111)	0.993**	(0.021)
DE*Short	-2.240***	(0.002)	-1.478**	(0.033)	-1.100**	(0.027)	-1.551***	(0.004)
Log(delta)			0.328*	(0.056)	0.015	(0.900)	-0.153	(0.321)
Log(vega)			0.018	(0.841)	-0.024	(0.739)	0.074	(0.404)
Leverage			-2.255**	(0.042)	-0.519	(0.547)	-1.707	(0.301)
Log(sale)			-0.453	(0.550)	-0.220	(0.751)	0.757	(0.523)
$[\text{Log(sale)}]^2$			0.079*	(0.087)	0.017	(0.697)	-0.031	(0.624)
Asset_Mat			0.059***	(0.000)	0.024**	(0.046)	0.048***	(0.000)
NOL_Dum			-0.422*	(0.056)	-0.161	(0.390)	0.026	(0.920)
Own			-5.108	(0.221)	0.229	(0.942)	3.241	(0.531)
M/B			0.110	(0.486)	-0.207	(0.119)	-0.380*	(0.062)
Term			0.062	(0.902)	-0.290	(0.473)	-0.416	(0.460)
Reg_Dum			1.028	(0.210)	0.824	(0.128)	0.872*	(0.089)
Abn_Earn			0.093	(0.651)	-0.008	(0.957)	0.030	(0.967)
Std_Ret			-1.938	(0.612)	5.703**	(0.041)	8.016	(0.192)
NotRated			-0.856*	(0.056)	-0.151	(0.668)	-0.417	(0.388)
Investment Grade			-0.570	(0.166)	-0.253	(0.458)	-0.461	(0.113)
ZScore_Dum			-0.635	(0.122)	-0.433	(0.188)	-0.341	(0.456)
IssueAmount			-1.188***	(0.000)	-0.190**	(0.011)	-0.193*	(0.092)
Inverse Mills Ratio							1.331	(0.161)
Year fixed effect	Yes		Yes		Yes		Yes	
Issue type fixed effect					Yes		Yes	
Adj. R^2	0.02		0.10		0.30			
Obs	4,399		4,399		4,399		3,317	

Table D.4: Subsample analysis between below-median and above-median market-to-book ratio firms

This table presents regression results on the model $Maturity_{i,t} = \beta_0 + \beta_1 DE_{i,t-1} + \beta_2 Short_{i,t-1} + \beta_3 DE_{i,t-1} * Short_{i,t-1} + \Theta_i * X_{i,t-1} + \varepsilon_{i,t}$ for firms with below-median market-to-book ratio (M/B) v.s. for firms with above-median market-to-book ratio. Panel A presents the net effect on the maturity of corporate debt issues across firms grouped by CEO relative leverage ratio and the incentive horizon of inside debt. The calculations are based on the estimates from Model (4) in Panel B. In Panel B, Models (1)-(3) report OLS regressions. Model (4) reports the second-stage results from the Heckman (1979) model, where the Probit estimates from the first stage (unreported) corrects for firms' self-selection into nonzero CEO inside debt compensation. Each model includes year fixed effects and Models (3) and (4) further include issue type fixed effect. The sample is constructed as described in Table D.2 and covers the 2007 to 2012 period. All independent variables are based on the previous fiscal year. All variables are defined in Appendix E. p-value (in parentheses) are based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: The cross-group inside debt effect on debt maturity

Groups	Corresponding Coefficients	Predicted Sign	Below-Median M/B	Above-Median M/B
Long-term debt bias − Long-term equity bias $(DE=1, Short=0) - (DE=0, Short=0)$	$(\beta_0+\beta_1)-\beta_0=\beta_1$	+	0.310	0.847** (0.042)
Long-term debt bias − Short-term debt bias $(DE=1, Short=0) - (DE=1, Short=1)$	$(\beta_0+\beta_1)-(\beta_0+\beta_1+\beta_2+\beta_3)=-(\beta_2+\beta_3)$	+	-0.134	1.005** (0.029)
Long-term equity bias - Short-term equity Bias $(DE=0, Short=0) - (DE=0, Short=1)$	$\beta_0-(\beta_0+\beta_2)=-\beta_2$	−	-0.568	-1.661** (0.033)

Table D.4 Continued

Panel B: Regression results based on the M/B subsamples

	Below-Median M/B				Above-Median M/B			
	(1) OLS		(2) Heckman		(1) OLS		(2) Heckman	
	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
DE	0.130	(0.698)	0.310	(0.499)	0.685**	(0.043)	0.847**	(0.042)
Short	0.192	(0.658)	0.568	(0.287)	1.104	(0.107)	1.661**	(0.033)
DE*Short	-0.214	(0.714)	-0.434	(0.557)	-1.936**	(0.015)	-2.666***	(0.003)
Log(delta)	0.222	(0.202)	0.054	(0.809)	-0.192	(0.177)	-0.470**	(0.038)
Log(vega)	0.008	(0.933)	0.080	(0.505)	-0.064	(0.509)	0.086	(0.525)
Leverage	-0.096	(0.927)	-1.104	(0.600)	-0.778	(0.608)	-2.191	(0.462)
Log(sale)	-1.511**	(0.047)	-1.198	(0.466)	1.097	(0.277)	2.380	(0.179)
$[Log(sale)]^2$	0.087*	(0.067)	0.073	(0.414)	-0.058	(0.363)	-0.121	(0.199)
Asset_Mat	0.009	(0.523)	0.033*	(0.054)	0.044**	(0.022)	0.063***	(0.001)
NOL_Dum	-0.041	(0.866)	0.406	(0.307)	-0.189	(0.472)	-0.212	(0.544)
Own	-4.061	(0.301)	0.652	(0.940)	3.490	(0.386)	7.842	(0.240)
M/B	-0.004	(0.997)	0.697	(0.610)	-0.081	(0.620)	-0.283	(0.290)
Term	-0.241	(0.526)	-0.396	(0.686)	-0.330	(0.547)	-0.365	(0.607)
Reg_Dum	1.077**	(0.044)	1.419**	(0.024)	-1.386*	(0.052)	-0.899	(0.508)
Abn_Earn	0.087	(0.634)	0.062	(0.934)	0.559	(0.543)	-0.790	(0.875)
Std_Ret	-1.417	(0.699)	3.134	(0.723)	9.265**	(0.016)	10.831	(0.224)
NotRated	-0.492	(0.323)	-1.078	(0.135)	0.255	(0.549)	0.431	(0.521)
Investment Grade	-0.443	(0.348)	-0.629	(0.127)	0.120	(0.760)	-0.173	(0.687)
ZScore_Dum	-0.312	(0.410)	-0.277	(0.594)	0.021	(0.963)	0.124	(0.936)
IssueAmount	-0.204**	(0.027)	-0.195	(0.275)	-0.155	(0.161)	-0.173	(0.250)
Inverse Mills Ratio			2.337*	(0.072)			-0.255	(0.847)
Year fixed effect	Yes		Yes		Yes		Yes	
Issue type fixed effect	Yes		Yes		Yes		Yes	
Adj. R^2	0.35				0.27			
Obs	2,131		1,604		2,268		1,713	

Table D.5: Controlling for existing corporate debt maturity structure

This table presents regression results that control for existing debt maturity structure $LT3$, which is the proportion of debt maturing beyond three years. Panel A presents the results based on the full sample. Models (1)-(3) report OLS regressions. Model (4) reports the second-stage results from the Heckman (1979) model. Each model includes year fixed effects and Models (3) and (4) further include issue type fixed effect. Panel B presents the results based on subsample sorted on market-to-book ratio. The sample is constructed as described in Table D.2 and covers the 2007 to 2012 period. All independent variables are based on the previous fiscal year. All variables are defined in Appendix E. p-value (in parentheses) are based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Table D.5 Continued

Panel A: Full sample regressions

	(1) OLS		(2) OLS		(3) OLS		(4) Heckman	
	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
DE	1.842***	(0.000)	0.977***	(0.001)	0.527**	(0.036)	0.737**	(0.015)
Short	1.732***	(0.000)	0.392	(0.435)	0.603	(0.104)	1.021**	(0.018)
DE*Short	-2.250***	(0.002)	-1.511**	(0.028)	-1.126**	(0.023)	-1.607***	(0.003)
Log(delta)			0.294*	(0.086)	-0.008	(0.945)	-0.180	(0.243)
Log(vega)			0.029	(0.744)	-0.017	(0.821)	0.091	(0.311)
Leverage			-2.412**	(0.030)	-0.634	(0.461)	-1.792	(0.277)
Log(sale)			-0.554	(0.464)	-0.292	(0.669)	0.646	(0.586)
$[\text{Log(sale)}]^2$			0.085*	(0.064)	0.022	(0.614)	-0.025	(0.692)
Asset_Mat			0.056***	(0.001)	0.022*	(0.069)	0.045***	(0.000)
NOL_Dum			-0.419*	(0.054)	-0.159	(0.391)	0.038	(0.883)
Own			-4.441	(0.284)	0.707	(0.821)	3.675	(0.477)
M/B			0.131	(0.407)	-0.192	(0.146)	-0.360*	(0.077)
Term			0.049	(0.923)	-0.299	(0.463)	-0.411	(0.465)
Reg_Dum			1.086	(0.184)	0.866	(0.109)	0.929*	(0.070)
Abn_Earn			0.124	(0.549)	0.014	(0.927)	0.010	(0.989)
Std_Ret			-1.701	(0.652)	5.853**	(0.035)	8.621	(0.161)
NotRated			-0.698	(0.117)	-0.036	(0.917)	-0.297	(0.542)
Investment Grade			-0.574	(0.160)	-0.256	(0.450)	-0.459	(0.114)
ZScore_Dum			-0.598	(0.140)	-0.406	(0.215)	-0.311	(0.497)
IssueAmount			-1.189***	(0.000)	-0.193***	(0.010)	-0.193*	(0.092)
LT3	1.930***	(0.000)	0.980***	(0.003)	0.705***	(0.005)	0.964**	(0.042)
Inverse Mills Ratio							1.306	(0.169)
Year fixed effect	Yes		Yes		Yes		Yes	
Issue type fixed effect					Yes		Yes	
Adj. R^2	0.03		0.10		0.30			
Obs	4,399		4,399		4,399		3,317	

Table D.5 Continued

Panel B: Subsample regressions

	Below-Median M/B				Above-Median M/B			
	(1) OLS		(2) Heckman		(1) OLS		(2) Heckman	
	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
DE	0.129	(0.698)	0.312	(0.496)	0.705**	(0.037)	0.881**	(0.035)
Short	0.200	(0.644)	0.606	(0.257)	1.120	(0.102)	1.671**	(0.032)
DE*Short	-0.212	(0.717)	-0.452	(0.540)	-1.979**	(0.013)	-2.718***	(0.002)
Log(delta)	0.203	(0.244)	0.005	(0.981)	-0.212	(0.135)	-0.481**	(0.034)
Log(vega)	0.016	(0.866)	0.100	(0.408)	-0.059	(0.550)	0.098	(0.468)
Leverage	-0.150	(0.886)	-1.214	(0.564)	-0.996	(0.514)	-2.365	(0.428)
Log(sale)	-1.537**	(0.043)	-1.199	(0.465)	0.993	(0.315)	2.229	(0.209)
$[\text{Log(sale)}]^2$	0.089*	(0.062)	0.074	(0.410)	-0.051	(0.409)	-0.113	(0.231)
Asset_Mat	0.008	(0.581)	0.031*	(0.069)	0.041**	(0.030)	0.060***	(0.002)
NOL_Dum	-0.048	(0.842)	0.389	(0.327)	-0.178	(0.493)	-0.193	(0.582)
Own	-3.569	(0.365)	2.096	(0.811)	3.814	(0.344)	7.816	(0.241)
M/B	-0.012	(0.988)	0.701	(0.608)	-0.061	(0.709)	-0.267	(0.319)
Term	-0.239	(0.539)	-0.414	(0.672)	-0.341	(0.537)	-0.349	(0.623)
Reg_Dum	1.113**	(0.037)	1.502**	(0.018)	-1.327*	(0.062)	-0.810	(0.551)
Abn_Earn	0.101	(0.583)	0.002	(0.998)	0.677	(0.456)	-0.562	(0.911)
Std_Ret	-0.991	(0.783)	5.643	(0.531)	9.119**	(0.017)	10.267	(0.250)
NotRated	-0.360	(0.456)	-0.890	(0.224)	0.327	(0.448)	0.497	(0.461)
Investment Grade	-0.436	(0.351)	-0.617	(0.134)	0.105	(0.788)	-0.181	(0.672)
ZScore_Dum	-0.281	(0.459)	-0.237	(0.648)	0.047	(0.917)	0.208	(0.893)
IssueAmount	-0.207**	(0.026)	-0.193	(0.278)	-0.159	(0.150)	-0.175	(0.245)
LT3	0.610*	(0.083)	1.124	(0.140)	0.635*	(0.058)	0.690	(0.270)
Inverse Mills Ratio			2.385*	(0.066)			-0.295	(0.823)
Year fixed effect	Yes		Yes		Yes		Yes	
Issue type fixed effect	Yes		Yes		Yes		Yes	
Adj. R^2	0.35				0.27			
Obs	2,131		1,604		2,268		1,713	

Table D.6: Bias-corrected nearest neighbor matching estimator

This table presents the effect of incentive bias change on the maturity of new debt issues, while holding the incentive horizon type the same (or vice versa). We employ a matched firm, difference-in-difference approach. Column titled "N" reports the number of matched pairs. Sample average treatment effect (SATE) is reported in the last column. The sample is constructed as described in Table D.2 and covers the 2007 to 2012 period. p-value (in parentheses) are based on heteroskedastic-robust standard errors. ***, **, and *, indicate significance at the 1%, 5%, and 10% level, respectively.

Groups	Predicted Sign	N	SATE
Long-term equity bias ⇒ Long-term debt bias ($DE = 0$, $Short = 0$) ⇒ ($DE = 1$, $Short = 0$)	$+$	106	2.315*** (0.000)
Long-term debt bias ⇒ long-term equity bias ($DE = 1$, $Short = 0$) ⇒ ($DE = 0$, $Short = 0$)	$-$	72	-1.487** (0.003)
Short-term debt bias ⇒ long-term debt bias ($DE = 1$, $Short = 1$) ⇒ ($DE = 1$, $Short = 0$)	$+$	12	1.738 (0.349)
Long-term debt bias ⇒ Short-term debt bias ($DE = 1$, $Short = 0$) ⇒ ($DE = 1$, $Short = 1$)	$-$	14	-1.852 (0.173)
Short-term equity bias ⇒ Long-term equity bias ($DE = 0$, $Short = 1$) ⇒ ($DE = 0$, $Short = 0$)	$-$	14	-1.958 (0.497)
Long-term equity bias ⇒ Short-term equity bias ($DE = 0$, $Short = 0$) ⇒ ($DE = 0$, $Short = 1$)	$+$	17	1.344 (0.291)

APPENDIX E

VARIABLE DEFINITIONS FOR SECTION 3

Compensation Variables	
Inside debt	Sum of the CEO's pension and deferred compensation.
Pension	The aggregate actuarial present value of the CEO's accumulated benefits under the company's pension plan (pension_value_tot).
Def. comp.	The CEO's aggregate balance in non-tax-qualified deferred compensation plans (defer_balance_tot).
Equity holdings	Sum of the CEO's stock holdings and option holdings.
Stock holdings	CEO stock holdings, i.e. the total number of stock holdings (shrown_excl_opts) multiplied by the fiscal year end stock price (prcc_f).
Option holdings	The Black&Schole value of CEO option holdings, see Appendix F.
Cashcomp	Sum of the CEO's salary and bonus compensation.
Rel_DE_Ratio	The CEO-firm relative debt-to-equity ratio, calculated as the CEO's debt-to-equity ratio divided by the firm's debt-to-equity ratio. the CEO's debt-to-equity ratio is inside debt divided by equity holdings, firm's debt-to-equity ratio is the sum of long-term debt plus debt in current liabilities, divided by the firm's market value of equity.
DE	A dummy variable that equals one if Rel_DE_Ratio is greater than 1.0.

Log(delta)	Natural logarithm of delta. Delta is the dollar change in the value of the CEO's stock and option portfolio due to a 1% increase in the value of the firm's common stock price (Appendix F).
Log(vega)	Natural logarithm of vega. Vega is the dollar change in the value of the CEO's option grants and any option holdings for a 0.01 change in the annualized standard deviation of stock returns (Appendix F).
Own	Number of shares owned by the CEO (shrown_excl_opts) scaled by total shares outstanding (Item #25).
CEO age	The CEO's age as reported in the ExecuComp database.
CEO tenure	The number of years that the current CEO has served in that capacity as reported in the ExecuComp.
Firm Variables	
LT3	1 - (Debt in current liabilities (Item #34) plus debt maturing in the second year (Item #91) plus debt maturing in the third year (Item #92), scaled by total debt. Total debt is defined as debt in current liabilities (Item#34) plus long-term debt (Item #9)).
Leverage	Total debt (Item#34+Item#9) divided by the market value of the firm.
Sale	sales (net) (data12).

M/B	Market value of the firm (Item #199 * Item #54 + Item #6 Item #60) divided by the book value of total assets (Item #6).
Asset_Mat	Book value-weighted average of the maturities of property plant and equipment and current assets, computed as (gross property, plant, and equipment (Item #7)/total assets (Item #6)) * (gross property, plant, and equipment (Item #7) /depreciation expense (Item #14)) + (current assets (Item #4)/total assets (Item #6)) * (current assets (Item #4)/cost of goods sold (Item #41)).
Abn_Earn	(Earnings in year t+1 (Item#20) - earnings in year t)/(share price (Item#199) * outstanding shares (Item#25) in year t).
Std_Ret	Monthly stock return standard deviation during the fiscal year multiplied by the ratio of the market value of equity (Item #199 * Item #25) to the market value of assets (Item #199 * Item #25 + Item #6 - Item #60).
Reg_Dum	Equals one if the firm's SIC code is between 4,900 and 4,939 and zero otherwise.
NOL_Dum	A dummy equal to one for firms with net operating loss carryforwards and zero otherwise (Item #52).
Not_Rated	Equals one if a firm has no S&P rating on long-term debt (Item #280), and zero otherwise.
Investment_Grade	Equals one if a firm has S&P rating on long-term debt (Item #280) BBB or higher, and zero otherwise.

ZScore_Dum	Equals one if Altmans Z-score is greater than 1.81, and zero otherwise. Altmans Z-score is computed as 3.3 * Item #178/Item #6 + 1.2 * (Item #4 - Item #5)/Item #6 + Item #12 /Item # 6 + 0.6 * Item #199 * Item #25 / (Item #9+Item #34) + 1.4 * Item #36/Item #6.
Term	The difference between the yield on 10-year government bonds and the yield on 6-month government bonds at the fiscal year end.
RD	Research and development expenditures (Item #46 or zero if missing) scaled by assets (Item #6).
Capex	Net capital expenditures (Item #128 - Item #107) scaled by asset (Item #6).
Liquidity	A dummy variable equal to one if the firm has negative operating cash flow, and zero otherwise. Operating cash flow is operating income before depreciation (Item #13)- Interest (Item #15) - income taxes (Item #16)- common dividends (Item #21)
Stock_Ret	Buy-and-hold return during the fiscal year.
Surcash	Cash from assets-in-place (Item #308 - Item #125 + Item #46) scaled by assets (Item #6).
Volatility	The standard deviation of first differences in EBITDA (Item #13) over the four years preceding the sample year, scaled by average assets (Item #6) for that period.
Fix_Asset	The ratio of net PPE (Item #8) to the book value of assets (Item #6).
ROA	The ratio of EBITDA (Item #13) to book value of assets (Item #6), measuring the profitability of the firm.

ITC_Dum	A dummy equal to one for firms with investment tax credits and zero otherwise (Item #51).

APPENDIX F

COMPUTATION OF OPTION VALUE, DELTA, AND VEGA

We follow the methodology used in Core and Guay (1999) and Edmans, Gabaix, and Landier (2009) to calculate option value and construct the delta and vega of the managerial compensation.

The value of a CEO's option holdings is the sum of the value for the three groups: new grants in the current year, existing unexercisable grants, and existing exercisable grants. Before 2006, exercise price is only reported for new option grants in each year. Certain imputation is needed to calculate exercise price for prior granted options. Starting in 2006 however, Execucomp provides a separate record for each outstanding option tranche, whose exercise price and expiration date are also reported.

The estimation of a stock option in any group bases on the same Black-Scholes model for European call options, adjusted for dividends by Merton (1974):

$$\text{Option value} = [Se^{-dT}N(Z) - Xe^{-rT}N(Z - \sigma\sqrt{T})],$$

where $Z = [\ln(S/X) + T(r - d + \sigma^2/2]/(\sigma\sqrt{T})]$, N is the cumulative probability function for the normal distribution, S is the price of the underlying stock σ is the expected stock-return volatility over the life of the option, r is the risk-free interest rate, d is expected dividend yield over the life of the option, T is time to maturity of the option in years, and X is the exercise price of the option. Among these variables, S, σ, r, and d are homogeneous at the firm-year level across the three groups of options, while T and X differ across groups.

Delta is the sensitivity with respect to a 1% change in stock price and a CEO's portfolio delta is the sum of the deltas for the exercisable and unexercisable options plus the delta of his shareholdings. The option *Delta* is defined as:

$$\partial(optionvalue)/\partial(price)] * (price/100) = e^{dT}N(Z) * (price/100).$$

The *Delta* from stock holdings is just the total number of stock holdings multiplied by a 1% change in stock price.

Vega is the sensitivity with respect to a 0.01 change in stock-return volatility. The option vega is defined as:

$$\partial(optionvalue)/\partial(stockvolatility) * 0.01 = e^{dT}N'(Z)ST^{(1/2)} * (0.01),$$

where N' is the normal density function. Following the existing literature (Coles, Daniel, and Naveen (2006)) that the *Vega* of any stock-holdings, including restricted stock, is assumed to be zero, the CEO's portfolio sensitivity with respect to a 0.01 change in stock-return volatility is equal to the *Vega* from his option holdings.