THREE ESSAYS IN CORPORATE FINANCE

by

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ABSTRACT

TAICHUN PIAO. Three essays in corporate finance. (Under the direction of DR. TAO-HSIEN DOLLY KING)

The first paper ("Does Executive Compensation Duration Generate Different Risk Incentives? Evidence on Corporate Hedging") investigates whether and how corporate hedging policy is affected by compensation duration. I find a positive and significant relation between compensation duration and hedging policy. The findings highlight the importance of including all compensation components. In the second paper ("Putable Bonds, Risk Shifting Problems, and Information Asymmetry"), I focus on the regular putable bonds and present an empirical examination of issuers' motives to issue putable bonds. The findings suggest that risk-shifting incentives and information asymmetry are the main motives for the firms to issue putable bonds. I consider the simultaneity of the decisions on putable, covenants, and leverage, and further confirm the findings of the risk-shifting and information asymmetry hypothesis. The third paper ("Shareholder-Creditor Conflict and Hedging Policy: Evidence from Mergers between Lenders and Shareholders") examines the effect of the shareholder-creditor conflict on the hedging policy. Using the mergers between the shareholder and creditor as an exogenous shock, I find that firms that experience mergers between the shareholder and creditor are more likely to hedge and hedge more in terms of the notional value.

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DEDICATION

I would like to dedicate my work to my parents, Jie Piao and Xiansu Li; to my wife, Xin Liu. Thank you for your love and support. I love you.

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CHAPTER 1: DOES EXECUTIVE COMPENSATION DURATION GENERATE DIFFERENT RISK INCENTIVES? EVIDENCE ON CORPORATE HEDGING

1. Introduction

How to motivate to promote long-term value creation has been drawing attention in recent years. Existing literature documents the relationship among short-term versus long-term incentives, firm policies, and managerial behaviors such as earning management and investment decisions. For example, Chi et al. (2019) provide evidence that managerial short-termism is linked to a higher probability of earnings management. Bebchuk and Fried (2010) argue that short-term payments drive excessive risk-taking behaviors by bank executives, leading to self-interested and myopic managerial decisions. Gopalan et al. (2014) introduce compensation duration as a quantitative measure of the vesting periods of different pay components. The compensation duration measure suggested by Gopalan et al. (2014) highlights the time dimension of CEO equity compensation. They document that a short compensation duration is associated with greater return volatility. We conjecture that the time dimension of inside debt should also be considered. Literature has shown that inside debt plays a significant role in driving managerial behaviors and firm policies, suggesting that it is an important component in CEO compensation. For instance, Sundaram and Yermack (2007) document that when the CEO’s personal debt-to-equity ratio exceeds the firm’s external debt ratio, the firm is managed more conservatively to reduce the probability of default. Edmans and Liu (2011) argue that inside debt is a superior solution to the agency cost of debt than the solvency-contingent payments. Phan (2014) investigates the relation between inside debt and mergers and acquisitions (M&A) and finds that inside debt is associated with less risk-taking.

Similarly, Bekum (2016) documents that debt-based compensation leads to lower bank risk. Based on the inside debt literature, we extend the duration measure by Gopalan et al. (2014) by including inside debt to examine the overall compensation duration consisting of all compensation components.

Given the prior studies on the impacts of managerial long-term incentive and firm risk, we explore the link between compensation long-term incentive and, one of the major financial policies, corporate hedging strategy. Using compensation duration as a measure of long-term incentive, this study extends the literature by investigating the relation between CEO compensation duration and hedging policy. We aim to answer the following questions: Does CEO compensation duration generate effective incentives to affect corporate hedging policy? If so, how does the duration of each compensation component influence hedging policy?

Among various corporate policies, hedging is a major financial policy that has been documented to affect firm value by smoothing future cash flows, lowering default risk, and reducing financing costs. Since executives with long-term payments will be more concerned about collecting payments in the future, we conjecture that a longer overall compensation duration is likely to result in a greater tendency to hedge. Furthermore, we argue that the impact of compensation duration on corporate risk-taking behaviors varies across cash-based, equity-based, and debt-based compensation due to the nature of these compensation components. Cash-based compensation may drive riskier behaviors due to the immediacy of the payments, especially if the compensation is tied to certain performance targets. We observe that most cash payments are performance-based. A large cash compensation duration reflects that cash accounts for a sizable percentage of the overall compensation and/or a longer vesting period to meet the performance targets. As a result, managers are likely to adopt a riskier policy to meet the performance goal.

Equity-based compensation, on the other hand, is mainly designed to align the interests of the managers with those of the equity holders. Equity compensation has been shown in the literature to incentivize managers to take more risks. The time dimension reflected in the vesting periods of the stock and option grants in pay contracts is also important. A large amount of equity and option grants with a long vesting period should lead to the strongest interest alignment between managers and shareholders, motivating managers to engage in risky projects to maximize the value of the equity-based compensation. On the other hand, a large amount of equity-based compensation with a short vesting period does not necessarily lead to a high level of interest alignment. More specifically, a short vesting period may lead to an emphasis on boosting the short-run performance by engaging in risky behaviors. As the equity-based compensation duration incorporates both channels, the link between equity-based compensation duration on hedging should reflect both effects. For debt-based compensation, the fixed-claimant hypothesis suggests that greater inside debt duration may lead to more conservative policies and behaviors as managers' interests are more aligned with those of the creditors. The impact of the overall compensation duration on hedging should reflect the combined effects of the cash-based, equity-based, and debt-based compensation components.

Using a sample of 4,288 firm-years based on data collected from Institutional Shareholder Services (ISS) Incentive Lab, EDGAR filings, and EXECUCOMP, we examine the effect of compensation duration on corporate hedging behavior from 2006 to 2015. We find that, on average, firms with a longer overall compensation duration are more likely to hedge. For example, an increase of one year in compensation duration is associated with a significant 6% increase in the probability of hedging after controlling other compensation variables, CEO characteristics, and firm-level and macro-level variables. By examining the different types of hedging activities, we find that the significant impact of overall compensation duration on hedging remains robust and consistent across interest rate, foreign currency, and commodity risk hedges. To address the concern that compensation duration and hedging activities may be endogenously determined, we apply the 2SLS model, propensity score matching method, and simultaneous equations model. We follow Li and Peng (2019) to use the median CEO pay duration of the non-industry-clustered firms within the same Metropolitan Statistical Areas (MSA) as the instrument. We also include two state policy variables as suggested by Chen et al. (2015) who use these state policy variables as instruments for executive compensation protection to examine the relationship between compensation protection and investment decisions. The positive relation between compensation duration and hedging is robust in the 2SLS regressions. To address the potential issue that omitted time-invariant factors may drive the results, we apply the propensity score matching method and find similar results. As an additional robustness check to alleviate the concern of reverse causality, we perform regressions of a simultaneous equation model consisting of the compensation duration and hedging equations. The results of the simultaneous equation model provide further support that compensation duration has a positive impact on hedging policy.

In contrast to the positive impact of the overall compensation duration on hedging, we document that the effect of duration on hedging varies substantially across compensation components. Particularly, cash duration is negatively related to the probability of hedging. Note that cash compensation without a vesting period is paid immediately and therefore does not enter the cash or overall compensation duration calculation. We observe that most of the cash grants with a vesting period are performance-based. The finding of a negative effect of cash duration on hedging suggests that managers are motivated to engage in riskier behaviors that may lead to a higher probability of meeting the performance goals. The evidence indicates that increasing the vesting period of cash grants does not help curb risk-taking behaviors. For equity duration, we find that a longer duration (i.e., a value-weighted vesting period) results in a lower probability of hedging. As discussed above, equity compensation motivates the managers to increase the volatility of the underlying assets when the vesting period of the equity compensation is long. This effect seems to dominate the conflicting effect of the managerial focus on the short-run performance because of a short vesting period. Furthermore, inside debt duration has a positive effect on hedging. Both the long-term and fixed claimant features of inside debt incentivize managers to take less risk. When combining the duration of the various compensation components and controlling for other compensation incentive factors (e.g., Delta and Vega), the finding of a positive impact of the overall compensation duration on hedging suggests that the long-term value creation incentive embedded in the debt-like compensation is likely a prominent driver.

CEO compensation is not the only way to align the interests of the managers with those of the claimholders. Large blockholder ownership and involvement are likely to promote corporate decisions that maximize shareholders' interest, aligning managerial incentives with those of equityholders. Thus, the effect of equity compensation duration on hedging may vary across firms with different levels of blockholder ownership. Similarly, the role of inside debt duration as an incentive alignment between managers and debtholders is likely to be contingent upon the presence and monitoring power of the creditors. With these lines of reasoning, we use blockholder ownership and private debt ratio as measures of shareholder and debtholder control, respectively. We investigate the relation between compensation duration and hedging, conditioning on the strength of shareholder/debtholder control. Our findings suggest that the positive relation between the overall compensation duration and hedging is less pronounced for firms with stronger shareholder or debtholder control. When we look at equity compensation duration, we find that the negative impact of duration on hedging is significantly strengthened by blockholder ownership. This result suggests that blockholder ownership, in addition to equity compensation duration, further enhances the interest alignment of managers with equityholders. On the other hand, the positive effect of inside debt duration on hedging is lessened in firms with stronger debtholder control measured by the private debt ratio. The results indicate that debtholder monitoring may serve as a substitute for inside debt duration in terms of curbing managerial risk-taking incentives.

This study contributes to the literature on managerial long-term incentive (Chi et al., 2019; Gopalan et al., 2014) by examining the design of compensation duration and its impact on risk incentives. First, our measurement of compensation duration is different from that in the prior literature by including the duration of inside debt and cash compensation with a vesting period to construct a comprehensive measure. Duration measures of various compensation components have different effects on managerial risk-taking incentives. We find that the level of CEO compensation duration, if not taking account of cash and inside debt components, will be significantly underestimated and hence cannot fully capture the impacts of compensation duration on corporate policies. Second, the literature on how the duration of each compensation component functions differently in generating incentives is sparse. Our findings indicate that cash-based or equity-based compensation duration leads to less hedging, while debt-based compensation duration is associated with more hedging. The effects on hedging of equity-based compensation duration (debt-based compensation duration) are further examined to show how the impacts are strengthened or lessened by shareholder (debtholder) control. Third, this paper contributes to the recent literature on the impacts of managerial incentives on hedging. Prior research on the relationship between hedging decisions, managerial stock and option holdings, and compensation convexity (Graham and Rogers, 2002; Knopf et al., 2002; Supanvanij and Strauss, 2006) suggests a robust relation between compensation and hedging based on the amount and sensitivity of equity-like compensation. Our findings provide strong support that the duration of the overall compensation package is an important aspect that should be considered in the exploration of the impacts of CEO compensation on hedging. With a longer compensation duration, managers are more concerned about collecting the long-term payments and therefore are more likely to engage in risk reduction (hedging) activities. To our best knowledge, this research is the first to consider the various incentives generated by the executive compensation duration and our study fills the gap by providing evidence that managerial risk attitude can be affected differently by equity or inside debt-dominated compensation duration.

The rest of the paper is structured as follows. Section 2 reviews the literature on compensation duration and hedging and develops our hypotheses. Section 3 describes our sample and data. Section 4 reports the empirical results of baseline models and additional robustness tests. Section 5 concludes.

2. Literature Review and Hypothesis Development

2.1 Compensation duration and corporate policy

The theoretical framework provides several reasons why managers focus more on short-term performance. Narayanan (1985) and Holmstrom (1999) develop models to learn about managerial skills through cash flows. They argue that managers boost short-term performance so that they can make an impression of being productive. Stein (1989) states that managers tend to "borrow" future earnings to mislead the current firm value. Shleifer and Vishny (1990) argue that short-termism is a result of an arbitrage opportunity since the short-term assets are easier to arbitrage. To avoid firm undervaluation, the manager will implement shorter-term projects. Given the above incentives, managers with less long-term focus may want to improve current firm performance at the expense of long-term firm value. Bizjak et al. (1993) provide evidence that managers who are concerned about current stock price will use investment decisions to manipulate the market's inferences, which could cause overinvestment or underinvestment. Bolton et al. (2006) derive a multiperiod agency model and show that the optimal compensation contract may boost short-term performance at the expense of long-term firm value. Edmans et al. (2016) document that a short horizon of CEO compensation proxied by equity compensation vested within a quarter leads to a reduction in real investment. Chi et al. (2019) provide evidence that managers with short-horizon compensation are more likely to engage in insider trading and earnings management. Cadman and Sunder (2014) study IPO events and find that venture capital firms motivate executives with short-horizon incentives to maximize short-term firm value.

However, time-vesting compensation does not provide sufficient incentives to managers since it is only contingent on time. Gopalan et al. (2014) provide a new quantitative measurement for compensation duration to resolve this issue. The new measure takes account of not only stock options (Cadman et al., 2010) but also salary, bonus, and restricted stocks. They develop two additional measures that incorporate the pay-for-performance sensitivity and all prior-year grants. They argue that compensation duration reflects additional incentives for managers that are not captured in equity-based compensation sensitivity measures including delta and vega. In particular, they indicate that a large amount of a stock or option grant is not likely to induce short-term riskier behaviors if the vesting period of the grant contract is long. Delta and vega reflect the managerial compensation's sensitivity to stock price changes and volatility, while duration captures the additional aspect of the short-term versus long-term incentives in compensation contracts. Welker (2015) examines the relationship between compensation duration and innovation and finds that a one-year increase in pay duration is associated with a 25% to 37% increase in citations of patents. Welker uses arguments that are similar to those in Gopalan et al. (2014) to explain his findings. He indicates that the difference between duration and the equity compensation sensitivity measures (e.g., delta, vega, correlation of compensation and stock returns or accounting performance) is that duration captures the time aspect of the grants. If the stock and/or option grants have a short vesting period, it is unlikely to affect managers' long-term incentives. For example, a recent study by Biggerstaff, Blank, and Goldie (2019) finds no evidence to support a connection between option compensation and innovation. Cheng et al. (2020) provide similar arguments that pay duration explicitly shows the time dimensions by incorporating the vesting periods of stock and option grants. Managers with a longer vesting period are less likely to sell their shares when receiving additional equity-based compensation than those with a shorter vesting period. Marinovic and Varas (2019) suggest that the design of monetary incentives alone in managerial contracts is not enough to eliminate short-termism.

Gopalan et al. (2021) apply the new duration measures and show that managers with longer compensation duration are less likely to leave the firms voluntarily. Chang et al. (2018) find that the removal of the short-sale constraints increases the compensation duration. Li and Peng (2019) find that CEOs with a longer compensation duration are more likely to engage in large acquisitions with negative announcement returns. Although the measurement of Gopalan et al. (2014) includes both the performance-vesting and time-vesting components, their estimation of duration focuses on the vesting periods of equity grants, salary, and bonus. We conjecture that cash and inside debt durations also play a role in explaining managerial behaviors. In this paper, we construct the measures of duration based on all compensation components including equity grants, cash, and inside debt. With this revised duration measurement, we can better examine the overall effect of compensation duration on corporate decisions.

2.2 Corporate hedging

The theoretical framework provides several reasons for hedging to have an impact on firm value. One of the benefits of hedging is the reduction in the probability of financial distress and therefore a drop in the financing cost. Chen and King (2014) find that hedging is associated with a lower cost of public debt. [1] Gay et al. (2011) document that the cost of equity of financial derivatives users is lower than non-users. Hedging reduces the costs of internal financing by allowing firms to secure internally generated funds on a more consistent basis. For non-hedgers, the variability of internal funds leads to the uncertainty associated with riskier cash flows or growth opportunities. Froot et al. (1993) develop a general framework and state that when external financing is costly, it is beneficial for firms to hedge to secure future investment opportunities. Lin et al. (2008) further develop a framework to examine the interaction between hedging, financing, and investment. They find a positive relation between leverage and hedging. Firms become more efficient in investment when they hedge. [2] They also suggest that hedging, financing, and investment decision are jointly determined. Another main benefit of corporate hedging is the reduction in tax liability. Smith and Stulz (1985) argue that when the tax schedule is convex, firms will reduce expected tax liability by hedging. Firms can reduce the expected value of tax liabilities by reducing the uncertainty of taxable income. However, MacKay and Moeller (2007) criticize

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[1] Bartram et al. (2009), Campello et al. (2011), and Purnanandam (2008) find evidence to support the financial distress hypothesis. Leland (1998) and Graham and Rogers (2002) argue that firms can increase debt capacity and interest payments deductions by hedging.

[2] Haushalter et al. (2007) state that hedging will secure future investment opportunities and gain advantages relative to rivals. Campello et al. (2011) also provide evidence that hedging will ease the investment restrictions for financially distressed firms.

this tax hypothesis by Smith and Stulz (1985) by arguing that there is a trade-off between the value of lowering cash flow volatility and the hedging gains related to the cost function.[3]

Hedging can help alleviate agency conflicts between shareholders and bondholders by reducing the overinvestment and underinvestment problems. Jensen and Meckling (1976) state that agency conflicts between shareholders and creditors increase the cost of financing. Given the nature of limited liabilities, shareholders enjoy the benefits of highly risky projects at the expense of the creditors. Campbell and Kracaw (1990) state that hedging could decrease the agency cost of external financing by controlling the project risk. On the other hand, since shareholders hold a residual claim on the firm’s assets, managers may forgo positive NPV projects. Hedging helps resolve this issue by lowering the cost of debt financing. However, as Aretz and Bartram (2010) point out, the complex relations between hedging and the other corporate policies make it difficult to examine these agency theories, which leads to mixed evidence supporting the relation between hedging and the underinvestment problems.

2.3 Hypothesis development: Compensation duration and corporate hedging

The compensation of top managers plays a role in hedging decisions. Smith and Stulz (1985) point out that shareholders have the incentive to devise a compensation contract to align the interests of the manager with those of the shareholders. They argue that when a risk-averse manager holds a large number of the firm’s shares, the expected utility of wealth is significantly affected by the variance of the firm’s profits. The manager may decide to hedge to secure his own wealth. Graham and Rogers (2002) argue that managers' stock and option holdings are important determinants of corporate hedging. Rogers (2002) documents a strong negative link between the

[3] Graham and Smith (1999), Aretz and Bartram (2010), and Graham and Rogers (2002) provide evidence to show that reduction of tax liability is not the main reason for firm to hedge.

risk incentives stemming from CEO compensation and the number of derivative holdings. Knopf et al. (2002) find that as the sensitivity of the manager's stock and option portfolios to stock price (delta) increases, firms tend to hedge more. As the sensitivity of managers' stock option portfolios to stock return volatility (vega) increases, firms tend to hedge less. Supanvanij and Strauss (2006) support Smith and Stulz's (1985) implication. They document that when management is compensated with options, fewer derivatives for hedging interest rate and currency risk are used. On the other hand, managerial compensation with more stocks is positively associated with hedging activity. However, the effect of the compensation horizon on hedging has not been examined. As discussed above, compensation duration measures the short-term versus long-term incentives of the pay contracts, which are not captured in delta and vega. From a maturity-matching perspective, managers with a long compensation duration are incentivized to make sure that the firm stays afloat on a long-term basis so they can receive their payments with a long vesting period in the pay contracts. As a result, CEOs with a longer compensation duration are likely to manage the firm more conservatively to ensure firm longevity for them to collect their long-term payments.

Welker (2015) uses a similar argument in his study of the relation between compensation duration and innovation. He suggests that problems may potentially arise when there is a mismatch between compensation duration and the duration of corporate investments. In other words, managers should have a pay contract with a long compensation duration to motivate them to engage in long-term investments with uncertain payoffs (Manso, 2011; Li and Peng, 2019).

In addition, given that bankruptcy is costly and managers lose all the unvested grants in their pay contracts in the case of default, managers with a long compensation duration are likely to adopt policies to reduce the default probability in order for them to collect payments.[4] Since

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[4] Gopalan et al. (2021) hypothesize that a manager who voluntarily or involuntarily leaves a firm typically forfeits all unvested grants. As a result, they expect managers with a longer compensation duration are less likely to exit the firm

hedging smooths the cash flows and thereby reduces the probability of financial distress, CEOs with a long compensation duration are more likely to engage in hedging. Therefore, we expect that a longer compensation duration is positively related to the probability of hedging. Accordingly, our first hypothesis is stated as follows:

H1: The probability of hedging increases as the overall compensation duration increases.

The duration of various compensation components may have different effects on corporate policies. Among the cash-based compensation contracts, only the incentive cash payments have a vesting period. Moreover, almost all incentive cash payments are performance-based. Since the cash compensation duration is the value-weighted average of the vesting periods, duration increases as the size of the incentive payments or the length of the vesting periods increases. Bennett et al. (2017) state that if there is a jump in managerial pay for achieving a performance goal, managers may take actions with possible negative long-term consequences with the purpose of boosting the short-term performance. And if the kink is convex, it will incentivize the managers to take riskier projects. Since the expected payment for the performance vested cash compensation is convex with a lower boundary of zero, we expected that managers with a large cash grant and a long vesting period are more likely to adopt a riskier policy to increase the probability of meeting the performance goal than those with a small cash grant with a short vesting period (Li and Wang 2016).[5] Thus, we expect that the probability of hedging decreases as the cash compensation duration increases.

voluntarily.

[5] Bizjak et al. (2015) finds that firms are more likely to manage real earnings when the performance metric is based on earnings.

H2: The probability of hedging decreases as the cash compensation duration increases.

The impact of equity compensation duration on hedging can be driven by two possible channels. First, equity compensation can be designed to align the interests of the managers with those of the shareholders. With a larger deferred equity compensation, the wealth of less diversified managers is more tied to equity value and their incentives are more aligned with those of the equityholders. Previous literature suggests that the interest alignment from equity compensation incentivizes the managers to take more risk. Tufano (1996) suggests that the convexity in compensation packages affects corporate risk management policy. Rajgopal and Shevlin (2002) find that executive stock options provide managers with an incentive to invest in risky projects. Rogers (2002) suggests that CEO's stock and option holdings are negatively related to firm's derivative holdings. Smith and Stulz (1985), Guay (1999), and Supanvanij and Strauss (2006) argue that when management is compensated with options, the firm takes more risk and uses fewer derivatives to hedge. Note that the interests of executives with a large amount of stock and option grants are not necessarily highly aligned with shareholder interests if the stock and option grants have a short vesting period. Interest alignment should be strongest when managerial compensation contains a large amount of equity and option grants and a long vesting period. In addition, Cheng et al. (2020) suggest that managers tend to sell their company shares when they receive additional equity compensation to diversity their portfolio. However, managers' tendency to sell shares decreases when the vesting period is long. In other words, a longer vesting period may lead to a larger holding of equity by managers. Based on the above discussion, managers whose interests are strongly aligned with those of the equityholders are more likely to engage in risky projects.

Therefore, we expect that a longer equity duration is more likely to lead to better interest alignments between shareholders and managers, resulting in more risk-taking behaviors and therefore a lower tendency to hedge.

The second channel relates to managerial short-termism. In particular, a shorter equity duration which reflects managerial short-termism may motivate managers to focus on boosting short-run performance by engaging in risky projects as suggested by Gopalan, et al. (2014) and others. For example, Chi et al. (2019) document that managers with short-horizon compensations are more likely to engage in insider trading and earning management. Ladika and Sautner (2020) document that with a shorter option vesting period, managers exercise options earlier and profit from boosting short-term performance. Chi et al. (2020) and Bolton (2006) suggest that managers with short-horizon incentives are incentivized to undertake strategies to inflate the stock price in the short run. Therefore, managers with a shorter equity duration are less likely to hedge due to managerial short-termism. In other words, there is a positive relation between equity duration and hedging.

As the equity-based compensation duration reflects these two conflicting effects, the link between equity compensation duration and hedging should be examined empirically to see which effect is more dominant.

H3a: The probability of hedging decreases as the equity compensation duration increases if a larger amount or a longer vesting period of equity and option grants motivate managers to seek risky projects to maximize equity value.

H3b: The probability of hedging decreases as the equity compensation duration decreases if managers engage in riskier projects to boost the short-run performance.

Recent literature highlights the importance of inside debt in CEO compensation. Inside debt obligations are unsecured, unfunded, and payable at a future date. CEOs face asymmetric payoffs with respect to firm performance like outside creditors. Sundaram and Yermack (2007) is among the first group of studies to look at the impact of inside debt on firm policies. They document that when the CEO's personal debt-to-equity ratio exceeds the firm's external debt ratio, corporate executives manage the firm more conservatively to reduce the probability of default. However, there is considerable heterogeneity in the way inside debt is designed that will affect the interest alignments with outside creditors. For example, Anantharaman et al. (2013) pointed out that some firms allow CEOs to withdraw pension benefits before the standard retirement age. Moreover, deferred compensation can have a flexible withdrawal schedule and the deferred amount is determined voluntarily. These features of inside debt make it less debt-like. Nonetheless, several studies (e.g., Anantharaman et al., 2013) find significant evidence that inside debt aligns the interests of the managers with those of the creditors. For instance, Wei and Yermack (2011) find higher bond prices, lower equity prices, and lower price volatility of debt and equity for firms whose CEOs have a larger pension and other deferred compensation (ODC). Pham (2014) finds that inside debt is positively related to M&A bond returns and negatively related to stock returns. Inside debt duration is defined as the value-weighted average of ODC and pension. As the inside debt duration increases, managerial interests are more aligned with those of the creditors. Therefore, the fixed claimant explanation suggests that CEOs manage the firm more conservatively to focus on long-term payoffs and prevent a negative event such as default. Accordingly, we form the following hypothesis regarding the inside debt duration:

H4: The probability of hedging increases as the inside debt compensation duration increases.

3. Sample Construction and Summary Statistics

3.1 Data and sample

We first obtain information on executive pension and characteristics from EXECUCOMP from 2006 to 2015. The EXECUCOMP dataset starts from 2006, which is used as the start year for our sample. After merging the data with COMPUSTAT to obtain firm-level information, we keep observations with valid financial data and arrive at a sample of 10,525 firm-year observations. We identify whether a given firm is involved in hedging activities by examining its 10-K filings and proxy statements covered in the Securities and Exchange Commission's (SEC) EDGAR database. In particular, we perform a textual search for derivatives uses and then review the context in which the related keywords appear to confirm the use of derivatives for hedging.[6] When a company is found to hold a hedging position or disclose its adoption of hedging policy in a given year, the dummy variable of hedging will be assigned with the value of one and zero otherwise. A company that holds derivatives solely for the purpose of trading or speculating in a given year is not counted as a hedger.

To accurately measure the duration of executives' compensation, we utilize the information on executive grants from the ISS Incentive Lab to complement the data of executive pension plans

[6] The list of keywords for searching hedging policy is provided in Appendix B.

from EXECUCOMP.[7] We collect the vesting periods of deferred compensation for each CEO in the sample. Companies generally have more than one deferred compensation plans, which are categorized into cash-based plans and stock-based plans. Some companies set up a minimum number of years required for their deferred compensation. In addition, we use the keyword “deferred compensation” to perform a textual search in the EDGAR database to manually collect the vesting periods if this information is missing in the ISS incentive Lab. For a given CEO in a given year, we record the smallest of the minimum required deferred years among all plans as the vesting period of deferred compensation. After further excluding the financial and utility firms, we arrive at the final sample of 4,288 observations associated with 755 unique firms.

3.2 Summary statistics

Following the methodology introduced by Gopalan et al. (2014) and Li and Peng (2019), we measure the overall compensation duration as the weighted average of the vesting periods of the compensation components. Traditional value dimension measures such as delta and vega capture the sensitivities to price and volatility, but the duration measures the mix of short-term and long-term incentives in the compensation.

$$Overall\ Duration = Pay\ Duration_{Cash} + \ Pay\ Duration_{Equity} + \ Pay\ Duration_{Inside\ Debt}$$

$$Pay\ Duration_{Cash} = \frac{(Salary + Bonus) \times 0 + \sum_{i=1}^{n_c} Cash\ Payment_i \times t_i}{Total\ Dollar\ Amount\ of CEO\ Compenation}$$

[7] Unlike the EXECUCOMP database, The ISS Incentive Lab collects the detailed information of CEOs' equity- and non-equity-based grants in about 2,000 US public companies since 1998, including award types, grant dates, plan size, vesting schedule, and vesting periods (Li and Peng, 2019).

$$Pay\ Duration_{Equity} = \frac{\sum_{j=1}^{n_s} Restricted\ Stock_j \times t_j + \sum_{k=1}^{n_o} Option_k \times t_k}{Total\ Dollar\ Amount\ of CEO\ Compenation}$$

$$Pay\ Duration_{Inside\ Debt} = \frac{\sum_{k=1}^{n_o} Pension \times t_l + Deferred\ Compensation \times t_m}{Total\ Dollar\ Amount\ of CEO\ Compenation}$$

$$Total\ Dollar\ Amount\ of\ CEO\ Compensation = Salary + Bonus + \sum_{i=1}^{n_c} Cash\ Payment_i + \sum_{j=1}^{n_s} Restricted\ Stock_j + \sum_{k=1}^{n_o} Option_k + Pension + Deferred\ Compensation$$

where $Cash\ Payment_i$ is the value of i_{th} incentive cash payment. $Restricted\ Stock_j$ is the grant-date value of j_{th} outstanding stock-based plans with the vesting period of t_j.[8] $Option_k$ is the Black-Scholes value of k_{th} outstanding option-based plans with the vesting period of t_k. If the remaining vesting time is negative, then we set it as zero. In 2006, the SEC adopted new disclosure guidelines that require mandatory disclosure of the accumulated present value of pension benefits and the fiscal year-end balance of deferred compensation. $Pension$ and $Deferred\ Compensation$ are the present value of accumulated benefits of all pension plans and the total balance of deferred compensation. t_l is the time to retirement. Following the literature, we use the number of years to the age of 65 (t_l) as the vesting period of pension. t_m is the vesting period granted to deferred compensation.

[8] We assume that grant date fair values do not change over time for the holding period.

We further decompose the duration of total compensation into cash compensation duration, equity compensation duration, and inside debt compensation duration. We measure the cash compensation duration, equity compensation duration, and inside debt duration as follows:

$$\text{Cash Duration} = \frac{(Salary + Bonus) \times 0 + \sum_{i=1}^{n_c} cash\ payment_i \times t_i}{Salary + Bonus + \sum_{i=1}^{n_c} cash\ payment_i}$$

$$\text{Equity Duration} = \frac{\sum_{j=1}^{n_s} Restricted\ Stock_j \times t_j + \sum_{k=1}^{n_o} Option_k \times t_k}{\sum_{j=1}^{n_s} Restricted\ Stock_j + \sum_{k=1}^{n_o} Option_k}$$

$$\text{Inside debt Duration} = \frac{\sum_{k=1}^{n_o} Pension \times t_l + deferred\ compensation \times t_m}{Pension + deferred\ compensation}$$

Panel A of Table 1 presents the summary statistics of CEO compensation. Overall, inside-debt compensation and equity compensation are two primary compensation components of the CEOs in our sample. CEOs are also paid with cash, mainly in the form of salary. Nearly all incentive cash compensation is performance vested. CEO inside debt compensation including pension and deferred compensation account for approximately 42% of the total compensation, which indicates that inside debt compensation is a critical part of the CEO compensation package and should not be ignored if we want to explore the incentives generated by compensation contracts. Additionally, we observe that the majority of the equity compensation is time vested. This is consistent with the literature that firms tend to defer the payments of equity-like compensation instead of paying CEOs immediately (e.g., Erkens, 2011).

Panel B of Table 1 presents the summary statistics of compensation duration. In our sample, the average overall compensation duration is 29.38 months, and the median overall duration is 22.05 months. Note that we collect information on deferred compensation vesting periods from

ISS Incentive Lab and EDGAR. If the information on deferred compensation vesting periods in a given year cannot be obtained from either database, the mean of the available vesting periods in that year is used. For robustness, we construct an alternative measure of overall duration (*Overall Duration_alt*) by treating the deferred compensation as fully vested, i.e., the vesting period is zero. Among different components of compensation, the average duration of cash compensation in our sample is 3.02 months and the average duration of equity compensation is 16.55 months. As a stark contrast, the average value of inside debt duration is 60.40 months. The alternative measure of inside debt duration (*Inside debt duration_alt*) based on the assumption that the deferred compensation is fully vested also shows greater values than cash or equity duration. Therefore, one could underestimate the duration of the full compensation package if only equity compensation is considered. In Panel C of Table 1, we present the compensation durations by industry by using the 2-digit SIC codes. Interestingly, inside-debt duration shows more variability across industries compared to cash duration and equity duration. For example, those CEOs working in transportation or communication industries are granted the longest inside debt compensation, while their peers in the construction industry are paid with the shortest inside debt compensation. Such distinction may suggest the heterogeneity of risk incentives demanded by companies in different sectors.

Corporate hedging policy offers a direct look at firms' risk management activities. Panel A of Table 2 presents the hedging activities of firms in our sample. We find that 66% of firms in our sample are engaged in hedging activities. More firms (49%) are engaged in the foreign exchange hedge than interest rate hedge (36%) and commodity hedging (16%). This result is somewhat different from those reported in previous studies, which suggest that interest rate and foreign exchange hedges are around the same level. A possible explanation for this difference in findings is that we consider firms that hold short-term foreign exchange derivatives (e.g., 3-month currency forward) as hedging firms since the stack-and-roll strategy of these short-term contracts is a common practice in currency markets to avoid the counter-party risk (Adam and Fernando, 2006). Among all industries, the manufacturing industry has the highest percentage of overall hedging, and the lowest hedging percentage is found in the retail trade industry. The pattern suggests that hedging strategies vary significantly across industries. Panel B of Table 2 presents the mean values of major firm characteristics for hedgers and non-hedgers. We observe that the hedgers and non-hedgers exhibit significant differences in firm size (proxied by *Total assets*), *Firm age*, *Leverage*, *Altman_Z*, *MTB*, *Tangibility*, and *Quick ratio*. The detailed definitions of these firm characteristics and all other variables can be found in Appendix A.

3.3 Univariate analysis

To gain a general understanding of the different risk incentives created by the duration of CEOs' compensation, we conduct a univariate analysis to examine the use of hedging policy and firm characteristics by the median value of overall compensation duration. Table 3 reports the results of this univariate comparison. The above-median sample of overall compensation duration has 71 % of hedgers, which is 11% higher than the proportion of hedgers in the below-median sample. The percentages of interest rate hedgers, foreign exchange hedgers, and commodity hedgers in the above-median subsample are also significantly higher than those in the below-median sample. The differences in mean suggest a plausible, albeit preliminary, implication: Firms that design their compensation contracts with a longer duration are more likely to hedge. Several firm characteristics with a longer compensation duration exhibit noticeably differences compared to those of firms with a shorter compensation duration. Consistent with Gopalan et al. (2014), firms with a longer compensation duration are larger or older firms. Firms awarding pay contracts with a shorter duration have a higher Altman's Z score, which is consistent with the negative relation between pay duration and firm risk suggested by the current literature. Firms wither more tangible assets tend to offer a longer duration contract. This is in the line with Gopalan et al. (2014) who find that firms with more tangible assets prefer a longer-duration compensation due to matching the duration of incentives with that of the firms' investments. Table 4 presents the correlation matrix of the main variables of interest in our sample. The overall duration is positively correlated with equity duration and inside-debt duration. As we expected, overall duration is positively correlated with all types of hedging. Furthermore, different types of hedging are positively related to each other, which indicates that firms involved in one type of hedging are more likely to adopt other types of hedging activities. We also note that the equity compensation sensitivity measures, delta and vega, are not significantly correlated with our compensation duration measures with the correlation ranging from -0.04 to 0.13. This is consistent with the argument by Gopalan et al. (2014), Welker (2015), and Cheng et al. (2020) that duration captures the incremental or different aspects that are not reflected in delta and vega.

4. Empirical Analyses

4.1 Baseline model

The above univariate analysis and correlation matrix demonstrate a possible association between CEO pay duration and firms' hedging policy. However, the decision to hedge may be concurrently affected by other incentive drivers designed in compensation packages (e.g., Delta incentive, Vega incentive, and total inside debt), CEOs' personal characteristics (e.g., age, tenure, or gender), and other hedging rationales associated with firm characteristics. We address this possibility by employing multivariate regressions using the afore-mentioned drivers of hedging.

In addition, two macroeconomic controls including credit spread and term spread are used to control for the time-varying market risk. We use two dummies associated with the financial crisis and industry dummies are included to control for the potential influence of the financial crisis and the variation across industry groups. The baseline regression is structured as below:

$$\begin{aligned} Hedging = \alpha + \beta_1 \times Overall\ Duration + \beta_2 \times Delta + \beta_3 \times Vega \\ + \beta_4 \times Log\ (Total\ inside\ debt) + \beta_5 \times CEO\ Charictoristics \\ + \beta_6 \times Firm\ Controls + \beta_7 \times Macroeconomic\ Controls \\ + Crisis\ Dummy + Post\ crisis\ Dummy + Industry\ Dummies + \varepsilon \end{aligned}$$

Table 5 presents the summary statistics of variables used in the multivariate regressions. We find that on average 66% of the sample firms use financial derivatives to hedge. The percentage of hedgers in the sample is consistent with that found in Chen and King (2014). The average overall duration is 29.38 months, which is longer than the average duration (1.218 years) reported in Gopalan et al. (2014). This difference can be explained by the fact that our overall duration measure includes the inside debt compensation. As shown in Table 1, the duration of inside debt compensation plays a dominant role in the overall compensation duration.

We report the results of baseline regressions using the Probit model in Table 6. Across all models, we find a significantly positive relationship between the overall compensation duration and hedging. As the compensation duration increases, managers are more sensitive to the long-term incentives. Therefore, CEOs with a longer compensation duration are expected to manage firms more conservatively so that they can collect long-term payments. After controlling for other incentive factors, CEO personal characteristics, firm-specific variables, and macroeconomic and industry variables, we find in Model 1 that a one-year increase in the overall compensation duration results in a 6% increase in the probability of hedging for a typical firm with the mean value of the other independent variables.[9] This finding indicates that duration consisting of both the time and size dimensions of compensation has a significant impact on hedging decisions. In Models 2 and 3, we regress the hedging dummy on two measures of the overall compensation duration after controlling for other incentives and control variables. The results confirm that the positive relation is robust to the estimation method of the vesting period of deferred compensation and controls. The coefficients of *Delta* and *Vega* are consistent with the findings from prior studies. Greater Vega incentives introduce more convexity in compensation, which drives the managers to adopt riskier policies. Larger Delta incentives lead to greater sensitivity of managers' wealth to stock price changes and therefore a potential tendency of risk avoidance. We also find that firms with a female CEO are less likely to engage in hedging activities. Consistent with the literature, our results suggest that CEOs of larger or younger firms may be more concerned about their reputation and thus adopt a less risky firm policy (e.g., more hedging). Froot et al. (1993) theorize that hedging can curtail the underinvestment problem. We use the market-to-book ratio to measure growth opportunities and use the quick ratio to measure internal funds. Both market-to-book and quick ratios are negatively related to hedging, suggesting that the demand for hedging is reduced when a firm has more growth opportunities or greater internal funds. Non-debt tax shield has a negative impact on hedging, suggesting that firms with greater tax shields are less willing to hedge so the firms can enjoy the benefits of tax shields. The positive coefficient of the crisis dummy and the negative coefficient of the post-crisis dummy imply that firms facing high-level market risk

[9] Given the dependent variable of regressions is a dummy variable measuring the likelihood of hedging policy, we apply the PROBMIT model and calculate the incremental impact of independent variables by using exp (0.054) - 1 = 6%.

are expected to benefit more from hedging than those operating in a non-crisis environment. Taken together, the baseline model results are consistent with the literature in terms of well-documented rationales for hedging. We find evidence supporting our first hypothesis that the probability of hedging increases when the overall compensation duration increases.

To verify the possibility that firms may select a specific type of derivatives to hedge against a certain underlying risk, we examine the duration of overall compensation on three major types of hedging: interest rate derivatives, currency derivatives, and commodity derivatives. In Table 7, we report the results of regressing each of the three types of hedging on the overall duration. The results suggest that CEO compensation duration remains to exert a strongly positive impact on all three types of hedging.

4.2 Robustness tests to address endogeneity

In this section, we perform several robustness checks to alleviate the concerns for endogeneity. As in most business research, endogeneity may be a concern in this study. While, by and large, the relation between the design of compensation contracts and managerial risk attitude is well supported by theoretical work, it remains challenging to estimate the causal effect of the incentives generated by compensation duration on hedging behaviors as compensation contracts and the hedging decision can be determined by the unobservable firm and CEO characteristics. As the first approach to address this concern, we adopt a 2SLS/IV model by following Li and Peng (2019) to use the median value of CEO pay duration from non-industry-clustered firms within the same Metropolitan Statistical Areas (MSA) as the instrumental variable.[10] Francis et al. (2016)

[10] In the spirit of Li and Peng (2019) and Almazan et al. (2010), we first update the 2010 MSA code to the 2018 code and calculate the MSA area median. Then we exclude firm-years from the same industry cluster. The firm-year is defined as an industry cluster if there are 10 or more firms from the same 2-digit SIC within the same MSA area or the aggregate market value of firms in the same industry is larger than 3% of the total market value.

show that firms clustered around the same metropolitan area tend to share a similar design of CEO compensation. Since the local peers' compensation should not be theoretically related to the firm's hedging policy, this instrument should meet the exclusion restrictions. We also include two state policy variables by following Chen et al. (2015): The dummy variable of the implied contract equals one if the state has an implied contract exception, and the dummy variable of good faith equals one if the state has a good faith and fair dealing exception. Chen et al. (2015) argue that these state policy variables satisfy the dual criteria of the relevance of instrumental variables as the compensation protection state policy eases the short-term performance pressure and thereby diminishes the need for long-term contracts. Table 8 presents the results of the 2SLS/IV regressions. In the first stage results shown in Model 1, the instrumental variables of *Good faith* and *MSA_duration* are significantly related to the endogenous CEO overall duration, which confirms that the inclusion restriction of instruments is satisfied. Furthermore, both Cragg-Donald F-statistic and Kleibergen-Paap F-statistic are larger than the Stock-Yogo critical values at the 5% significance level, confirming that these instruments are relevant. The second stage results reported in Model 2 suggest that the overall duration has a significant and positive impact on hedging. To conclude, the positive relation between the overall duration and hedging is robust in the 2SLS/IV model when the instrumental variables are used to control for the potential endogeneity bias.

The main variable of interest, *Overall duration*, may be self-selected by certain factors (e.g., CEOs' personality traits or industry effects) that may also drive corporate hedging decisions. Consequently, the econometric assumption of random sampling is violated. In this case, the estimate of baseline models is subject to selection bias since CEOs gaining benefits from the selected design of compensation duration are more likely to hedge. To address this concern, we adopt the propensity score matching (PSM) approach to reduce the selection bias and eliminate the "curse of dimensionality" when multiple characteristics are required for matching (Bartram et al., 2011). Following Gopalan et al. (2014), we estimate the propensity score based on the firm characteristics including firm size, R&D, non-debt tax shield, firm risk (proxied by the Altman Z score), leverage, market-to-book, CAPX, ROA, and tangibility. We also include the industry fixed effect to ensure that the design of compensation duration is less contaminated by the endogenous factors. In our context, the propensity score is the probability that the CEO compensation duration is greater than the median value of the compensation duration of all sample firms conditioned on the determinants documented in the literature. As a result, the base sample is the firm-year observations from the above-median group of compensation duration in a given year. Each observation of the base sample is paired with its corresponding peer that has the closest propensity score (the "nearest neighborhood" matching) but from the below-median group of compensation duration in the same year. This one-to-one matching process gives us a sample of 3,732 observations. Models 3 and 4 of Table 8 present the results of regressions based on the PSM approach. Consistent with the results reported so far, both measures of the overall compensation duration have a positive and significant impact on hedging. The results confirm the robustness of our main findings in the baseline models, indicating that the significant relation between the compensation duration and the hedging decision is unlikely to be driven by the self-selection bias.

Although we argue that a longer compensation duration is likely to lead to more hedging, presumably, a firm with less risk tolerance may also tend to grant their executives pay contracts with a longer duration. Such reverse causality may cause a spurious correlation between the hedging decision and compensation duration. To address this concern, we perform a set of regressions using the simultaneous equations model (SEM) consisting of two equations: the Duration and Hedge equations. The Duration equation is similar to the model in Gopalan et al.

(2014) by including various CEO and firm characteristics. The Hedge equation is the same model used in the baseline model. The SEM results are reported in Table 9. We find that hedging has a positive and significant coefficient in the Duration equation and the overall duration has a positive coefficient in the Hedge equation. With this finding, we recognize that it is possible that a hedger is likely to design executives' pay contracts with a longer duration. More importantly, the SEM results confirm the significant positive impact of compensation duration on hedging after considering the possibility that the tendency of hedgers to adopt a longer duration in CEO pay contracts. Thus, our inferences from the baseline regressions remain robust to the concern of reverse causality.

4.3 Duration of different compensation components

So far, we have presented baseline and robustness test results suggesting a significant and positive relation between compensation duration and hedging. In this section, we explore Hypotheses 2-4 formulated in Section 2 to further investigate the relation between the duration of different compensation components and corporate hedging policy. In particular, we perform the hedging regressions for cash duration, equity duration, and inside debt duration, respectively. Model 1 of Table 10 presents the hedging regression with cash duration as the main explanatory variable. As discussed above, cash compensation duration increases as the size of incentive payment and/or the length of the vesting periods increase. Managers with a large or long-vesting period cash compensation tend to take riskier projects with the hope of meeting the performance goal than those with a small and short-vesting period cash gran. In other words, we expect that cash duration and hedging are negatively correlated, which is supported by the result in Model 1.

As discussed above in Hypothesis 3, we conjecture that the impact of equity compensation duration on hedging can be driven by two potential effects. On one hand, the interests of managers with a longer duration of equity grants are more aligned with those of the equity holders. Undiversified managers with equity grants of a long vesting period are motivated to take more risk to maximize the value of the equity. On the other hand, managers with a shorter equity duration may focus on boosting the short-run performance by engaging in risky projects. In Model 2, the coefficient of equity duration is negative and significant, which means that the incentive alignment effect is more dominant. Results in Models 3 and 4 show that inside-debt duration has a positive and significant impact on hedging. A longer duration of inside-debt results in a better interest alignment between managers and creditors and therefore stronger incentives for managers to manage the firm more conservatively to focus on long-term payoffs, as suggested by the fixed claimant explanation. These effects drive the manager to adopt a more conservative policy, reflecting a higher propensity for hedging.

To further test the interest alignment argument, we investigate whether the duration of time-vesting and performance-vesting compensation have different effects on hedging. When the compensation is performance vested, the vesting period is more complicated as it depends on multiple factors such as the state of the economy and firm performance. We proxy the vesting period of the performance vested compensation by assuming that managers will meet all performance goals. In Model 1 of Table 11, we find a significant and negative coefficient of performance cash duration, which supports the argument of the performance vesting mechanism for cash duration shown in Table 10. The results in Models 2 and 3 indicate that the interest alignment is also a dominant effect for the equity duration: Both time-vested and performance-vested equity duration have a significant and negative effect on hedging. The results shown in

Tables 10 and 11 provide strong support that the impact of compensation duration on hedging varies by compensation components. Overall, our results indicate that after controlling for other compensation incentives (i.e., Delta, Vega, and total inside debt), the positive impact of inside debt duration outweighs the negative impact of cash and equity duration, resulting in a positive impact of the overall duration on hedging. The implication is that the influence of compensation duration reflects the competing effects of incentive alignments generated through cash, equity, and inside debt duration.

4.4 Shareholder and debtholder control

Monitoring and control of claimholders like blockholders and creditors are additional mechanisms to align the interests of the managers with those of the claimholders. Large equity holdings and active monitoring of blockholders, which proxy for shareholder control, have been shown to influence corporate decisions to maximize shareholder interests by aligning managerial incentives with those of the equityholders.[11] Chung and Zhang (2011) show that corporate governance is positively related to institutional ownership across 5 different types of institutions. Based on a survey, McCahery et al. (2016) document that in general institutional ownership can be viewed as a mechanism of corporate governance and investors with a long-term horizon tend to be more intensively involved with corporate policies or major activities.[12] Greater institutional ownership may help align the interests of the managers with those of the shareholders, thereby encouraging managers to take more risks. Mishra (2011) finds that better monitoring through an

[11] Shleifer and Vishny (1986, 1989), Smith (1996), and Gillan and Starks (2000), McCahery et al. (2016).

[12] There are two other scenarios in which institutional ownership affects firm policy: passive monitoring and siding with managers to exploit minority shareholders. Admati et al. (1994) states that in the passive monitoring scenario, institutional investors have limited incentives to monitor because of free-rider problem. Institutional investors such as investment banks may side with manager to receive future banking businesses at expense of minority shareholders (Brickley et al., 1988).

ownership structure dominated by large blockholders leads to greater risk raking. John et al. (2008) and King and Wen (2011) document a positive relation between institutional ownership and risk-taking. Therefore, the link between equity compensation duration and hedging may be strengthened by shareholder control proxied by the level of blockholder ownership.

Similarly, the effect of inside debt duration as an incentive alignment between managers and debtholders may vary by the monitoring power of the creditors. The literature suggests that optimal executive compensation is designed to minimize the agency costs of the shareholder-management agency problem as well as the risk-shifting problem between shareholders and debtholders.[13] John et al. (2010) study the bank CEOs' compensation and provide evidence that the incentives in CEO compensation can be strengthened by outside monitoring intensity. CEOs who are paid with more equity-like compensation will be aligned more with shareholders to undertake excessive risk at the expense of debtholders. However, intensive debtholder monitoring could alleviate the risk-shifting problems by curbing the excessive risk-taking behaviors of managers. If debtholder control or monitoring can mitigate the risk-shifting problems, the need for debt-like compensation to encourage more conservative policies such as hedging to reduce the performance volatility may be lessened (Aggarwal and Samwick, 1999). In other words, the role of inside debt compensation duration in impacting managerial risk incentives can be partially substituted by strong creditor monitoring. As a result, we expect that the effect of inside debt duration as an incentive alignment between managers and debtholders may be substituted by the monitoring power of the creditors.

We investigate the relationship between compensation duration and hedging, conditioning on the strength of shareholder or debtholder control. We collect the total percentage of shares

[13] Jensen and Meckling (1976), Agrawal and Mandelker (1987), John and John (1993).

owned by the top five blockholders and define the dummy variable *Blockholder ownership* to equal one if the ownership of the top five blockholders is higher than the sample median and zero otherwise. Table 12 reports the regressions of hedging on duration measures interacted with *Blockholder ownership*. In Model 1, we find that the effect of the overall duration on hedging remains positive and significant as shown in the baseline results. The coefficient of the interacted term, *Overall duration×Blockholder ownership* is significantly negative (-0.053). This suggests that the impact of overall duration on hedging is reduced for firms with greater blockholder ownership. Models 2 and 3 results offer further implications when we examine equity and inside debt duration separately. First, equity duration continues to have a negative impact on hedging. Interestingly, the negative impact is more pronounced for firms with higher blockholder ownership as indicated by the negative and significant coefficient of the interaction term of *Equity duration×Blockholder ownership*. The finding supports our argument that the effect of equity duration on hedging reflects the interest alignment of managers and equityholder. When a firm is associated with stronger shareholder control proxied by the ownership of large blockholders, the incentive alignment between managers and shareholders is strengthened and consequently executives are motivated to take riskier projects to maximize shareholder value. This result is also consistent with Amihud and Lev (1981) who find that firms are less likely to engage in risk-reducing investments such as diversifying acquisitions when a large percentage of shares are owned by major blockholders. We find that the impact of inside debt duration is positive and significant, while the interaction term of *Inside debt duration×Blockholder ownership* is not significant. This finding indicates minimal effects of blockholder ownership on the link between CEO inside debt duration and hedging.

Existing literature documents that banks monitor the operations of companies to ensure the repayment of their debt. For debtholder control, we collect the percentage of private debt to total debt to measure the monitoring intensity of banks. *Private debt ratio* is a dummy variable that equals one if the private debt ratio of the firm is higher than the sample median and zero otherwise. Table 13 presents the regressions of hedging on various duration measures and the interaction terms of duration measures and private debt ratio. Model 1 result suggests that the positive effect of overall duration on hedging is reduced for firms with more private debt. In addition, Models 2 and 3 reveal that the private debt ratio impacts the relation between compensation duration and hedging only through the inside debt duration. Interestingly, the negative and significant coefficient of the interaction term *Inside debt duration*×*Private debt ratio* suggests that bank monitoring serves as a substitute for the interest alignment mechanism of inside debt duration. The result indicates that as the incentive alignment between managers and creditors is enforced by strong bank monitoring, the impact of inside debt duration on hedging is less pronounced for firms with a high private debt ratio. Following the same argument, the effect of inside debt duration on hedging should be more pronounced for firms with little bank monitoring (i.e., a low private debt ratio), where the need for incentive alignment is much greater.

5. Conclusion

This study examines the relation between CEO compensation duration and hedging policy. We construct an overall compensation duration measure using various compensation components including cash, equity-like, and debt-like compensations. We find that a longer overall compensation duration is associated with a higher likelihood of hedging. The effect is similar when we examine different types of hedging including interest rate, currency, and commodity hedges.

Our results remain robust after addressing the concern for the potential endogeneity of unobservable factors, selection bias, and reverse causality. Our findings provide strong evidence to support the impacts of the time dimension of compensation incentives on corporate hedging.

More interestingly, we find that cash duration or equity duration is negatively related to the probability of hedging, while inside debt duration has a positive effect on the tendency to hedge. The incentives for meeting performance targets in cash compensation and the interest alignment between managers and shareholders from a large and long-vesting period equity compensation led to greater risk-taking behaviors, whereas the long-term focus and fixed claimant feature in debt-like compensation result in more conservative policies. Consequently, we highlight the importance of recognizing the differing risk incentives generated by the duration of various components in executive compensation. Our findings present evidence on the trade-off between the negative effect of cash and equity duration and the positive effect of inside-debt duration on hedging.

We further explore whether the relation between compensation duration and hedging is contingent on the strength of shareholder or debtholder control. Our findings suggest that the negative relation between equity duration and hedging is more pronounced for firms with a larger blockholder ownership, implying that strong shareholder control strengthens the incentive alignment effect of compensation duration. We find that the positive relation between inside debt duration and hedging is lessened as debtholder monitoring power increases. This finding highlights that creditor monitoring may serve as a substitute for inside debt compensation duration in terms of alleviating managerial risk-taking behaviors.

Appendix A: Variable definition

Hedge	dummy variable equals one in a given year if a firm holds a hedging position or has a detailed description of their hedging policy for the given year, zero otherwise.
Interest rate hedge	dummy variable equals one in a given year if a firm holds an interest rate hedging position or has a detailed description of their hedging policy for the given year, zero otherwise.
Foreign FX hedge	dummy variable equals one in a given year if a firm holds a foreign exchange hedging position or has a detailed description of their hedging policy for the given year, zero otherwise.
Commodity hedge	dummy variable equals one in a given year if a firm holds a commodity hedging position or has a detailed description of their hedging policy for the given year, zero otherwise.
Compensation variables	
Overall duration	value-weighted average vesting periods of all compensation components assuming that the missing vesting period of deferred compensation is the average of all available vesting periods of deferred compensation.
Overall duration_alt	value-weighted average vesting periods of all compensation components assuming that the missing vesting period of deferred compensation is 0.
Cash duration	value-weighted average vesting periods of cash compensation components include salary and bonus.
Performance vested cash duration	value-weighted average vesting periods of cash compensations that are marked as performance vested in ISS.
Stock duration	value-weighted average vesting periods of stock compensations.
Option duration	value-weighted average vesting periods of option compensations.
Equity duration	value-weighted average vesting periods of stock and option compensations.
Performance vested equity duration	value-weighted average vesting periods of stock and option compensations that are marked as performance vested in ISS database.
Time vested equity duration	value-weighted average vesting periods of stock and option compensations that are marked as time vested in ISS database.
Inside debt duration	value-weighted average vesting periods of non-qualified deferred compensations and pensions assuming that the missing vesting period of deferred compensation is the average of all available vesting periods of deferred compensation.
Inside debt duration_alt	value-weighted average vesting periods of non-qualified deferred compensations and pensions assuming that the missing vesting period of deferred compensation is 0.

MSA_duration	the median CEO compensation duration from non-industry-clustered firms within the same Metropolitan Statistical Areas (MSA).
Delta	the sensitivity of grants value on change of stock value scaled by firm related wealth.
Vega	the sensitivity of grants value on change of stock standard deviation scaled by firm related wealth.
Log (Total inside debt)	Natural logarithm of total dollar amount of inside debt.
CEO characteristics	
CEO age	CEO age at the observation fiscal year.
Time to retirement	retirement age (65) – fiscal age.
CEO tenure	fiscal year – year become CEO.
Female CEO	Dummy variable equals to 1 if the CEO is female, zero otherwise.
Firm characteristics	
Log (Total assets)	Natural logarithm of total assets.
Firm age	year counts since the firm first appears in Compustat.
Leverage	(debt in current liability + total long - term debt)/total assets.
Altman_Z	1.2×(current assets - current liabilities)/total assets+1.4×(retained earnings/total assets) + 3.3×(pretax income/total assets) + 0.6×(stock price at the end of fiscal year×share outstanding/total liabilities) + 0.9×(sales/total assets).
MTB	(debt in current liability + total long - term debt + stock price at the end of fiscal year×share outstanding)/total assets.
Tangibility	net property, plant, and equipment/total assets.
R&D	R&D expenses/total assets.
CAPX	capital expenditures/total assets.
ROA	operating income before depreciation/total assets.
Quick ratio	(current asset – inventory)/current liability.
Non-debt tax shield	depreciation/total assets.

Private debt ratio	((Long term debt + Debt in current Liabilities) – (Notes + Subordinated Debt + Debentures + Commercial paper)) / (Total asset – Common Equity + Common Shares Outstanding × Close Price)
Blockholder ownership	Blockholder ownership is a dummy variable equaling one if the total percentage of shares owned by top-five institutional investors is greater than the sample median and zero otherwise.
Crisis dummy	Dummy variable equals one if the firm-year is from 2007 to 2009.
Post-crisis dummy	Dummy variable equals one if the firm-year is after 2008.

Appendix B. Keyword list

Interest rate hedging:

"interest rate swaption" or "interest rate futures" or "interest rate option" or "interest rate agreement" or"forward rate agreement" or "interest rate floor" or "basis swap" or "Interest rate derivative" or "Interest rate hedging" or "Interest rate swap" or "Interest rate contract" or "Interest rate cap" or "Interest rate collar" or "Interest rate protection" or "Interest rate lock" or "Interest rate forward" or "Hedge interest rate risk using derivative" or "Mitigate our interest rate risk" or "Mitigates its interest rate risk" or "Mitigate interest rate risk" or "Manage our interest rate risk" or "Manage its interest rate risk" or "Manage interest rate risk" or "Hedge interest rate risk" or "Hedge our interest rate risk" or "Hedge its interest rate risk"
and not "Does not use interest rate derivative" and not "Does not utilize interest rate derivative" and not "Did not have any interest rate swap" and not "No interest rate derivative" and not "No interest rate swap" and not "Did not have any interest rate derivative" and not "Did not have any interest rate contract" and not "Does not hedge its interest rate risk" and not "Does not utilize interest rate contract" and not "Does not use any derivative contracts to hedge its interest rate risk" and not "No material interest rate risk" and not "Does not use derivative financial instruments, such as interest rate swap" and not "No open interest rate derivatives" and not "Manages its interest rate risk exposure by maintaining a mix of" and not "Manages interest rate risk exposure by maintaining a mix of" and not "Interest rate hedging master agreement" and not "Means any interest rate swap" and not "Do not use interest rate derivative" and not "The company may enter into certain foreign currency and interest rate derivative" and not "The company may enter into interest rate derivative" and not "The company may enter into interest rate swap" and not "The company may also enter into certain foreign currency and interest rate derivative" and not "The company may also enter into interest rate derivative" and not "The company may also enter into interest rate swap" and not "No outstanding currency swap, interest rate derivative" and not "Liabilities under interest rate swap" and not "Changes in fair value of interest rate swap" and not "No interest rate contract" and not "Termination of interest rate swap"
and not "Termination of related interest swap" and not "Termination of an interest rate swap" and not "no open interest rate derivative" and not "it is not the company policy to enter into derivative financial instruments" and not "it is not the company's policy to enter into derivative financial instruments"

Foreign exchange hedging:

"currency derivative" or "currency futures" or "currency contract" or "exchange forward" or "exchange future" or "exchange swap" or "exchange option" or "exchange contract" or "forward exchange contract" or "exchange agreement" or "currency forward" or "currency option" or "currency rate hedge" or "foreign exchange forward" or "exchange rate contract" or "foreign exchange derivative" or "foreign exchange contract" or "foreign exchange rate contract" or "forward foreign exchange" or "exchange rate derivative" or "forward currency exchange contract" or "currency swap" or "cross-currency swap" or "foreign currency hedge contract" or "manage its currency risk" or "manage currency risk" or "manage our currency risk" or "manage its exchange rate risk" or "manage our exchange rate risk" or "manage exchange rate risk" or "hedges its exchange rate risk" or "hedge our exchange rate risk" or "hedge exchange rate risk" or "foreign currency exchange rates and utilize derivatives" or "forward contract"
and not "no currency forward" and not "no currency option" and not "no foreign exchange forward" and not "no exchange rate contract" and not "no foreign exchange derivative" and not "no foreign

exchange contract” and not “no foreign exchange rate contract” and not “no forward foreign exchange” and not “no exchange rate derivative” and not “no foreign currency exchange rate” and not “no currency swap” and not “no cross-currency swap” and not “no foreign currency hedge contract” and not “does not have any exchange rate derivative” and not “does not have currency forward” and not “does not manage our currency risk” and not “does not have any currency derivative” and not “does not have any outstanding foreign exchange derivative” and not “does not have any outstanding exchange rate contract” and not “does not have any outstanding foreign currency forward contract” and not “does not utilize currency derivative” and not “does not use currency derivative” and not “does not utilize foreign currency derivative” and not “does not utilize currency forward” and not “no material exchange rate risk” and not “but continues to monitor the effects of foreign currency exchange rate” and not “no outstanding commodity derivatives, currency swap” and not “no outstanding interest rate derivatives, currency swap” and not “no outstanding interest rate derivatives, foreign exchange contract” and not “not directly subject to foreign currency exchange rate fluctuations” and not “not subject to foreign currency exchange rate fluctuations” and not “do not engage in forward foreign exchange” and not “no foreign currency forward contract” and not “does not currently have any significant foreign currency exposure” and not “it is not the company policy to enter into derivative financial instruments” and not “it is not the company’s policy to enter into derivative financial instruments”

Commodity hedging:
“commodity futures” or “commodities future” or “commodity option” or “commodity derivative” or “commodity swap” or “commodity swaption” or “commodity agreement” or “derivative commodity instrument” or “manage commodity price risk” or “hedge commodity price” or “manage fuel price risk” or “hedge fuel price risk” or “natural gas option” or “natural gas swap” or “crude oil hedge” or “oil futures” or “oil contract” or “jet fuel forward” or “gold contract” or “commodity forward” or “manage exposure to fluctuation in commodity prices” or “manage exposure to fluctuations in commodity prices” or “manage exposure to changes in commodity prices” or “manage exposure to change in commodity prices” or “manage electricity cost” or “aluminum forward” or “natural gas forward” or “utilizes commodity futures and options” or “diesel fuel hedge contract” or “fuel hedge”
and not “no commodity futures” and not “no commodities future” and not “no commodity option” and not “no derivative commodity instrument” and not “does not hedge its commodity price risk” and not “do not use any commodity derivative” and not “does not have any commodity derivative outstanding” and not “does not have material commodity price risk” and not “no commodities future contract” and not “has not used derivative commodity instruments” and not “manages commodity price risk through negotiated supply contract” and not “manages commodity price risk through supply contract” and not “manages commodity price risks through negotiated supply contract” and not “manages commodity price risks through supply contract” and not “no outstanding commodity derivative” and not “does not use financial instruments to hedge commodity prices” and not “we do not hold or issue derivatives, derivative commodity instruments” and not “company has not entered into any transactions using derivative financial instruments or derivative commodity instruments” and not “does not use derivative commodity instrument” and not “we do not use a derivative or other financial instruments or derivative commodity instruments to hedge” and not “not utilize derivative financial instruments, derivative commodity instrument” and not “not utilize derivative commodity instrument” and not “it is not the company policy to

enter into derivative financial instruments" and not "it is not the company's policy to enter into derivative financial instruments"

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Table 1: Summary Statistics of CEO Compensation

This table presents descriptive statistics for the CEO compensation sample. The CEO compensation sample has 4,288 firm-year observations from 2006 to 2015. All compensation variables are defined in the Appendix and the unit is thousands of dollars. All continuous variables are winsorized at the 1% and 99% percentiles of their distributions.

Panel A CEO Compensation (thousand dollars)						
	N	Mean	Median	Std Dev	25%	75%
Cash compensation						
Salary	4,288	1005.98	968.68	454.32	767.69	1,155.00
Bonus	4,288	268.69	0.00	1,832.69	0.00	0.00
Performance vested cash	4,288	1,254.56	0.00	5,148.86	0.00	1,166.12
Time vested cash	4,288	7.82	0.00	227.04	0.00	0.00
Inside-debt compensation						
Pension	4,288	4,721.24	0.00	10,314.54	0.00	4,795.65
Deferred compensation	4,288	3,796.48	620.75	10,404.53	0.00	3,097.30
Equity compensation						
Option compensation	4,288	3,769.69	799.15	14,404.70	0.00	3,407.51
Stock compensation	4,288	5,365.87	2,088.09	10,440.85	0.00	6,375.12
Performance vested equity	4,288	2,807.60	0.00	6,543.35	0.00	2,999.98
Time vested equity	4,288	6,327.97	2,459.33	16,411.50	539.04	6,629.52
Panel B Compensation Duration (month)						
Overall duration	4,288	29.38	22.05	24.60	14.04	37.12
Overall duration_alt	4,288	24.79	16.52	25.11	8.87	31.91
Cash duration						
Cash duration	4,288	3.02	0.00	4.38	0.00	5.17
Performance vested cash duration	4,288	5.05	0.00	6.92	0.00	9.00
Equity duration						
Equity duration	4,288	16.55	16.49	11.42	9.11	23.75
Performance vested equity duration	4,288	9.89	0.00	13.02	0.00	20.32
Time vested equity duration	4,288	14.49	13.36	12.38	0.74	22.98
Inside-debt duration						
Inside debt duration	4,288	60.40	35.82	44.82	34.08	78.70
Inside debt duration_alt	4,288	43.35	23.42	53.45	0.00	71.07

Table 1: Summary Statistics of CEO Compensation (cont.)

Panel C Compensation duration by industry (months)

		Cash	Equity	Inside-debt	Overall
01 - 09	Agriculture, Forestry & Fishing	3.84	15.48	28.92	19.32
10 - 14	Mining	3.24	17.04	33.96	22.08
15 - 17	Construction	3.36	12.96	3.84	8.52
20 - 39	Manufacturing	2.88	16.32	38.40	27.36
40 - 49	Trans. & Comm.	2.90	17.52	59.81	29.18
50 - 51	Wholesale trade	3.96	17.16	39.36	31.20
52 - 59	Retail trade	3.48	17.64	16.80	18.84
70 - 89	Services	2.64	15.36	19.92	18.24
91 - 99	Public Administration	4.08	14.28	29.76	27.00

Table 2: Summary Statistics of Hedging Behavior

This table presents descriptive statistics for the sample firm-years. The CEO compensation sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All variables are winsorized at the 1% and 99% percentiles of their distributions. Panel B presents the average hedging ratio by industry. Panel C presents the firm characteristics by hedging.

Panel A Hedging by industry

		Hedge	Interest rate Hedge	Foreign FX Hedge	Commodity Hedge
01 - 09	Agriculture, Forestry & Fishing	0.62	0.54	0.54	0.54
10 - 14	Mining	0.63	0.38	0.23	0.46
15 - 17	Construction	0.70	0.30	0.47	0.20
20 - 39	Manufacturing	0.74	0.39	0.61	0.19
40 - 49	Trans. & Comm.	0.59	0.37	0.33	0.12
50 - 51	Wholesale trade	0.58	0.41	0.37	0.00
52 - 59	Retail trade	0.44	0.27	0.27	0.07
65 - 67	Real Estate and holdings	0.61	0.31	0.39	0.09
70 - 89	Services	0.57	0.31	0.42	0.00
91 - 99	Public Administration	0.60	0.47	0.60	0.33
	Full Sample	0.66	0.36	0.49	0.16

Panel B Firm characteristics	Hedger (Mean Value)	Non-Hedger (Mean Value)	Difference in Mean
Total assets ($Mil)	15093.52	12728.76	2364.76***
Firm age	34.39	30.74	3.66***
Leverage	0.24	0.21	0.03***
Altman_Z	4.25	5.53	-1.28***
MTB	1.64	1.98	-0.34***
Tangibility	0.24	0.28	-0.04***
R&D	0.03	0.03	0.00
CAPX	0.05	0.05	-0.01
ROA	0.15	0.16	-0.01
Quick ratio	1.57	1.91	-0.34***
Non-debt tax shield	0.04	0.04	0.00

Table 3: Hedging and CEO Compensation Duration

This table presents the mean value of hedging and firm characteristics by sample duration median. The difference in means is tested by the t-test with unequal variances. *, **, and *** denote significance at the 10, 5, and 1 percent levels, respectively. All variables are defined in the Appendix.

	Above median duration	Below median duration	Mean difference
Hedging variables			
Hedge	0.71	0.60	0.11***
Interest rate hedge	0.42	0.30	0.12***
Foreign FX hedge	0.55	0.44	0.11***
Commodity hedge	0.21	0.11	0.10***
CEO compensation			
Delta	1225.93	1935.71	-709.78
Vega	268.50	206.80	61.71***
Firm characteristics			
Total assets ($Mil)	19522.62	9046.37	10476.25***
Firm age	38.86	27.43	11.43***
Leverage	0.24	0.22	0.02***
Altman_Z	4.38	5.00	-0.62***
MTB	1.69	1.82	-0.13***
Tangibility	0.27	0.24	0.03***
R&D	0.02	0.04	-0.01
CAPX	0.05	0.05	0.00
ROA	0.16	0.15	0.01
Quick ratio	1.49	1.87	-0.38***
Non-debt Tax shield	0.04	0.04	0.00

Table 4: Correlation matrix

This table presents the correlation matrix of the main variables of interest in the sample. The CEO compensation sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All variables are winsorized at the 1% and 99% percentiles of their distributions. * denotes significance at the 1 percent level.

	Overall Duration	Cash duration	Equity duration	Inside-debt duration	Delta /Comp	Vega /Comp	Hedge	Interest rate hedge	Foreign EX hedge	Commodity hedge
Overall Duration	1.00									
Cash duration	0.00	1.00								
Equity duration	0.11*	0.04	1.00							
Inside-debt duration	0.73*	-0.01	0.00	1.00						
Delta	0.12*	-0.04	-0.07*	0.09*	1.00					
Vega	0.11*	-0.01	-0.05	0.13*	0.83*	1.00				
Hedge	0.15*	-0.05*	-0.03	0.07*	0.07*	0.04	1.00			
Interest rate hedge	0.15*	-0.02	-0.04*	0.09*	0.06*	0.04	0.55*	1.00		
Foreign FX hedge	0.08*	-0.02	-0.02	0.03	0.14*	0.09*	0.66*	0.17*	1.00	
Commodity hedge	0.20*	-0.03	0.02	0.05*	0.03	0.02	0.34*	0.20*	0.07*	1.00

Table 5: Summary Statistics of Variables

This table presents descriptive statistics for the sample firm-years. The CEO compensation sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All variables are winsorized at the 1% and 99% percentiles of their distributions.

Variable	N	Mean	Median	Std Dev	25%	75%
Hedge	4,288	0.66	1.00	0.47	0.00	1.00
Interest rate hedge	4,288	0.36	0.00	0.48	0.00	1.00
Foreign FX hedge	4,288	0.49	0.00	0.50	0.00	1.00
Commodity hedge	4,288	0.16	0.00	0.36	0.00	0.00
Overall duration	4,288	29.38	22.05	24.60	14.04	37.12
Cash duration	4,288	3.02	0.00	4.38	0.00	5.17
Equity duration	4,288	16.55	16.49	11.42	9.11	23.75
Inside debt duration	4,288	60.40	35.82	44.82	34.08	78.70
Delta	4,288	1580.82	382.37	13949.11	155.19	882.30
Vega	4,288	237.65	127.47	409.28	34.44	292.22
Log (Total inside debt)	4,288	6.21	7.76	3.89	0	9.19
CEO age	4,288	56.24	56.00	6.42	52.00	60.00
CEO tenure	4,288	6.81	5.00	6.53	2.00	9.00
Female CEO	4,288	0.03	0.00	0.18	0.00	0.00
Total assets ($Mil)	4,288	14284.49	4822.37	31548.18	2148.62	12168.41
Firm age	4,288	33.14	29.00	18.14	17.00	49.50
Leverage	4,288	0.23	0.22	0.15	0.12	0.32
Altman_Z	4,288	4.69	3.81	3.90	2.69	5.54
MTB	4,288	1.75	1.47	1.15	1.01	2.11
Tangibility	4,288	0.26	0.18	0.22	0.10	0.35
R&D	4,288	0.03	0.01	0.05	0.00	0.04
CAPX	4,288	0.05	0.03	0.05	0.02	0.06
ROA	4,288	0.15	0.15	0.08	0.11	0.19
Quick ratio	4,288	1.68	1.31	1.52	0.93	1.93
Non-debt tax shield	4,288	0.04	0.04	0.02	0.03	0.05

Table 6: Impact of Compensation Duration on Hedging

This table presents the baseline Probit regression results. Dependent variable Hedge equals one in a given year if a firm holds a hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. The CEO compensation sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Overall Duration	0.028***	0.014*	
	(4.076)	(1.953)	
Overall Duration_alt			0.012*
			(1.848)
Delta/Comp		11.373**	11.429**
		(2.364)	(2.377)
Vega/Comp		-6.163***	-6.188***
		(-2.895)	(-2.908)
Log (Total inside debt)		0.004	0.005
		(0.988)	(1.396)
Log (CEO age)		-0.126	-0.134
		(-1.203)	(-1.288)
Log (CEO tenure)		-0.012	-0.011
		(-0.990)	(-0.973)
Female CEO		-0.115**	-0.115**
		(-2.188)	(-2.192)
Log (Total assets)		0.044***	0.043***
		(3.799)	(3.768)
Log (Firm age)		-0.044**	-0.043**
		(-2.121)	(-2.086)
Leverage		0.061	0.060
		(0.731)	(0.711)
Altman_Z		-0.004	-0.004
		(-0.744)	(-0.742)
MTB		-0.050***	-0.049***
		(-3.360)	(-3.348)
Tangibility		-0.148	-0.147
		(-1.351)	(-1.342)
R&D		0.215	0.217
		(0.649)	(0.656)
CAPX		0.335	0.337
		(0.976)	(0.986)

Table 6: Impact of Compensation Duration on Hedging (cont.)

	(1)	(2)	(3)
ROA		0.311**	0.313**
		(2.395)	(2.414)
Quick ratio		-0.024**	-0.024**
		(-2.467)	(-2.468)
Non-debt tax shield		-1.742***	-1.748***
		(-2.731)	(-2.733)
Credit spread		-0.140***	-0.140***
		(-6.532)	(-6.529)
Term spread		0.096***	0.096***
		(10.521)	(10.487)
Crisis dummy		0.096***	0.097***
		(4.880)	(4.912)
Post-crisis dummy		-0.167***	-0.169***
		(-6.418)	(-6.464)
Industry Fixed effect	YES	YES	YES
Number of observations	4,288	4,288	4,288
Pseudo R-squared	0.085	0.148	0.147

Table 7: Impact of Compensation Duration on Different Types of Hedging

This table presents the different hedging Probit regression results. Interest rate hedge equals one in a given year if a firm holds an interest rate hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. Foreign EX hedge equals one in a given year if a firm holds a foreign exchange hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. Commodity hedge equals one in a given year if a firm holds a commodity hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. The sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Interest rate hedge	Foreign EX hedge	Commodity hedge
Overall duration	0.015**	0.013*	0.010*
	(2.208)	(1.850)	(1.919)
Delta	5.001	7.911	8.738*
	(0.994)	(1.531)	(1.759)
Vega	-3.591	-2.902	-3.270
	(-1.625)	(-1.268)	(-1.454)
Log (Total inside debt)	0.003	0.008*	0.009*
	(0.638)	(1.883)	(1.917)
Log (CEO age)	-0.024	-0.046	0.110
	(-0.204)	(-0.373)	(0.910)
Log (CEO tenure)	-0.015	-0.014	-0.018
	(-1.170)	(-1.111)	(-1.553)
Female CEO	-0.027	-0.099	-0.018
	(-0.440)	(-1.620)	(-0.348)
Log (Total assets)	0.024*	0.071***	0.014
	(1.852)	(5.463)	(1.100)
Log (Firm age)	-0.028	-0.044*	-0.033*
	(-1.329)	(-1.930)	(-1.861)
Leverage	0.542***	-0.385***	-0.142
	(5.799)	(-3.628)	(-1.367)
Altman_Z	-0.008	-0.006	-0.004
	(-1.401)	(-1.163)	(-0.589)
MTB	-0.021	-0.026	-0.019
	(-1.201)	(-1.609)	(-0.902)
Tangibility	-0.002	-0.364***	0.269**
	(-0.017)	(-2.794)	(2.279)
R&D	-0.434	0.227	-1.838***
	(-1.081)	(0.612)	(-3.351)
CAPX	-0.278	0.122	0.395
	(-0.788)	(0.315)	(1.443)

Table 7: Impact of Compensation Duration on Different Types of Hedging (cont.)

	Interest rate hedge	Foreign EX hedge	Commodity hedge
ROA	0.408***	0.216	0.292**
	(2.699)	(1.392)	(2.278)
Quick ratio	-0.029**	-0.016	-0.058***
	(-2.099)	(-1.527)	(-3.231)
Non-debt tax shield	-1.374*	-0.607	-0.347
	(-1.825)	(-0.813)	(-0.517)
Credit spread	-0.040*	-0.110***	-0.041**
	(-1.759)	(-5.047)	(-2.184)
Term spread	0.043***	0.080***	0.036***
	(4.436)	(8.591)	(4.626)
Crisis dummy	0.084***	0.062***	0.016
	(4.191)	(3.197)	(0.836)
Post-crisis dummy	-0.123***	-0.118***	0.005
	0.408***	(-4.682)	(0.222)
Industry Fixed effect	YES	YES	YES
Number of observations	4,288	4,288	4,288
Pseudo R-squared	0.118	0.177	0.312

Table 8: 2SLS Regressions and Propensity Score Matching

This table presents the 2SLS regression and propensity score matching results. The second stage is Probit regression. The second stage dependent variable Hedge equals one in a given year if a firm holds a hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. Column (3) to (5) present the baseline Probit regressions by matching the firm-years that are above the median of that year. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. *T*-statistics and Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	2SLS		PSM	
	(1) First Stage	(2) Second Stage	(3)	(4)
MSA_duration	0.707***			
	(12.39)			
Implied contract	0.075			
	(0.35)			
Good faith	-0.053***			
	(-2.82)			
Overall duration		0.015***	0.014*	
		(1.73)	(1.823)	
Overall duration_alt				0.014*
				(1.912)
Delta	54.147**	14.206***	16.511***	16.067***
	(2.01)	(2.23)	(2.862)	(3.062)
Vega	-13.507	-7.370***	-8.002***	-8.556***
	(-1.19)	(-2.56)	(-3.162)	(-3.119)
CEO Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Crisis & Post-crisis	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Number of observations	4,188	4,188	3,732	3,732
Cragg-Donald Wald F		239.29		
Kleibergen-Paap Wald F		62.25		

Note: Stock-Yogo critical value at 5% is 16.85

Table 9: Impact of Compensation Duration on Hedging: Simultaneous Equations Model

This table presents the results of the simultaneous equation system. The sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)		(2)	
	Duration	Hedge	Duration_ alt	Hedge
Hedge	4.424***		4.357***	
	(4.62)		(6.23)	
Overall duration		0.097***		0.147***
		(10.28)		(13.34)
Delta		8.034***		10.553***
		(3.65)		(4.73)
Vega		-4.753***		-4.387***
		(-4.23)		(-4.13)
CEO Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Crisis & Post-crisis dummies	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Number of observations	4,288	4,288	4,288	4,288

Table 10: Components of Compensation Duration on Hedging

This table presents the different duration component Probit regression results. Dependent variable Hedge equals one in a given year if a firm holds a hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. The sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Cash duration	-0.081***			
	(-3.133)			
Equity duration		-0.017**		
		(-1.982)		
Inside debt duration			0.007*	
			(1.828)	
Inside debt duration_alt				0.006*
				(1.885)
Delta	10.936**	10.911**	10.052**	9.954**
	(2.232)	(2.247)	(2.114)	(2.100)
Vega	-6.020***	-6.003***	-6.296***	-6.272***
	(-2.800)	(-2.789)	(-2.932)	(-2.934)
CEO Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Crisis & Post-crisis dummies	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Number of observations	4,288	4,288	4,288	4,288
Pseudo R-squared	0.150	0.147	0.162	0.162

Table 11: Duration of Time-vested and Performance-vested Compensation on Hedging

This table presents the Probit regression results of time vested and performance vested compensation duration on hedging. Dependent variable Hedge equals one in a given year if a firm holds a hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. The sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Performance cash duration	-0.037**		
	(-2.485)		
Time equity duration		-0.018**	
		(-2.263)	
Performance equity duration			-0.015*
			(-1.802)
Delta	11.163**	10.925**	10.967**
	(2.286)	(2.245)	(2.251)
Vega	-6.083***	-5.914***	-6.113***
	(-2.835)	(-2.748)	(-2.841)
CEO Controls	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes
Crisis & Post-crisis dummies	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
Number of observations	4,288	4,288	4,288
Pseudo R-squared	0.148	0.148	0.147

Table 12: The Impact of Compensation Duration Interacted with Shareholder Control

This table presents the Probit regression results of duration, hedging, and blockholder ownership. Dependent variable Hedge equals one in a given year if a firm holds a hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. The sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Overall duration	0.023**		
	(2.476)		
Overall duration×Blockholder ownership	-0.015*		
	(-1.806)		
Equity duration		-0.013*	
		(-1.801)	
Equity duration×Blockholder ownership		-0.007*	
		(-1.715)	
Inside debt duration			0.013**
			(2.484)
Inside debt duration×Blockholder ownership			-0.008
			(-1.545)
Blockholder ownership	-0.091***	-0.112***	-0.109***
	(-3.236)	(-3.893)	(-3.381)
Delta	10.969**	10.615**	9.209*
	(2.274)	(2.188)	(1.935)
Vega	-5.784***	-5.654***	-5.894***
	(-2.694)	(-2.607)	(-2.735)
CEO Controls	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes
Crisis & Post-crisis dummies	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
Number of observations	4,288	4,288	4,288
Pseudo R-squared	0.164	0.161	0.184

Table 13. The Impact of Compensation Duration Interacted with Debtholder Control

This table presents the Probit regression results of duration, hedging, and private debt ratio. Dependent variable Hedge equals one in a given year if a firm holds a hedging position or has a detailed description of their hedging policy for the given year, zero otherwise. The sample has 4,288 firm-year observations from 2006 to 2015. All variables are defined in the Appendix. All models include industry fixed effects based on the first two digits of SIC code. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Overall duration	0.013***		
	(3.235)		
Overall duration×Private debt ratio	-0.007**		
	(-2.745)		
Equity duration		-0.008	
		(-1.285)	
Equity duration×Private debt ratio		-0.003	
		(-0.623)	
Inside debt duration			0.022**
			(2.637)
Inside debt duration×Private debt ratio			-0.002**
			(-2.216)
Private debt ratio	0.086**	1.108**	1.115**
	(2.236)	(2.672)	(2.727)
Delta	14.314***	15.314***	15.203***
	(2.734)	(2.733)	(2.156)
Vega	-7.015***	-7.209***	-7.013***
	(-3.015)	(-3.616)	(-2.961)
CEO Controls	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes
Crisis & Post-crisis dummies	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
Number of observations	4,288	4,288	4,288
Pseudo R-squared	0.167	0.163	0.165

CHAPTER 2: PUTABLE BONDS, RISK SHIFTING PROBLEMS, AND INFORMATION ASYMMETRY

1. Introduction

Over the past several decades, bondholders experience turbulent credit markets driven by corporate events, unfavorable economic conditions, and the financial meltdown. As a result, bondholders are keenly aware of the severity of credit risk, interest rate, and financial crisis and demand protection against these risks. Credit risk refers to the risk associated with a significant decline in the bond's rating, deterioration in firm performance, and corporate events such as leveraged buyouts (LBOs) and mergers and acquisitions (M&As). The severe impacts on bondholders due to the credit and liquidity crunch in the financial crisis signify how important protection is against such catastrophic events. Putable bonds give bondholders a right to redeem the bond at a pre-determined put price, and therefore can help protect against these risks. Putable bonds have been issued in the corporate debt market since the 1960s. Given the long history of putable bond issues, it is surprising that there has been relatively limited literature on these securities. Current literature on putable bonds mainly focuses on the special kind of putable bonds, i.e., bonds with poison puts or event risk covenants with protection against certain corporate events (see Bae and Klein (1997), Bae, Klein, and Padmaraj (1994), Bae, Klein, and Padmaraj (1997), Cook and Easterwood (1994), Crabbe (1991), Roth and McDonald (1999), Torabzadeh and Roufagalas, and Woodruff (2000)). Chatfield and Moyer (1986) are one of the first empirical studies on putable bonds that are not associated with event triggers. They examine 90 putable bonds issued between 1974 and 1984 and show that the inclusion of a put provision reduces the investor-required yields by 89 basis points. Crabbe and Nikoulis (1997) provide an overall look at the structure, past performance, and trading strategies associated with these securities. David (2001) develops a theoretical model to price the strategic value of putable securities in liquidity crises. Elkamhi, Ericsson, and Wang (2008) document that the values of the embedded put options are related to default probability, term structure, and illiquidity risk. Koziol (2010) develops a model to analyze how firm value increases when a put feature in debt contracts rather than renegotiation is used.

Another line of literature examines putable convertibles, which are convertible securities that contain a put option. For example, Chemmanur and Simonyan (2010) study issuers' rationale for issuing putable convertible bonds relative to regular convertibles. They find support for the asymmetric information and tax savings hypotheses, but not for the risk-shifting hypothesis. Other studies examine callable and putable bonds with various focuses. Kalotay and Abreao (1999) explore the intermarket arbitrage and other strategies using putable, callable, and reset bonds. Tewari and Ramanlal (2010) find firms issuing callable-putable bonds underperform the market, and the presence of put option provides protection to the bondholders and helps improve equity returns. They suggest that put option can mitigate agency problems between shareholders and bondholders.

As discussed above, there have been very few studies on putable bonds that are nonconvertible, noncallable, and not tied to specific event triggers. These securities are unique as they are a straightforward combination of a straight debt component and a European (or Bermudian) put option. In this study, we use a comprehensive sample of putable bonds in the U.S. corporate debt from 1976 to 2019 to empirically examine the following research questions. We first document the issuance activities and bond structure across industry groups and over the past four decades. Second, we explore the main motives of firms to issue bonds with an embedded put.

Based on prior literature, we propose that risk-shifting problems and information asymmetry are the main explanations for the issuance of putable bonds. Using several proxies for the risk-shifting incentives, we examine if an issuer's decision to include a put option in a bond contract is explained by the agency problem of risk-shifting. We further explore whether the impact of the risk-shifting incentives on the issuance of a putable bond is more pronounced for firms with a higher likelihood of financial distress or greater financial constraints as these firms are expected to face more severe risk-shifting problems. Firms with a high level of information asymmetry may have limited access to the public debt market may need to include a putable option in their bond contracts to attract investors and increase the chance of a successful issuance. We use various proxies for firm opaqueness to test whether an issuer's decision to issue putable bonds can be explained by information asymmetry.

We find that putable bonds have been issued since the 1970s, with the 1990s being the most active period of issuances. Among industry groups, industrial firms account for 55% of the putable bond issues, while financial and utility firms account for 30% and 15%, respectively. These bonds generally have a smaller offer size, a longer year to maturity, and a smaller number of covenants than straight debt issues. These statistics vary across industry groups and over time periods. In addition, putable issuers have a smaller firm size, lower leverage, higher asset volatility, higher R&D ratio, and lower profitability than straight debt issuers. We use Probit and Logit regressions to examine issuers' motives to issue putable bonds. We find evidence that is consistent with the risk-shifting and information asymmetry explanations. In particular, issuers with a high market-to-book ratio or WW index are more likely to issue putables. Cash holdings have a negative impact on the likelihood of issuing putables. In addition, we find that the effect of risk-shifting on putable issuance is stronger for firms with a greater likelihood of financial distress. We further test the information asymmetry argument of putable issuance. We find that a higher level of information asymmetry motivates firms to include a putable option in their bond contracts to attract investors. In particular, firms with less analyst coverage, greater forecast dispersion, or a larger average forecast error are more likely to issue a putable bond. Our findings support that information asymmetry serves as an important factor for firms' decisions to issue putable bonds.

Finally, we use the 2-equation and 3-equation simultaneous systems to examine the issuers' decisions on putable, covenants, and leverage. By considering the simultaneity of these components, we explore the relation and interactions among putable, leverage, and covenants. The simultaneous system results confirm the risk-shifting and information asymmetry explanations for the issuance of putable bonds.

This study fills the important gap in the literature by providing a comprehensive examination of the regular putable bonds and contributes to the literature in the following ways. First, based on a comprehensive sample of putable bonds in terms of sample size and time period compared to prior studies, we find interesting cross-sectional variation in issuers and time series trend in issuance behavior over the last four decades. Specifically, the issuance of putable bonds varies significantly across industries and is more often adopted by smaller and less profitable firms with a riskier investment portfolio. The time series impacts of the systematic factors on the firm's decision to issue a putable bond are soundly supported by our findings. Second, we provide empirical results on the unique set of factors that motivate the probability of including a put option. The results are consistent with the risk-shifting and information asymmetry explanations. Third, in addition to the univariate and multivariate regressions, we use multiple-equation simultaneous systems to explore the corporate decisions on putable bond issuance, including covenants, and leverage.

The rest of the paper is structured as follows. Section 2 presents the literature review and hypothesis development. Section 3 describes the data sample and presents the descriptive statistics. In Section 4, we present the multivariate tests for the issuers' motives to issue putable bonds. Section 5 reports the simultaneous equation regression results. Section 6 concludes.

2. Literature Review and Hypothesis Development

2.1 Literature Review

Many bonds issued in the market have embedded option features such as callable, convertible, extendable, puttable, and other covenants. Previous literature on these options and covenants sheds light on the theoretical explanations and empirical analysis of corporate bonds. For example, Gompers and Lerner (1996) document that the cost of contracting and supply and demand conditions are important in determining the number and the type of covenants in venture capital partnership contracts. Smith and Warner (1979) provide a comprehensive study of the covenant structure. They examine ways in which debt contracts are written to control the agency conflicts between bondholders and stockholders. Chava, Kumar, and Warga (2009) document that managerial entrenchment and the risk of managerial fraud significantly influence the use of covenants. Cook, Fu, and Tang (2014) argue that firm liquidity has a negative impact on the inclusion of all categories and sub-categories of restrictive bond covenants. Zhang and Zhou (2018) document a significant positive relation between institutional block ownership and the number of bond covenants. Similar to Zhang and Zhou (2018)'s finding, Ma, Stice, and Williams (2019) document that bonds with cross-monitoring of banks include more covenants. It is consistent with the argument that bondholders want to protect themselves from private lenders. Mansi, Qi, and Wald (2021) find that default-related covenants are associated with higher bankruptcy risk and higher spreads which help explain the relation between covenant use and the cost of debt documented in prior literature.

Among these bond covenants, the put option gives bondholders a right to redeem the bond at a pre-determined price. Even though putable bonds have been in the corporate bond market for over half a century, there have been a limited number of studies examining putable debt. On the pricing of put options, Driessen (2005) provides an empirical decomposition of the default, liquidity, and tax factors that determine expected corporate bond returns. Lim, Li, and Linetsky (2012) provides an efficient method to evaluate callable and putable bonds. Elkamhi, Ericsson, and Wang (2011) develop a model to disentangle the reduction in yield spread of putable bonds due to default risk and interest rate risk. Goldberg, Ronn, and Xu (2021) use the one-factor LogNormal interest-rate model to calibrate the implied volatilities and value the callable and putable bonds. David (2001) suggests that putable securities have a strategic value larger than the intrinsic value because the holders have a claim on the firm's liquid assets and may threaten to force solvent issuers to bear the costs of financial distress. This strategic value depends on the issuer's size, potential distress costs, and the distribution of put ownership relative to the firm's liquidity position. He shows that the strategic value is an important determinant of the payouts received by bondholders in the case of liquidity crises.

Instead of the regular putable bond, most of the studies on putable bonds focus on bonds with a poison put, which is a special type of bond designed to guard the bondholders against event risk. Event risk refers to the risk associated with events such as a significant decline in the bond's rating, deterioration in firm performance, leveraged buyouts (LBOs), and mergers and acquisitions (M&As). Poison put gives bondholders a right to redeem a bond contingent upon pre-specified triggers. One of the reasons why firms issue poison puts is the reduction in borrowing costs. Crabbe

(1991) studies the investment-grade industrial bonds issued between November 1988 and December 1989. He shows that the holders of the investment-grade industrial bonds experience sizable losses after these bonds are downgraded to speculative grades due to leveraged restructuring. Importantly, he finds that the bonds containing event risk covenants help lower the financing costs by roughly 20 to 30 basis points. He notes that this cost reduction effect seems to have declined along with the general decline in corporate restructuring activities. On the other hand, Fields, Kidwell, and Klein (1994) analyze the yield effects of poison puts versus coupon reset options in debt contracts. They find that the protection from poison put covenants is not valued by investors whereas coupon reset provisions reduce the yield spread of newly issued industrial bonds by 32 basis points. Torabzadeh, Roufagalas, and Woodruff (2000) show that a poison put provision lowers the yield by 58 to 78 basis points. However, the conversion of a simple poison put to a super poison put does not reduce the yield further.

Bae, Klein, and Padmaraj (1994) show that the higher abnormal returns associated with the issuance of poison put bonds are due to the higher level of agency cost of debt for these issuers. They propose that not all firms benefit from issuing the poison put bonds. Firms with greater agency costs of debt and a smaller size benefit most from this type of debt issuance. In a follow-up study, Bae, Klein, and Padmaraj (1997) examine the relation between firm characteristics and the likelihood of event risk covenants in bond indentures. They suggest that the likelihood of event risk covenants in bond indentures is related to the agency costs of debt and the potential for takeover. However, their results do not support the financial distress costs hypothesis. Cheng and King (2009) find that poor bond market performance and favorable equity market performance motivate the issuances of poison put debt. Roth and McDonald (1999) find that firms with higher free cash flows are more likely to issue debt containing poison puts. They also find support for a negative relation between the management ownership and the probability of issuing debt with event risk covenants.

Another special type of putable bond that has been examined in the literature is the putable convertible bond. Putable convertible bonds allow bondholders to sell the bonds back to the issuer at a prespecified price on prespecified dates and allow the bondholders to convert their bond to common stock. The putable convertibles become popular in the 1990s since they provide bondholders the option to enjoy not only the upside potential of stock price appreciation but also the downside protection associated with the put option. Chemmaur and Simonyan (2010) document that putable convertible issuers are larger and less risky firms with higher cash flows, smaller growth opportunities, and lower bankruptcy risk compared to those issuing convertible bonds without a put. Their results support the view that firms issue putable convertible bonds due to asymmetric information and tax savings.

To sum up, the scope of prior studies on putable bonds is mostly focused on the special types of putable bonds, namely, the poison put and putable convertible bonds. Research on the regular putable issues is rather limited. The literature on poison put bonds provides some support for the agency and information asymmetry theory, while the studies on putable convertible bonds indicate that information asymmetry and tax considerations are the main drivers. It is important to explore whether any of the aforementioned motives for issuing poison put and putable convertible bonds applies to bonds with a simple put option. In this paper, we study a large sample of regular putable bonds issued by U.S. corporations to explore the determinants of the issuance of putable bonds.

2.2 Hypothesis Development

2.2.1 Agency problem hypothesis

In the setting of incomplete contracting and financial distress, equity holders have the incentives to engage in risk-shifting activities (Jensen and Meckling, 1976). Literature has shown that bond covenants are a possible solution to the risk-shifting problem. For example, Green (1984) shows that convertible bonds can mitigate the loss in value associated with the risk-shifting or underinvestment problem. Tewari and Ramanlala (2010) suggest that putable bonds can also reduce these incentive distortions as putable bonds give bondholders a right to exercise the put option during the life of the bond, allowing bondholders to redeem their bonds at par if they expect a value loss due to interest rate and/or credit risk. The downside protection for putable bondholders usually leads to a lower yield on these bonds. In other words, firms incur a lower borrowing cost when issuing a putable bond (Chatfield and Moyer,1986). In addition, putable bonds help reduce the value loss associated with the overinvestment or risk-shifting problems, especially for firms that are close to financial distress. Koziol (2010) suggests that firm value is higher when a put feature is included in the debt contracts than when a renegotiation is used at the time of distress. To reduce the agency cost of debt, firms with greater risk-shifting problems have stronger incentives to issue a putable bond. As the incentives to engage in risk-shifting behavior increase in the probability of financial distress, we expect the impact of risk-shifting incentives on the likelihood of issuing a putable bond is stronger for firms that are closer to financial distress. Based on the above discussion, we form the following two testable hypotheses:

Hypothesis 1: Firms with more severe risk-shifting problems are more likely to issue a putable bond.

Hypothesis 2: Risk-shifting incentives have a stronger impact on the likelihood of issuing a putable bond for firms with a higher probability of financial distress.

2.2.2 Information asymmetry hypothesis

Literature suggests a strong link between information asymmetry and the cost of debt capital. Sengupta (1995) uses corporate disclosure quality as the measure of information asymmetry and investigates its impact on the cost of debt. He finds that firms with high disclosure quality ratings enjoy a lower interest cost of issuing debt. Yu (2005) focuses on the credit spreads and finds that firms with higher disclosure ratings have lower credit spreads. Mansi, Maxwell, and Miller (2005) suggest that analyst activity reduces bond yield spreads. Khalil, Mansi, Mazboudi, and Zhang (2019) report that bondholders react negatively to a late filing announcement. Goswami, Noe, and Rebello (1995) provide the optimal design of debt maturity, coupon payments, and dividend payout restrictions under asymmetric information. They find that if the information asymmetry is concentrated around near-term cash flows with refinancing risk, issuers prefer long-term debt with no dividend restriction. Duffie and Lando (2001) and Cetin, Jarrow, Protter, and Yildirim (2004) also provide theoretical support that increasing information risk and worsening information asymmetry lead to higher credit spreads. In practice, it is difficult for bond investors to observe a firm's assets directly. With imperfect information, the credit spread of a bond increases with the level of information asymmetry, indicating that bondholders demand a higher yield due to asymmetric information. From the perspectives of corporate issuers, there are two main motivations for them to consider putable bonds when external debt financing is needed. First, opaque firms would be required by the market participants to pay a premium to compensate for the high level of information asymmetry. One possible way to alleviate the high borrowing cost is to issue a putable bond. Second, firms with severe information asymmetry problems, in general, have limited access or face significant challenges in raising capital from the public bond markets due to their opacity. To increase the likelihood of successful bond issuance, these firms choose to issue bonds with a put option to attract bondholders to consider investing in their bonds. Based on the above discussion on the link between information asymmetry and putable bond issuance, we form the following testable hypothesis:

Hypothesis 3: Firms with a higher level of information asymmetry are more likely to issue a putable bond.

3. Putable Bond Sample and Descriptive Statistics

3.1 Putable Bond Sample

In this study, we obtain the sample of bonds from the Fixed Income Securities Database (FISD). FISD is the most comprehensive and publicly available collection of bond data on publicly offered U.S. Treasury, agency, and corporate bonds. FISD reports detailed information on debt issue characteristics, documents over 50 different types of covenants, and includes over 150,000 public issues from 1894 to 2019. From FISD, we collect a sample of putable bonds that contains all U.S. domestic non-convertible, non-callable corporate bonds with at least one year to maturity and an issue date between January 1976 and December 2019, resulting in a sample of 2,874 regular putable bonds. Note that these putable bonds do not contain a poison put covenant and are straight debt with a simple put option embedded. Using the same sample period, we construct a control sample for the purpose of a direct comparison to the putable bond sample. The control sample contains 490,072 straight debt issues that are non-convertible, non-callable, and non-putable (poison or regular put). We exclude money market instruments such as commercial papers. For both the putable and straight debt samples, we collect information on the issue and issuer, including offering yield and price, coupon, maturity, credit rating, put price schedule (if putable), industry codes, and covenant information.[14] The sample collection process yields a sample of 624 regular putable bonds and 16,059 straight bonds.

Table 1 presents the descriptive statistics of the putable debt characteristics. We show the main characteristics including offering amount, original maturity, coupon, years to next put price, put price, offering yield, Treasury spread, and the number of covenants. We follow Billett, King, and Mauer (2007) to categorize the covenants into 15 categories.[15] Panel A shows the results for the full sample of 624 putable issues. We find that putable bonds on average have an issue size of $149.65 million, an original maturity of 19.77 years, and a coupon rate of 6.66%. It is interesting to note that the time to the first put price has an average of 8.46 years. In addition, the put price is par value for most of the bonds. The offering yield is consistent with the coupon rate, indicating that the bonds are generally issued close to par. Putable bonds have a relatively small number of covenants with an average number of covenants of 1.19. Out of 15 covenant categories, putable securities have a maximum of 5 covenants and a minimum of 0 covenant. Panel B presents the sample the descriptive statistics for the investment grade and speculative grade bonds, respectively. Consistent with our expectation, coupon and offering yield are higher for speculative than for investment grade bonds. Investment grade bonds are generally larger in issue size than speculative bonds. We do not find a significant difference in put price or the number of covenants between these two groups.[16] Maturity is similar between the two groups as well, averaging around 20 years.

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[14] We use information from the Moody's Annual Bond Record to fill in any missing put prices and dates. In addition, we use Datastream, SDC, and Bloomberg to fill in missing offering price and coupon rate.

[15] See Billett, King, and Mauer (2007) for the methodology.

[16] Treasury spread is significantly lower for speculative grade debt because many of these issues are issued in the late 1970s and the 1980s, during which the spreads are low. In addition, note that Treasury spread does not consider the coupon rates

Lastly, we examine the putable bond sample by industry and present the results in Panel C. We note a few interesting observations. Of the three industry groups, industrial bonds represent the largest group, accounting for 54.97% (=343/624) of the sample. Financial and utility bonds account for 30.29% (=189/624) and 14.74% (=92/624) of the sample, respectively. In terms of the offering amount, industrial bonds have the largest offering size while utility bonds have the smallest size. Financial bonds have the shortest maturity and time to first put. Industrial bonds have the greatest number of covenants while utility bonds have the smallest number of covenants.

3.2 Issuer and Bond Characteristics: Putable and Straight Debt Sample

For the sample of putable and straight debt issues, we obtain financial information from Compustat, and equity returns from CRSP. Data on analyst forecast is collected from I/B/E/S and information on institutional ownership is obtained from Thomson 13F. By requiring the putable and straight debt issues to have valid Compustat, CRSP, I/B/E/S, and Thomson 13F data, we arrive at 239 regular putable issues and 2,242 straight debt issues in our final sample. Table 2 presents the firm characteristics of putable issuers and straight debt issuers. All variables are measured at the fiscal year end prior to the debt issuance, except otherwise indicated.

The market to book ratio is the ratio of the market value of the firm to total assets, where the market value of the firm equals the sum of total assets and the market value of equity minus the book value of equity. The market value of equity is the product of the number of shares outstanding and the price per share. We follow Whited and Wu (2006) to calculate the WW index. WW index is the measure of financial constraints that is measured as the projection of the shadow price of raising equity capital onto the following variables: cash flow to asset, a dummy capturing

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on the putable and Treasury securities.

whether the firm pays a dividend, long-term debt to total assets, size, sales growth, and industry sales growth. Total assets are presented in millions of dollars, and we use the natural log of sales and total assets in the multivariate regressions reported in later sections. Leverage is long-term debt plus debt in current liabilities divided by the market value of the firm, shown in percent. Asset volatility is equity volatility multiplied by (1 - leverage) where equity volatility is the standard deviation of equity returns over the 24-month period prior to debt issuance. Asset volatility is presented in percent. We also examine several firm policy variables including Research and Development (R&D), fixed assets, free cash flow, cash holdings, and profitability. R&D is R&D expense divided by total assets and shown in percent. Fixed assets are net Property, Plant, and Equipment (PP&E) over total assets in percent. Free cash flow is defined as [Operating Income Before Depreciation - Total Income Tax + (Deferred Taxes and Investment Tax Credit - Lagged Deferred Taxes and Investment Tax Credit) - Interest Expense - Common Dividends - Preferred Dividends]/Total Assets. Cash is cash and cash equivalents divided by total assets. Both free cash flow and cash are shown in percent. Profitability is Operating Income Before Depreciation over Sales presented in percent.

For measures of information asymmetry, we first use analysis coverage which is the number of analysts that follow the firm for that year. Forecast dispersion is the standard deviation of the forecast EPS. The average forecast error is the average of the difference between announced EPS and forecast EPS. For bond characteristics, the offering amount is presented in $ million, offering yield is shown in percent, and investment grade dummy equals 1 if the bond is investment grade and 0 otherwise.

Generally, putable debt issuers and straight debt issuers are similar in firm size and leverage. We find that the market to book ratio of putable issuers is 1.48, which is higher than 1.32 of the straight debt issuers. More strikingly, putable issuers have a higher WW Index than straight debt issuers. Importantly, putable issuers have higher asset volatility but lower fixed assets ratio, profitability, and cash ratio than straight debt ones. These characteristics suggest that putable issuers are likely firms exhibiting greater risk-shifting tendency as reflected in its growth and volatility measures. In addition, these issuers have less profitable and maintain a lower cash ratio, indicating a potentially greater need for external financing compared to straight debt issuers.

Consistent with the information asymmetry argument, the average ratio of R&D expense of putable issuers is much higher than straight debt issuers. Moreover, the level of information asymmetry is higher for putable issuers based on analysis coverage, forecast dispersion, and average forecast error. For bond characteristics, putable bonds are smaller in size with an average offering amount of $137.33 million, compared to an average of $267.03 million in the straight debt sample. The average maturity of 19.77 years for putable bonds is almost double that for straight debt issues (10.96 years). As the put option gives bondholders solid protection against interest and credit risk, the need for additional restrictive covenants is likely to be less compared to straight debt. As a result, it is not surprising to observe that putable bonds have fewer number of covenants compared to straight bonds. The offering yield and percentage of investment grade bonds do not differ significantly between the two groups. Table 3 presents the Pearson correlation of the firm characteristics using the full sample consisting of the putable and straight debt samples.

4. Multivariate Tests: Issuers' Motives to Issue Putable Bonds

In this section, we study the issuers' motives to issue putable bonds using multivariate regression models. In particular, we use the sample of putable, and straight bonds described in Table 2 to examine the risk-shifting and information asymmetry hypothesis for the inclusion of a put option in corporate bonds. Using the Probit and Logit models,[17] we run regressions in which the dependent variable is the putable dummy variable that equals 1 if the bond is a putable bond and 0 otherwise. In addition, we adopt various measures for the risk-shifting incentives and information asymmetry as main explanatory variables to examine issuers' motivation to issue putable bonds. We also include a set of firm and bond control variables suggested by the theoretical and empirical literature on bonds with embedded options.

4.1 Risk Shifting Hypothesis

We use two measures to the potential for risk-shifting problems. The first measure is the market to book ratio, which is the proxy for the risk-shifting incentives following Mclaughlin, Safieddine, and Vasudevan (1998). Firms with a higher market to book ratio are likely to have more growth opportunities, resulting in a greater propensity for risk-shifting behaviors. We expect a positive relation between the market to book ratio and the likelihood of issuing putable bonds. In addition, we follow Whited and Wu (2006) to use the WW index to proxy for the risk-shifting incentives. They consider that risk shifting behavior is more likely to happen for financially constrained firms. Compared to the text-based index from Hadlock and Pierce (2010) and Kaplan and Zingales (1997), Whited and Wu (2006) follow a different approach to develop the WW Index based on the coefficients obtained from a structural model containing various firm characteristics. Farre-Mensa and Ljungqvist (2012) examine different measures of risk-shifting tendency and find that the WW Index performs somewhat better than the KZ and HP Index. We expect a positive relation between the WW index and the likelihood to issue a putable bond.

[17] We also consider other models such as the Cox Proportional Hazzard model, the Heckman model, and the multi-layer perception classifier based on the machine learning approach for a class or dummy dependent variable. However, none of them are suitable for our analysis.

Table 4 reports the results for the Probit and Logit regressions. Models 1 and 2 show the Probit regression results with marginal effects, models 3 and 4 present Logit regression results. Several important results emerge. We find that market to book ratio has a positive effect on the likelihood of issuing a putable bond. The coefficient on market to book ratio is positive in both models 1 and 3, which is significant at the 5% level. This is consistent with the notion that firms with higher risk-shifting incentives are more likely to issue putable bonds. In model 2 and 4, we also find a positive relation between the WW index and putable issuance. Firms with a higher WW Index are more financially constrained and are likely to have more severe risk-shifting problems. The results are consistent with our first hypothesis that the agency problem of risk-shifting serves as a main driver for putable issuance. Furthermore, we find strong evidence to support a substitution effect between covenants and puts. The number of covenants has a negative impact on putable issuance. We also find results to suggest a strong negative relation between cash holdings and putable bond issuance which indicates that firms with higher liquidity are less likely to issue putable bonds.

4.2 Risk Shifting Incentives and Financial Distress

As the incentives to engage in risk-shifting behavior increase in the probability of financial distress, we expect the impact of risk-shifting incentives on putable bond issuance is more prominent for firms that are closer to financial distress. To test this hypothesis, we rerun the regressions for various sets of subgroups based on the level of financial distress. We adopt five proxies for financial distress: leverage, Z-score, distance to default, secured debt, and regulated industry. For the continuous measures of financial distress including leverage, Z-score, and distance to default, the sample is divided into quartiles. The Z-score is defined as 1.2 × (current assets - current liabilities)/total assets + 1.4 × (retained earnings/total assets) + 3.3 × (pretax income/total assets) + 0.6 × (stock price at the end of fiscal year × share outstanding/total liabilities) + 0.9 × (sales/total assets). We follow Bharath and Shumway (2008) to define the distance to default (DD) as $DD=[\ln[(E+F)/F] + r - 0.5\sigma 2]/\sigma$. For the dichotomous variables including the secured debt and regulated industry dummy variables, the sample is divided into two groups: one group in which the dummy variable equals 1 and the other group where the dummy variable equals 0. The variable secured debt equals 1 if the firm holds secured debt for the given year and 0 otherwise. The regulated industry dummy variable equals 1 if the firm belongs to public utilities (SIC code 49), airlines and railroads (SIC codes 40–47), and financial institutions (SIC codes 60–69). Table 5 presents the regressions based on the continuous measures of financial distress for the top and bottom quartile groups, respectively. Panel A presents the Probit regressions of the putable dummy variable on risk-shifting measures and control variables for the top and bottom leverage groups. In the top quartile group, the results suggest that the WW Index has a significant impact on putable issuance. However, for the lowest quartile group, neither the market to book ratio nor the WW Index shows a strong impact on the likelihood of issuing a putable bond. Panel B shows results using Z-score as a measure for financial distress. Note that a lower Z-score indicates a higher financial distress level. Consistent with our prediction, the WW index has a significant impact on putable issuance in the bottom quartile group with the highest level of financial distress. The sample is divided based on the distance to default in Panel C. A shorter distance to default indicates a higher probability of financial distress. The WW Index continues to show a significantly positive impact on putable issuance in the bottom quartile group with the highest default probability. In Table 6, the sample is separated based on the dichotomous variables of secured debt and regulated industry. Smith and Warner (1979) argue that secured debt limits the ability to engage in asset substitution, thus alleviating the risk-shifting problems. Therefore, risk shifting incentives should have a stronger effect on putable issuance for firms without secured debt. Our result in Panel A of Table 6 is consistent with our expectation. In the subgroup without secured debt, both risk shifting measures have a significant and positive impact on putable issuance. We also divide the sample into two groups based on whether firms are in the regulated industry. Following Hermalin and Weisbach (1988), we define public utilities (SIC code of 49), airlines and railroads (SIC code of 40–47), and financial institutions (SIC code of 60–69) as regulated industries. Dasgupta and Nanda (1993) and Spiegel and Spulber (1994) suggest that regulated firms tend to have a higher leverage ratio and need frequent access to the public debt markets. As a result, these issuers are monitored regularly by the credit markets and are more sensitive to default risk. Therefore, for regulated firms, risk shifting incentives should have a stronger effect on putable issuance. The results in Panel B of Table 6 confirm our expectation: both market to book ratio and WW index have a significant positive impact on the likelihood of issuing a putable bond for the regulated firms but not for the non-regulated firms. To sum up, we find strong evidence to support that the impact of risk shifting incentives on putable issuance is more pronounced for firms with a higher level of financial distress.

4.3 Information Asymmetry Hypothesis

Another important factor that affects the decision of issuing putable bonds is information asymmetry. As the borrowing cost increases with the level of information asymmetry, bondholders require a higher return because of the imperfect information. Therefore, firms with a higher level of information asymmetry are likely to issue a putable bond to reduce the borrowing cost. Moreover, issuers with less information exposure would need to provide a valuable covenant to attract bondholder attention and increase the probability of a successful issue. A put option that provides bondholders valuable downside protection against credit and interest rate risk is a suitable solution. Based on these arguments, we hypothesis that firms with a higher level of information asymmetry are more likely to issue putable bonds. Table 7 reports the Probit and Logit regressions of putable dummy variable on various measures of information asymmetry and control variables. In particular, we use three proxies for information asymmetry: analyst coverage, forecast dispersion, and average forecast error. Models 1 to 3 present the results of the Probit model while models 4 to 6 show the results of the Logit model. We find that firms with lower analyst coverage, greater forecast dispersion, or higher forecast error are more likely to issue putable bonds to alleviate borrowing costs and attract investors. In other words, firms with a higher level of information asymmetry have a greater propensity to issue a putable bond. Our findings suggest that information asymmetry is an important motive for corporate issuers to consider the issuance of a putable bond.

To examine the risk shifting and information asymmetry hypotheses together, we include the measures for risk-shifting incentives and information asymmetry in the regressions and present the results in Table 8. Panel A presents the Probit regression results with marginal effects.The results suggest significant impacts of risk-shifting measures and information asymmetry proxies on the probability of putable issuance. Our findings indicate strong empirical support that risk shifting and information asymmetry are the main motivations for why firms issue putable bonds. In Panel B shows the Tobit regression results for the putable sample when the dependent variable is log (offering amount). The results suggest that within the putable issues, information asymmetry plays a more important role in determining the offering amount.

5. Simultaneous Equation Model Analysis

5.1 Simultaneous Equation Model: The Two-Equation System

We conjecture that the decisions on various components in the debt contracts are made simultaneously. We first consider that the decision on the number and types of restrictive covenants and whether to include a put option are determined at the same time. We use a two-equation system to consider these two decisions simultaneously. In this system, the choice of covenants is reflected in one equation and the decision to include an embedded put is in the other equation. Table 9 reports the results for the two-equation system. We focus on the putable equation for the implications of results. We find that risk-shifting incentives measured by the market to book ratio have a positive impact on putable issuance, which is consistent with the single equation results shown in the Probit and Logit regressions. The positive and significant coefficient of average forecast error is also consistent with our previous findings. Lastly, we find that cash is negatively related to putable issuance and the number of covenants. Firms with high cash holdings are likely to have great liquidity and ample internal funds, indicating less need for stringent covenants or a put option to reduce the agency cost of debt. In the second system, we consider the decision on leverage in one equation and the decision on putable in the other equation. We follow Billett, King, and Mauer (2007) to select the appropriate explanatory variables for the covenants and leverage equations. Similarly, we focus on the putable equation for the interpretation of results. The results associated with the system of leverage and putable equations provide further confirmation for the risk-shifting and information asymmetry explanations. Interestingly, we find that larger or more profitable firms are more likely to issue putable bonds.

5.2 Simultaneous Equation Model: The Three-Equation System

To follow the methodologies used in recent empirical studies on leverage, covenants, and debt maturity, we expand the two-equation simultaneous system to the three-equation system that consists of three capital structure decisions: covenant, putable, and leverage. In this system, we assume corporations make decisions on leverage ratio and the components within their debt contracts (i.e., covenants and embedded options) simultaneously. Table 10 presents the results for the three-equation system. First, the results for the covenant and leverage equations are generally consistent with findings in prior literature. We focus our interpretation of the results associated with the putable equation. In particular, we find that market to book ratio has a positive impact on putable issuance, which is consistent with the risk-shifting explanation. Average forecast error has a significantly positive impact on putable issuance, which is consistent with the information asymmetry hypothesis. For robustness checks, we use an alternative measure of risk-shifting incentives (the WW Index) and the other information asymmetry measures (analyst coverage and forecast dispersion) in the system and find consistent results.

6. Conclusion

Using a comprehensive sample of putable and straight debt issues from 1976 to 2019, we empirically examine issuers' motivation to issue putable bonds. We examine factors associated with the agency problem of risk-shifting and information asymmetry explanations. We focus on the regular putable bonds that are not tied to specific event risks, non-convertible, and non-callable. These unique securities have received little attention in the literature. We find evidence that is consistent with the risk-shifting and information asymmetry explanations for putable issuance. Further, we find that the impact of risk-shifting incentives is more pronounced for firms with a higher level of financial distress. We find strong empirical support that firms with greater information asymmetry are more inclined to issue putable bonds.

Our findings imply that the put option is an effective contracting term that can help protect the bondholders and reduce borrowing costs for the issuers. Finally, we consider the simultaneity of the decisions on putable, covenants, and leverage by employing the two-equation and three-equation simultaneous systems to examine the relation and interaction among agency problems, information asymmetry, and putable issuance.

Appendix: Variable Definition

Firm Characteristics	
Market to Book Ratio	The ratio of the market value of the firm to total assets, where the market value of the firm equals the sum of total assets and market value of equity minus the book value of equity. The market value of equity is the product of the number of shares outstanding and price per share.
WW Index	following Whited and Wu (2006) and Hennessy and Whited (2007) as −0.091[(ib + dp)/at] − 0.062(indicator set to one if dvc + dvp is positive, and zero otherwise) + 0.021(dltt/at) − 0.044[log(at)] + 0.102(average industry sales growth, estimated separately for each three-digit SIC industry and each year) − 0.035(sales growth),
Total Assets ($M)	Total assets.
Total Asset Growth	The percentage of growth in total assets from year -1 to 0, where year 0 is the year in which debt is issued.
Leverage (%)	Long term debt plus debt in current liabilities divided by book value of firm, shown in percent.
Asset Volatility (%)	The equity volatility multiplied by (1 - leverage), presented in percent.
R&D (%)	R&D expense divided by total assets and shown in percent.
Fixed Assets (%)	Net total Property, Plant and Equipment (PP&E) over total assets in percent.
Free Cash Flow (%)	Defined as [Operating Income Before Depreciation - Total Income Tax + (Deferred Taxes and Investment Tax Credit - Lagged Deferred Taxes and Investment Tax Credit) - Interest Expense - Common Dividends - Preferred Dividends]/Total Assets.
Cash (%)	Cash and cash equivalents divided by total assets.
Profitability (%)	Operating Income Before Depreciation over Sales
Z-score	1.2 × (current assets - current liabilities)/total assets + 1.4 × (retained earnings/total assets) + 3.3 × (pretax income/total assets) + 0.6 × (stock price at the end of fiscal year × share outstanding/total liabilities) + 0.9 × (sales/total assets)
Distance to Default	Following Bharath and Shumway (2008), distance to default (DD) over the next year is defined as DD=[ln[(E+F)/F]+r−0.5σ2]/σ, where E equals CRSP items |prc| × shrout /103, F equals Compustat items dlc + 0.5dltt, r is the firm's annual stock return computed by cumulating monthly returns (CRSP item ret) over the previous 12 months, and σ2 captures the volatility of the firm's total value (debt and equity). σ is approximated as (E/(E+F)) ×σE+(F/(E+F)) ×(0.05+0.25σE).

Appendix (continued)

Secured Debt	Dummy that equals one if the firm hold secured debt for the given year and 0 otherwise.
Regulated industry	Following Hermalin and Weisbach (1988), the dummy that equals 1 if the firm belongs to public utilities (SIC code 49), airlines and railroads (SIC codes 40–47), and financial institutions (SIC codes 60–69).
Analysis Coverage	The number of analysts that have issued a forecast for the current fiscal year, in the last month of that fiscal year.
Forecast Dispersion	The standard deviation of the EPS forecast.
Average Forecast Error	The average difference between actual EPS and forecast EPS.
Interest Rate Controls	
Interest Rate Level	1-year Treasury Constant Maturity Rate.
Interest Rate Slop	The difference between the 10-year Treasury Constant Maturity Rate and the 1-year Constant Maturity Rate.
Interest Rate Volatility	The standard deviation of the 10-year Treasury Constant Maturity Rate over the 12-month period prior to the issue date.
Bond Characteristics	
Putable	Dummy that equals one if the bond is a putable bond and zero otherwise.
Years to Maturity	Years to the date that the issue's principal is due for repayment.
Number of Covenants	Following Billett, King, and Mauer (2007) to categorize covenants into 15 major categories. The number of covenants is the count of covenant categories that range from 0 to 15.
Offering Yield (%)	Yield to maturity at the time of issuance, based on the coupon and any discount or premium to par value at the time of sale.
Investment Grade	The dummy variable equals 1 if the bond is rated above Baa at issuance.
Offering Amount ($M)	The par value of debt initially issued.
Coupon (%)	The current applicable annual interest rate that the bond's issuer is obligated to pay the bondholders.
Years to Next Put	Years to the next date upon which a bondholder can put back his bond.
Next Put Price (% of Par)	The price the issuer will pay the bondholder who exercises the put option on the next put date as the percent of the par value.

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Table 1 Putable Bonds

The table describes simple statistics for 624 putable bonds issued from 1976 to 2019. Descriptive statistics of offering amount in $ million, original maturity in years, coupon rate in percent, years to first put price, the first put price in percent of par value, offering yield in percent, spread above comparable Treasury in basis points, and the number of covenants. We follow Billett, King, and Mauer (2007) to categorize covenants into 15 major categories. All variables are winsorized at the 5% and 95% percentiles of their distributions.

Panel A. Full Sample (n = 624)

Variable	Mean	Median	Std. Dev.	Min	Max
Offering Amount ($M)	149.65	100.00	133.86	10.00	500.00
Years to Maturity	19.77	16.00	12.13	3.00	40.00
Coupon (%)	6.66	7.00	2.86	0.00	11.75
Years to Next Put	8.46	7.00	5.78	2.00	22.00
Next Put Price (% of Par)	99.99	100.00	0.06	99.75	100.00
Yield (%)	7.17	7.08	2.24	2.17	11.87
Treasury Spread (basis points)	28.26	11.50	136.57	-334.81	361.00
Number of Covenants	1.19	0.00	1.80	0.00	5.00

Panel B. By Credit Rating

	Investment Grade (n = 232)					Speculative Grade (n = 392)				
Variable	Mean	Median	Std. Dev.	Min	Max	Mean	Median	Std. Dev.	Min	Max
Offering Amount ($M)	170.89	112.50	150.68	10.00	500.00	137.07	100.00	121.28	10.00	500.00
Years to Maturity	19.81	20.00	12.05	3.00	40.00	19.74	15.00	12.19	3.00	40.00
Coupon (%)	6.50	6.96	2.63	0.00	11.75	6.76	7.00	2.99	0.00	11.75
Years to Next Put	8.63	7.00	6.03	2.00	22.00	8.36	7.00	5.62	2.00	22.00
Next Put Price (% of Par)	99.99	100.00	0.05	99.75	100.00	99.98	100.00	0.06	99.75	100.00
Yield (%)	6.93	6.99	1.94	2.17	11.87	7.31	7.21	2.39	2.17	11.87
Treasury Spread (basis points)	39.36	28.50	138.40	-334.81	361.00	21.69	3.50	135.22	-334.81	361.00
Number of Covenants	1.43	0.00	1.78	0.00	5.00	1.05	0.00	1.80	0.00	5.00

Table 1 Putable Bonds, *continued*

Panel C. By Industry

	Industrial Firms (n = 343)					Financial Firms (n = 189)				
Variable	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**
Offering Amount ($M)	170.68	125.00	142.10	10.00	500.00	137.22	100.00	119.36	10.00	500.00
Years to Maturity	23.01	30.00	12.38	3.00	40.00	12.73	10.00	9.28	3.00	40.00
Coupon (%)	6.53	6.95	2.80	0.00	11.75	6.64	7.50	3.40	0.00	11.75
Years to Next Put	10.05	9.46	6.20	2.00	22.00	5.87	4.73	4.71	2.00	22.00
Next Put Price (% of Par)	99.98	100.00	0.06	99.75	100.00	99.99	100.00	0.04	99.75	100.00
Yield (%)	6.94	7.02	2.45	2.17	11.87	7.48	7.60	2.18	2.17	11.87
Treasury Spread (basis points)	16.88	14.00	157.65	-334.81	361.00	30.41	0.38	100.39	-334.81	361.00
Number of Covenants	1.35	0.00	1.97	0.00	5.00	1.04	0.00	1.55	0.00	5.00

	Utility Firms (n = 92)				
Variable	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**
Offering Amount ($M)	96.76	52.50	111.96	10.00	500.00
Years to Maturity	22.12	30.00	10.24	3.00	40.00
Coupon (%)	7.20	6.88	1.55	0.00	10.00
Years to Next Put	7.89	7.00	3.78	2.00	22.00
Next Put Price (% of Par)	99.98	100.00	0.07	99.75	100.00
Yield (%)	7.39	6.91	1.17	5.33	11.35
Treasury Spread (basis points)	66.27	30.50	107.26	-38.00	361.00
Number of Covenants	0.88	0.00	1.56	0.00	5.00

Table 2. Putable and Straight Debt Issues

The table presents descriptive statistics of issuer and issue characteristics for 239 putable bonds and 2,242 straight bonds issued from 1976 to 2019. We report the results of the difference in mean and median tests for putable bond and straight bond sample variables. All variables are winsorized at the 5% and 95% percentiles of their distributions.

	Putable Debt Issues (n = 239)					Straight Debt Issues (n = 2,242)				
Firm Characteristics	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**
Market to Book Ratio	1.48	1.36	0.56	0.66	2.92	1.32	1.14	0.58	0.66	2.92
WW Index	0.02	-0.01	1.30	-5.26	7.68	-0.15	-0.06	1.43	-9.11	8.24
Total Assets ($M)	45.80	17.18	71.85	1.25	244.44	46.31	15.94	73.06	1.28	259.17
Leverage (%)	36.75	36.84	13.65	6.86	91.82	38.18	34.74	21.96	6.86	91.82
Asset Volatility (%)	4.17	4.16	2.71	0.00	12.58	3.62	3.82	3.08	0.00	14.54
R&D (%)	1.09	0.00	1.83	0.00	5.80	0.80	0.00	1.63	0.00	5.80
Fixed Assets (%)	37.68	34.48	27.15	0.00	86.91	39.94	36.66	30.38	0.00	86.91
Free Cash Flow (%)	4.94	6.10	5.22	-7.97	14.09	4.67	5.59	5.89	-7.97	14.09
Cash (%)	2.22	1.29	2.82	0.00	14.31	3.30	1.51	4.22	0.00	14.66
Profitability (%)	25.22	20.71	16.54	5.52	94.78	29.56	19.81	25.60	5.47	94.78
Information Asymmetry										
Analysis Coverage	1.72	0.00	4.75	0.00	20.00	2.93	0.00	5.91	0.00	20.00
Forecast Dispersion	2.01	2.30	0.73	0.01	2.30	1.73	2.30	0.96	0.01	2.30
Average Forecast Error	3.74	4.36	1.49	0.01	4.36	3.23	4.36	1.88	0.01	4.36
Bond Characteristics										
Offering Amount ($M)	137.33	100.00	129.40	7.50	830.00	267.03	200.00	255.26	4.20	1000.00
Offering Yield (%)	6.77	6.90	2.42	1.04	16.73	6.69	7.09	2.98	0.00	17.00
Years to Maturity (years)	19.77	16.00	12.13	3.00	40.00	10.96	10.00	9.85	1.00	100.00
Number of Covenants	1.82	0.00	2.15	0.00	6.00	2.67	3.00	2.15	0.00	6.00
Investment Grade	0.38	0.00	0.49	0.00	1.00	0.34	0.00	0.47	0.00	1.00

Table 3. Correlation Matrix

The table presents the correlation between main variables for 239 putable bonds and 2,242 straight bonds issued from 1976 to 2019. All variables are defined in Appendix and winsorized at the 5% and 95% percentiles of their distributions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Market to Book Ratio	1.000	-0.059	0.139	-0.112	-0.106	-0.190	-0.179	0.651	0.406	-0.037	0.505	0.317	-0.229
(2) WW Index	-0.059	1.000	-0.030	0.020	0.018	-0.031	-0.064	-0.060	-0.046	0.017	-0.021	0.014	-0.079
(3) Coverage	0.139	-0.030	1.000	-0.813	-0.810	0.095	-0.030	0.129	0.101	-0.053	0.058	0.039	-0.054
(4) Forecast Dispersion	-0.112	0.020	-0.813	1.000	0.975	-0.098	0.033	-0.109	-0.098	0.087	-0.043	-0.027	0.045
(5) Average Forecast Error	-0.106	0.018	-0.810	0.975	1.000	-0.094	0.025	-0.112	-0.088	0.087	-0.033	-0.030	0.048
(6) Log (Total Assets)	-0.190	-0.031	0.095	-0.098	-0.094	1.000	0.351	-0.409	-0.073	-0.465	-0.530	-0.194	0.472
(7) Leverage	-0.179	-0.064	-0.030	0.033	0.025	0.351	1.000	-0.360	-0.244	-0.118	-0.400	-0.180	0.644
(8) Asset Volatility	0.651	-0.060	0.129	-0.109	-0.112	-0.409	-0.360	1.000	0.360	0.076	0.559	0.420	-0.440
(9) R&D	0.406	-0.046	0.101	-0.098	-0.088	-0.073	-0.244	0.360	1.000	-0.148	0.325	0.316	-0.224
(10) Fixed Assets	-0.037	0.017	-0.053	0.087	0.087	-0.465	-0.118	0.076	-0.148	1.000	0.448	0.031	-0.088
(11) Free Cash Flow	0.505	-0.021	0.058	-0.043	-0.033	-0.530	-0.400	0.559	0.325	0.448	1.000	0.292	-0.392
(12) Cash	0.317	0.014	0.039	-0.027	-0.030	-0.194	-0.180	0.420	0.316	0.031	0.292	1.000	-0.263
(13) Profitability	-0.229	-0.079	-0.054	0.045	0.048	0.472	0.644	-0.440	-0.224	-0.088	-0.392	-0.263	1.000

Table 4. Risk Shifting Hypothesis and Issuance of Putable Bonds

The table presents the risk shifting regression results of putable bonds and straight bonds issued from 1976 to 2019. Columns (1) and (2) are Probit regression results with marginal effects and Columns (3) and (4) are Logit regression results. All variables are winsorized at the 5% and 95% percentiles of their distributions. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Probit (1)	Probit (2)	Logit (3)	Logit (4)
Market to Book Ratio	0.042**		0.534**	
	(2.274)		(2.302)	
WW Index		0.008*		0.088*
		(1.717)		(1.697)
Log (Total Assets)	0.004	0.006	0.042	0.077
	(0.376)	(0.612)	(0.300)	(0.548)
Leverage	0.000	0.000	0.004	0.001
	(0.395)	(0.045)	(0.469)	(0.127)
Asset Volatility	0.004	0.009**	0.063	0.125**
	(1.045)	(2.427)	(1.147)	(2.348)
R&D	0.002	0.003	0.028	0.044
	(0.425)	(0.704)	(0.393)	(0.630)
Fixed Assets	-0.000	-0.000	-0.002	-0.005
	(-0.739)	(-1.218)	(-0.550)	(-0.988)
Free Cash Flow	-0.001	0.001	-0.015	0.013
	(-0.638)	(0.370)	(-0.504)	(0.424)
Cash	-0.012***	-0.013***	-0.172***	-0.188***
	(-4.514)	(-4.777)	(-5.093)	(-5.581)
Profitability	-0.001	-0.000	-0.010	-0.007
	(-1.082)	(-0.662)	(-1.261)	(-0.856)
Log (Years to Maturity)	0.101***	0.103***	1.494***	1.542***
	(7.512)	(7.557)	(5.247)	(5.247)
Number of Covenants	-0.022***	-0.022***	-0.312***	-0.317***
	(-4.744)	(-5.040)	(-4.040)	(-4.139)
Offering Yield	0.001	-0.002	0.003	-0.027
	(0.212)	(-0.617)	(0.065)	(-0.707)
Investment Grade	0.019	0.016	0.230	0.193
	(1.043)	(0.919)	(0.950)	(0.788)
Year Fixed effect	Yes	Yes	Yes	Yes
Observations	2481	2481	2481	2481
Pseudo R-square	0.211	0.220	0.221	0.229

Table 5. Risk Shifting Hypothesis and Issuance of Putable Bonds by Financial Distress

The table presents the risk shifting regression results of putable bonds and straight bonds issued from 1976 to 2019 for different financial distress groups. Columns (1) and (2) are top quartile regression results with marginal effects and Columns (3) and (4) are bottom quartile results. All variables are winsorized at the 5% and 95% percentiles of their distributions. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Leverage	Top Quartile		Bottom Quartile	
	(1)	(2)	(3)	(4)
Market to Book Ratio	0.038		-0.015	
	(0.558)		(-0.732)	
WW Index		0.011**		0.006
		(2.036)		(0.799)
Firm Controls	Yes	Yes	Yes	Yes
Bond Controls	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Adjusted R-square	0.183	0.221	0.370	0.372
Panel B: Z-score	**Top Quartile**		**Bottom Quartile**	
	(1)	(2)	(3)	(4)
Market to Book Ratio	-0.002		0.070	
	(-0.086)		(1.116)	
WW Index		0.007		0.019**
		(1.095)		(2.428)
Firm Controls	Yes	Yes	Yes	Yes
Bond Controls	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Adjusted R-square	0.377	0.379	0.126	0.175
Panel C: Distance to Default	**Top Quartile**		**Bottom Quartile**	
	(1)	(2)	(3)	(4)
Market to Book Ratio	0.019		0.008	
	(0.765)		(0.203)	
WW Index		-0.009		0.023*
		(-0.840)		(1.886)
Firm Controls	Yes	Yes	Yes	Yes
Bond Controls	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Adjusted R-square	0.493	0.493	0.399	0.433

Table 6. Risk Shifting Hypothesis and Issuance of Putable Bonds by Secured Debt and Regulated Industry

The table presents the risk shifting regression results of putable bonds and straight bonds issued from 1976 to 2019 for firms that have secured debt or regulated. All variables are winsorized at the 5% and 95% percentiles of their distributions. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Firms with Secured Debt	With Secured Debt		Without Secured Debt	
	(1)	(2)	(3)	(4)
Market to Book Ratio	0.019		0.050***	
	(0.330)		(2.671)	
WW Index		-0.002		0.009*
		(-0.107)		(1.928)
Firm Controls	Yes	Yes	Yes	Yes
Bond Controls	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Observations	276	274	2205	2205
Adjusted R-square	0.447	0.495	0.215	0.219
Panel B: Regulated Industry	**Regulated Firms**		**Non-Regulated Firms**	
	(1)	(2)	(3)	(4)
Market to Book Ratio	0.213*		0.020	
	(1.899)		(1.110)	
WW Index		0.018***		-0.000
		(2.632)		(-0.067)
Firm Controls	Yes	Yes	Yes	Yes
Bond Controls	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes
Observations	740	740	1744	1744
Adjusted R-square	0.124	0.104	0.308	0.329

Table 7. Information Asymmetry and Issuance of Putable Bonds

The table presents the information asymmetry regression results of putable bonds and straight bonds issued from 1976 to 2019. Columns (1), (2), and (3) are Probit regression results with marginal effects and Columns (4), (5), and (6) are Logit regression results. All variables are winsorized at the 5% and 95% percentiles of their distributions. Z-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Probit (1)	Probit (2)	Probit (3)	Logit (4)	Logit (5)	Logit (6)
Analyst Coverage	-0.003*			-0.032**		
	(-1.945)			(-2.026)		
Forecast Dispersion		0.028***			0.284***	
		(2.763)			(3.090)	
Average Forecast Error			0.013***			0.137***
			(2.652)			(2.918)
Log (Total Assets)	0.006	0.005	0.005	0.063	0.055	0.053
	(0.574)	(0.517)	(0.492)	(0.601)	(0.538)	(0.511)
Leverage	0.000	0.000	0.000	0.004	0.004	0.004
	(0.580)	(0.564)	(0.594)	(0.602)	(0.596)	(0.627)
Asset Volatility	0.009**	0.009**	0.009**	0.089**	0.088**	0.090**
	(2.471)	(2.467)	(2.520)	(2.331)	(2.305)	(2.378)
R&D	0.004	0.004	0.004	0.029	0.033	0.031
	(0.769)	(0.842)	(0.803)	(0.592)	(0.676)	(0.638)
Fixed Assets	-0.000	-0.000	-0.000	-0.004	-0.004	-0.004
	(-0.971)	(-1.038)	(-1.010)	(-1.056)	(-1.120)	(-1.090)
Free Cash Flow	-0.000	0.000	-0.000	-0.000	0.001	-0.001
	(-0.024)	(0.024)	(-0.073)	(-0.011)	(0.039)	(-0.063)
Cash	-0.012***	-0.012***	-0.012***	-0.120***	-0.121***	-0.121***
	(-4.538)	(-4.562)	(-4.569)	(-5.288)	(-5.323)	(-5.342)
Profitability	-0.001	-0.001	-0.001	-0.006	-0.006	-0.006
	(-0.987)	(-0.946)	(-0.989)	(-1.001)	(-0.973)	(-1.019)
Log (Years to Maturity)	0.102***	0.101***	0.101***	1.025***	1.012***	1.015***
	(7.519)	(7.482)	(7.467)	(7.042)	(6.952)	(6.966)
Number of Covenants	-0.021***	-0.021***	-0.021***	-0.207***	-0.205***	-0.207***
	(-4.620)	(-4.605)	(-4.599)	(-4.387)	(-4.382)	(-4.395)
Offering Yield	-0.000	-0.000	-0.000	0.004	0.005	0.004
	(-0.078)	(-0.038)	(-0.069)	(0.124)	(0.157)	(0.126)
Investment Grade	0.016	0.017	0.019	0.180	0.191	0.208
	(0.923)	(1.000)	(1.063)	(1.011)	(1.079)	(1.150)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2482	2482	2482	2482	2482	2482
Adjusted R-square	0.212	0.218	0.217	0.164	0.170	0.169

Table 8. Information Asymmetry, Risk Shifting, and Issuance of Putable Bonds

The table presents the information asymmetry regression results of putable bonds and straight bonds issued from 1976 to 2019. Panel A presents the Probit regression results with marginal effects. The dependent variable in Panel A is putable dummy variable. Panel B presents the Tobit regression results for putable bond sample. The dependent variable in Panel B is log (Offering Amount). All variables are winsorized at the 5% and 95% percentiles of their distributions. T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Probit Model

	(1)	(2)	(3)	(4)	(5)	(6)
Analyst Coverage	-0.003**			-0.003*		
	(-1.979)			(-1.821)		
Forecast Dispersion		0.028***			0.026***	
		(2.782)			(2.646)	
Average Forecast Error			0.013***			0.012**
			(2.664)			(2.510)
Market to Book Ratio	0.043**	0.043**	0.042**			
	(2.393)	(2.379)	(2.357)			
WW Index				0.008*	0.008*	0.008*
				(1.677)	(1.679)	(1.671)
Log (Total Assets)	0.005	0.005	0.004	0.008	0.007	0.007
	(0.496)	(0.434)	(0.406)	(0.712)	(0.654)	(0.630)
Leverage	0.000	0.000	0.000	0.000	0.000	0.000
	(0.429)	(0.414)	(0.446)	(0.076)	(0.066)	(0.095)
Asset Volatility	0.005	0.005	0.005	0.010***	0.010***	0.010***
	(1.175)	(1.174)	(1.233)	(2.624)	(2.634)	(2.687)
R&D	0.002	0.003	0.003	0.004	0.004	0.004
	(0.490)	(0.550)	(0.518)	(0.770)	(0.828)	(0.792)
Fixed Assets	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.670)	(-0.743)	(-0.716)	(-1.173)	(-1.245)	(-1.216)
Free Cash Flow	-0.001	-0.001	-0.001	0.001	0.001	0.001
	(-0.597)	(-0.547)	(-0.630)	(0.390)	(0.447)	(0.336)
Cash	-0.012***	-0.012***	-0.012***	-0.013***	-0.013***	-0.013***
	(-4.537)	(-4.571)	(-4.577)	(-4.786)	(-4.799)	(-4.809)
Profitability	-0.001	-0.001	-0.001	-0.000	-0.000	-0.000
	(-1.097)	(-1.051)	(-1.092)	(-0.675)	(-0.627)	(-0.676)
Log (Years to Maturity)	0.100***	0.098***	0.098***	0.101***	0.100***	0.100***
	(7.462)	(7.435)	(7.417)	(7.507)	(7.464)	(7.446)
Number of Covenants	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***
	(-4.751)	(-4.740)	(-4.731)	(-5.030)	(-5.013)	(-5.000)
Offering Yield	0.001	0.001	0.001	-0.002	-0.001	-0.001
	(0.312)	(0.343)	(0.306)	(-0.535)	(-0.486)	(-0.518)
Investment Grade	0.017	0.019	0.020	0.015	0.016	0.018
	(0.988)	(1.065)	(1.128)	(0.876)	(0.945)	(1.007)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2481	2481	2481	2481	2481	2481
Adjusted R-square	0.218	0.224	0.223	0.225	0.232	0.230

Table 8. Information Asymmetry, Risk Shifting, and Issuance of Putable Bonds, continued

Panel B: Tobit Model (Offering amount)						
	(1)	(2)	(3)	(4)	(5)	(6)
Analyst Coverage	-0.019*			-0.017*		
	(-1.906)			(-1.802)		
Forecast Dispersion		0.131*			0.129*	
		(1.751)			(1.772)	
Average Forecast Error			0.071**			0.071**
			(2.109)			(2.195)
Market to Book Ratio	-0.012	-0.007	-0.016			
	(-0.072)	(-0.041)	(-0.098)			
WW Index				0.290***	0.284***	0.281***
				(4.605)	(4.561)	(4.538)
Log (Total Assets)	0.283***	0.279***	0.276***	0.016**	0.016**	0.017**
	(4.713)	(4.682)	(4.683)	(2.358)	(2.460)	(2.486)
Leverage	0.011	0.011	0.011	0.022	0.021	0.026
	(1.548)	(1.627)	(1.630)	(0.539)	(0.541)	(0.659)
Asset Volatility	-0.011	-0.011	-0.006	-0.017	-0.012	-0.014
	(-0.227)	(-0.240)	(-0.127)	(-0.420)	(-0.282)	(-0.328)
R&D	-0.051	-0.046	-0.048	-0.004	-0.004	-0.003
	(-1.132)	(-1.005)	(-1.054)	(-1.113)	(-1.117)	(-1.060)
Fixed Assets	-0.004	-0.004	-0.004	0.054**	0.055**	0.052**
	(-1.330)	(-1.342)	(-1.300)	(2.254)	(2.288)	(2.174)
Free Cash Flow	0.069***	0.070***	0.067***	0.040	0.036	0.036
	(2.701)	(2.715)	(2.611)	(1.496)	(1.326)	(1.347)
Cash	0.051*	0.046*	0.046*	-0.001	-0.001	-0.002
	(1.890)	(1.705)	(1.743)	(-0.165)	(-0.219)	(-0.343)
Profitability	-0.000	-0.001	-0.001	0.111	0.108	0.111
	(-0.080)	(-0.135)	(-0.242)	(0.840)	(0.826)	(0.844)
Log (Years to Maturity)	0.115	0.112	0.116	0.134***	0.134***	0.133***
	(0.847)	(0.830)	(0.853)	(3.225)	(3.251)	(3.230)
Number of Covenants	0.108**	0.107**	0.106**	0.174***	0.175***	0.173***
	(2.338)	(2.343)	(2.313)	(3.525)	(3.560)	(3.513)
Offering yield	0.142***	0.142***	0.140***	-0.107	-0.112	-0.088
	(2.727)	(2.758)	(2.693)	(-0.664)	(-0.700)	(-0.556)
Investment grade	-0.056	-0.059	-0.036	0.290***	0.284***	0.281***
	(-0.330)	(-0.349)	(-0.215)	(4.605)	(4.561)	(4.538)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	239	239	239	239	239	239
Adjusted R-square	0.140	0.140	0.141	0.160	0.161	0.162

Table 9. Two-Equation Simultaneous System of Putable Issuance, Covenants, and Leverage

The table presents the two-equation system for the decision on covenant and putable, and the decision on leverage and putable. The sample has putable bonds and straight bonds issued from 1976 to 2019. All variables are winsorized at the 5% and 95% percentiles of their distributions. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Putable Equation	Covenant Equation		Putable Equation	Leverage Equation
Putable		-1.166	*Putable*		-31.374***
		(-0.50)			(-2.86)
Number of Covenants	-0.054***		*Number of Covenants*	-0.022***	-1.196***
	(-3.65)			(-5.90)	(-3.61)
Market to Book Ratio	0.101***	1.098***	*Market to Book Ratio*	0.080***	3.932***
	(5.11)	(6.59)		(4.86)	(3.11)
Average Forecast Error	0.017***	0.049	*Average Forecast Error*	0.015***	0.286
	(4.64)	(1.18)		(4.43)	(1.09)
R&D	0.005		*R&D*	0.006	
	(0.95)			(1.32)	
Total Asset Growth	-0.000		*Total Asset Growth*	-0.000	
	(-0.07)			(-0.74)	
Cash	-0.015***	-0.085***	*Cash*	-0.009***	
	(-6.53)	(-3.22)		(-5.12)	
Leverage	-0.000	-0.004	*Leverage*	-0.004***	
	(-0.10)	(-1.05)		(-4.04)	
Log (Total Assets)	0.013***	0.160***	*Log (Total Assets)*	0.015***	2.247***
	(3.19)	(7.76)		(4.10)	(11.20)
Profitability	-0.001**	-0.003	*Profitability*	0.001**	0.533***
	(-2.50)	(-0.65)		(2.03)	(25.12)
Interest Rate Controls	Yes	Yes	*Interest Rate Controls*	Yes	Yes

Table 10. Three-Equation Simultaneous System of Putable Issuance, Covenants, and Leverage

The table presents the three-equation system for the decision on covenant, putable, and leverage. The sample has putable bonds and straight bonds issued from 1976 to 2019. All variables are winsorized at the 5% and 95% percentiles of their distributions. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Putable Equation	**Covenant Equation**	***Leverage Equation***
Leverage	-0.004***	0.003	
	(-4.40)	(0.35)	
Number of Covenants	-0.047***		0.980
	(-3.23)		(0.82)
Putable		0.403	-55.268***
		(0.15)	(-3.46)
Average Forecast error	0.016***	0.039	-0.004***
	(4.61)	(0.87)	(-4.40)
Fixed Asset			-0.031*
			(-1.67)
Log (Total Assets)	0.019***	0.136***	1.954***
	(4.61)	(5.10)	(7.22)
R&D	0.004		
	(1.16)		
Total Assets Growth	-0.000		
	(-0.29)		
Market to Book Ratio	0.100***	1.004***	3.589**
	(4.97)	(5.54)	(2.29)
Cash	-0.012***	-0.061**	
	(-5.75)	(-2.24)	
Profitability	0.001**	-0.006	0.507***
	(1.97)	(-1.01)	(18.72)
Interest Rate Controls	Yes	Yes	Yes

CHAPTER 3: SHAREHOLDER-CREDITOR CONFLICT AND HEDGING POLICY: EVIDENCE FROM MERGERS BETWEEN LENDERS AND SHAREHOLDERS

1. Introduction

The shareholders and creditors have different preferences on the firm policy because they have different claim orders on the firm's assets. (Jensen and Meckling, 1976; Myers, 1977). A large number of studies analyze the relation between shareholder-creditor conflict and various firm policies. For example, Billett, King, and Mauer (2004) use the bond price reaction to measure the conflict and test the relation between mergers and acquisitions. Chu (2018) finds a negative impact of the reduced shareholder-creditor conflict on payout policies. One of the reasons that shareholders and creditors prefer different firm policies is that they have different risk preferences. Because of the limited liability, the shareholders enjoy the most or all of the upset benefits of the risky project. On the other hand, the creditors have to bear the downside costs associated with taking risky projects. In particular, the equity carries the feature of a call option on the firm's total assets (Merton, 1974). The call option feature leads to a positive relationship between equity value and firm risk and a negative relation between the firm's debt value and the risk. Therefore, managers, who act in the interest of the firm's shareholders, will adopt risky projects as long as the gain in equity value exceeds the loss in debt value. Although creditors realize the risk-shifting incentive and charge higher interest, these protections are not efficient in eliminating the existence of risk-shifting in equilibrium (Dichev and Skinner 2002).

One of the firm policies that can directly reflect the risk preference is the firm's hedging policy. This paper attempts to shed the light on the effect of shareholder-creditor conflicts on the corporate hedging policy. From the foundation of Jiang, Li, and Shao (2010), we examine this problem by exploiting a unique setting to assess the simultaneous holdings of a firm's debt and equity by the same institutional investor (henceforth, "dual-holder"). Institutional dual-holders, due to their large stakes in both a firm's equity and debt, have strong incentives and abilities to internalize the conflicts of interest between shareholders and creditors. By analyzing the extent to which a firm is owned by such dual-holders, we can identify the effect of shareholder-creditor conflicts on the firm's hedging policy without directly measuring such conflicts, which is known to be very difficult.

To test the effect of dual-holders on the firm's hedging policy. We follow Jiang, Li, and Shao (2010) to identify firms with dual-holders and examine the relation between corporate hedging policy and the existence of dual-holders using the ordinary least squares (OLS) regression. Consistent with our prediction that dual-holders mitigate the conflict between shareholders and creditors, we find that firms with dual-holders hedge more than the otherwise identical firms without dual-holders. In terms of economic significance, we find that firms with dual-holders are 1.5% more likely to use financial instruments to hedge.

While the results of the OLS regression are consistent with the existence of shareholder-creditor conflicts and dual holders' roles in the corporate hedging policy. Nevertheless, it is difficult for us to provide a causal relationship between dual ownership and the corporate hedging policy. Specifically, the decision to become the dual-holder of the firm is endogenous. For instance, financial institutions may choose to become the firm's dual-holder if the firm hedges because this behavior protects the interests of debt-holders. To mitigate this concern, we follow the identification strategy developed by Chu (2018) and Yang (2019). Specifically, we implement a difference-in-differences (DID) regression based on the quasi-natural experiment of the mergers of the financial institutions that may generate plausibly exogenous variation in the presence of dual-holders. We construct the sample of mergers between lenders and shareholders as follows. First, we identify all mergers between the financial institutions in Statistics & Data Corporation (SDC) dataset. Second, we match the names of the acquirers and targets with lender names in the DealScan and shareholder names from Thomson Reuters 13F. Finally, we identify firms that are the borrowers of the merging lender and whose stocks are held by the merging institutional shareholder. We require that the institutional investors hold more than 1% of all shares outstanding at the time of the merger and the lender is allocated more than 10% of the loan at the origination. We define those firms as the treated firms. For each treated firm, we find the closest control firm by matching *Firm size*, *Leverage*, *Market-to-book ratio*, *Sales growth*, *ROA*(Return on assets), *R&D* (Research on development), *Capital expenditure*, *Firm age*, *Tangibility*, *Non-debt tax shield*, *Altman's Z-score*, and at the time require the control firms to have bank loans outstanding.

Next, we perform the DID regression, we find that the treated firms hedge more than the control firms after the merger. For each category of the hedging activities, treated firms hedge more for the interest rate risk and the foreign exchange risk than control firms do. In terms of the economic significance, we find that after the merger, the treated firms are 4.5%, 4.9%, and 3.9% more likely to use financial instruments, interest rate-related financial instruments, and foreign exchange rate-related financial instruments to hedge.

The DID regression relies on the parallel trend assumption. The parallel trend assumption assumes that in absence of treatment, the difference between control and treated groups would be constant over time. To test the parallel assumption, we follow Chu (2018) to examine the dynamics of the effect of the mergers between the shareholders and creditors on a firm's hedging policy. If the DID regression results are driven by the pre-existing differences between the treated and control firms, then the results are likely to become statistically and economically significant before the mergers between the shareholders and creditors. Otherwise, the results are likely to become statistically and economically insignificant before the mergers between the shareholders and creditors. We find that the effects of mergers on the firm's hedging policy are statistically and economically insignificant before the mergers, suggesting that the DID regression results are unlikely to be driven by the pre-existing differences between treated and control firms.

To find out the heterogeneity of the effect of reduced shareholder-creditor conflict on the firm's hedging policy, we further explore whether the effect of the merger is stronger for firms in financial distress. To test this, we create sub-samples based on the firm's *Leverage* ratio and run the DID regressions. We find that the positive and significant effects of the merger between shareholders and creditors on the firm's hedging policy are stronger for firms in the higher *Leverage* sub-sample. This result further suggests that the mergers between shareholders and creditors affect the firm's hedging policy through the channel of reducing conflict between the shareholders and creditors.

Next, to further justify the validity of our results. We hand-collect the commodity-related hedge positions of firms from the oil and gas industry (SIC code: 1,300-1,399) for our sample period and re-run the DID regression by replacing the dummy dependent variable indicates hedging activities with the notional value of the hedging contracts. We run the DID regressions on both the firm-year level and the contract-year level. We find that after the merger, the treated firms hedge more by using commodity-related financial instruments. In terms of the economic significance, we find that after the merger, the notional value of the hedging contracts used by the treated firm increases 78.24% more than that of the control firms.

The literature has explored that why firms hedge and provided several explanations. Bartram, Brown, and Fehle (2004) report that 65% of U.S. firms use derivatives to hedge, which indicates that hedging is one of the widely adopted firm policies that impact the overall firm risk. Nance, Smith, and Smithson (1993) find that firms that hedge face more convex tax functions, have less coverage of fixed claims, have more growth options in their investment opportunity set, and employ fewer hedging substitutes. Campello, Lin, Ma, and Zou (2011) find that hedgers pay lower interest spreads and are less likely to have capital expenditure restrictions in their loan agreements. These favorable financing terms, in turn, allow hedgers to invest more. Haushalter (2000) finds that the likelihood of hedging is related to economies of scale in hedging costs and the basis risk associated with hedging instruments. Campbell and Kracaw (1990) state that hedging could decrease the agency cost of finance by controlling the project risk. Chen and King (2014) find consistent results showing that hedging is associated with a lower cost of public debt. Lin, Phililips, and Smith (2008) also document a positive relation between *Leverage* and hedging. Aretz and Bartram (2010) try to link the agency conflict to hedging policy and point out that the complex relations between hedging and other corporate policies make it difficult to examine the agency theories. Nevertheless, direct empirical evidence on the impact of agency conflict on hedging is still understudied.

One potential reason for lacking direct empirical evidence is the difficulty to measure the conflict between shareholders and creditors. This paper contributes to the literature by investigating the relation between dual ownership which directly measures shareholder-creditor conflict and hedging.

Our paper also contributes to the literature on the effect of dual-holders. Using mergers between institutional shareholders and lenders to the same firms as exogenous shocks to identify firms with institutional dual-holders, Cheng, Cheng, Weng, and Yan (2021) find that such firms are less likely to provide management forecasts and disclose fewer voluntary 8-K items. Jiang, Li, and Shao (2010) find that syndicated loans with dual-holder participation have loan yield spreads that are 18–32 bps lower than those without. Yang (2019) finds that firms held by dual-holders generate fewer but more valuable patents. Chu (2018) finds that firms pay out less when there is less conflict between shareholders and creditors, suggesting that the shareholder-creditor conflict induces firms to pay out more at the expense of creditors. Chava, Wang, and Zou (2018) find that firms with dual ownership are less likely to have capital expenditure restrictions in loan contracts, and the relationship varies in predicted ways with the monitoring needs of borrowers and the monitoring capacity of dual owners. Bodnaruk and Rossi (2016) find that the existence of dual-holders of target firms in M&A deals results in higher merger premiums and larger abnormal bond returns.

The rest of the paper is structured as follows. Section 2 develops our main hypothesis. Section 3 describes the data sample and our identification strategy. Section 4 presents our main results. Section 5 reports our notional value results and Section 6 concludes.

2. Hypothesis

Hedging reduces the agency costs between shareholders and creditors and increases the firm value (e.g., Dobsen and Soenen, 1993). The literature provides some evidence of the negative relation between shareholder-creditor conflict and the hedging policy. Campbell and Kracaw (1990) find that hedging decreases agency costs by controlling the project risk. Chen and King (2014) find that hedging is associated with a lower cost of debt. On the other hand, hedging reduces the agency's cost by controlling the underinvestment incentive and by increasing the proportion of future states in which equity holders are the residual claimants (e.g., Bessembinder, 1991). Last, hedging increases the firm value by securing value-increasing changes in contracting terms with the creditors (e.g., Bessembinder, 1991). Therefore, to reduce the agency cost of debt and increase firm value, firms are more likely to hedge.

Institutional dual-holders, given their claims in both equity and debt of the company, have the incentive to serve as a commitment mechanism and mitigate the conflicts of interest between shareholders and creditors. If the institutions simultaneously hold significant positions in equity and debt, then these institutions will have incentives to monitor and prevent managers from opportunistic behaviors at the expense of creditors. Therefore, we should expect that the presence of significant dual ownership will (at least partly) reduce the conflict between shareholders and creditors. Consistent with this argument, Jiang, Li, and Shao (2010) find that dual-holders exhibit longer investment horizons and stronger lending relationships with borrowing firms, indicating that they monitor intensively on both equity and debt sides. Therefore, firms with dual-holders are more likely to hedge.

The above arguments lead to the following empirical predictions: firms are more likely to engage in hedging activities compared to similar firms without significant dual ownership.

Hypothesis 1: All else equal, firms with institutional dual-holders use more financial hedge instruments in general than those without dual-holders.

In addition, the risk-shifting incentive and underinvestment incentive are more pronounced for financially distressed firms (Jensen and Meckling, 1976). Eisdorfer (2008) finds evidence of risk-shifting behavior in financial distress firms. Due to the higher level of conflict between shareholders and creditors, the firms will face a higher agency cost of debt. Therefore, the impact of agency conflict on hedging is more pronounced for firms under financial distress. Accordingly, we have the following hypothesis:

Hypothesis 2: The effect of institutional dual-holders on hedging is more pronounced for financial distress firms.

3. Sample construction and the identification strategy

3.1 OLS regression sample construction

We start our sample construction with all firms that filed 10-K filings from 1994 to 2020. We start our sample from 1994 because it is when the DealSacan database starts to have comprehensive coverage of corporate loans. We use the same procedure as in Jiang, Li, and Shao (2010) to identify dual-holders. . Wee obtain firm-year level financial variables from Compustat. Based on the above sample's Central Index Key (CIK) number, We identify firms' hedging behavior by examining the 10-K filings and the proxy statements from the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) website. In particular, we perform a keyword search for derivatives uses. The keywords are listed in the Appendix. We then define the dummy variable, hedging, to be one in a given year for firms holding a hedging position or having a detailed description of their hedging policy in the year. The company holds derivatives for trading or speculating purpose does not count as a hedger for the given year. To determine whether the company hold derivatives for trading purpose, we read each firm's 10-K forms. For instance, Target mentions that "During 2008, we hold certain 'pay floating' interest rate swaps with a combined notional amount of $3,125 million for cash proceeds of $160 million, which are classified within other operating cash flows in the Consolidated Statements of Cash Flows. We had no derivative instruments designated for trading purposes." in its 2009 10-K form. This procedure produces a sample of 39,139 firm-year observations.

3.2 Variable definition and summary statistics

In addition to the dummy variable indicating whether the firm hedges, we use three other variables to measure the corporate hedging policy for different purposes. *Interest rate hedge*, *Foreign exchange hedge*, and *Commodity hedge*. The *Interest rate hedge* is a dummy variable that equals one if the firm-year uses the financial instrument to hedge for interest rate risk but not for trading purposes, and zero otherwise. The *Foreign exchange hedge* is a dummy variable that equals one if the firm-year uses the financial instrument to hedge for currency exchange risk but not for trading purposes, and zero otherwise. The *Commodity hedge* is a dummy variable that equals one if the firm-year uses the financial instrument to hedge for commodity price risk but not for trading purposes, and zero otherwise.

We also include the following firm-level control variables: *Firm size*-the natural logarithm of total assets (AT), *Leverage*-the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), *Market-to-book ratio*-the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), *ROA*-the earnings Before Interest (EBITDA) divided by total assets (AT), *R&D*-Research and Development Expense (XRD) divided by total assets (AT), *Capital expenditure*-Capital Expenditures (CAPX) divided by total sales (SALE), *Non-debt tax shield*-the ratio of depreciation (DP) to total assets (AT), *Altman's Z-score*, *Cash holdings*, *Tangibility*-total property, plant, and equipment (PPENT) scaled by total assets (AT), and *Firm age*-the natural logarithm of years firm exists in Compustat.

Table 1 provides the summary statistics for variables used in our baseline OLS regressions. About 57% of firm-year observations report hedging activities, among which 45%, 38%, and 16% report interest rate, foreign exchange, and commodity hedging activities. These numbers are similar to those reported in Lin, Phillips, and Smith (2008) and Chen and King (2014)

3.2 Difference-in-Differences regression sample construction

Next, we follow Chu (2008) to construct the sample for the DID regression. We start with all mergers between firms in the financial industry from 1998 to 2017 in the SDC mergers and acquisitions database. We begin the mergers sample from 1998 because we need four years of data before the merger between the firm's shareholders and creditors. We end our sample in 2017 because we need four years of data after the merger between the firm's shareholders and creditors. The reason we end at 2017 is that 2017 is also the fiscal year 2016 for some firms (e.g., Walmart). In the second step, we collect the lenders' information from the DealScan database and match the lender names with the names of either the acquirers or the targets of the mergers between the financial institutions. We follow

Chu (2018) to match the acquirer names. We not only match the names of the lenders directly involved in the merger deal but also match the names of the parent companies of the lenders and acquirers. We also use the addresses of the companies in both databases to facilitate the match. After this step, we obtain all mergers for which either the acquirer or the target can be matched with a lender in the DealScan database.

In the next step, we collect institutional investors' names from Thomson Reuter's 13F database. After collecting the institutional investors' names, we match the institutional investors' names with the unmatched acquirer and target names from the last step. Just as we did for the names in the DealScan database, we not only match the names of companies directly involved but also match the names of their parent companies of acquirers. After matching the names, we have 511 mergers between a lender on the DealScan database and an institutional investor in Thomson Reuter's 13F database.

Next, we identify the treated firms. First, we identify all firms whose loans from the merging lenders are still outstanding at the time of the merger. Next, we require that the merging institutional investor holds stocks of the firm at the end of the quarter immediately before the merger. Following Jiang, Li, and Shao (2010), we restrict the lender holding more than 10% of the loan at the origination and the institutional shareholder holds more than 1% of all shares outstanding of the firm. For firms identified as treated firms more than one time, we only keep the first time the firm is treated. Next, we delete all firms in the financial and utility industries and firms with missing key variables. Finally, this procedure provides us with 455 treated firms.

We then use the following procedure to find control firms. First, we exclude all firms ever treated by the mergers. Second, we require control firms to also have bank loan(s) outstanding at the time of the merger. Third, we do a propensity score matching to identify the list of control firms. Specifically, we do a Probit regression to estimate the propensity score. The dependent variable of the Probit regression is a dummy variable that equals one for the treated firm, and zero otherwise. The independent variables include *Firm size*, *Leverage*, *Market-to-book ratio*, *Sales growth*, *ROA*, *R&D*, *Capital expenditure*, *Firm age*, *Tangibility*, *Non-debt tax shield*, and *Altman's Z-score*. We include year-fixed effects in the Probit regression and cluster the standard errors at the firm level. We report the marginal effects and the standard errors of the Probit regression results in Table 2. After the Probit regression, each observation receives a propensity score (p-score). Then, for each treated firm, we retain the closest control firm based on their propensity score. Also, because the number of the control firms is limited, to ensure a better quality of matching, we use the one-on-one match with replacement. This matching procedure produces a sample of 398 control firms.

In our DID regression, we use the window of t-4 to t+4, that is, four years before to four years after the mergers. To ensure a clean identification, we discard firm fiscal years during which the mergers occurred. To ensure robustness, we also try 3-, and 5-year windows and find similar results.

Table 3 provides the summary statistics for the sample used in the DID regression. that the statistics of *Hedge*, *Interest rate hedge*, *Foreign exchange hedge*, and *Commodity hedge* are similar to those presented in Table 1.

4. Main results

4.1 OLS results of the effect of the dual-holders on the corporate hedging policy

We first provide the OLS regression results on the effect of dual-holders on the corporate hedging policies for all firms with DealScan loans outstanding.

We then estimate the following regression:

$$Y_{it} = \alpha_i + \alpha_t + \beta Dual_{it} + \gamma X_{it-1} + \varepsilon_{it},$$

where Y_{it} are dummy variables equal one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise; $Dual_{it}$ is a dummy variable equals one if the firm-year has a dual-holder, and zero otherwise; α_i is the firm fixed effects; $\alpha_t$is the year fixed effects. Following Petersen (2009), we cluster the standard errors at the firm level. We use a linear model for estimation instead of a non-linear Probit or logit model because

Table 5 provides the results from estimating Equation (1). All independent variables are lagged by one year. In columns (1) and (2), we present the results for the *Hedge* dummy, with and without control variables. In both columns, the coefficient estimates on *Dual* are positive and statistically significant, consistent with the argument that dual holders reduce the shareholder-creditor conflict and hence decrease firms' risk-taking incentives. In columns (3) and (4), we present the results for interest rate hedging. The coefficient estimates remain positive and statistically significant. The results for the exchange rate in columns (5) and (6) are similar. However, the coefficient estimates on *Dual* for commodity hedging in columns (7) and (8) are small and statistically insignificant. Based on the estimate in column (2), firms with dual-holders are 1.5% more likely to use financial derivative instruments to hedge. Columns (4) and (6) suggest that firms with dual-holders are 2.6% and 1.9% more likely to use financial derivative instruments to hedge the firm's interest rate and foreign exchange risk.

4.1 Baseline difference-in-differences results

The OLS regression results are subject to obvious endogenous concerns. In particular, dual holding and hedging decisions can be driven by unobservable firm characteristics, such as risk management policies and corporate financial policy. The results can also be driven by reverse causality, that is, firms that hedge are more likely to attract dual holders. To mitigate this concern, we then rely on mergers between shareholders and lenders to generate plausibly exogenous variation in dual holding and examine the effect of the mergers on corporate hedging policy in a DID setting.

When a lender and an institutional investor of the same firm merge, the conflict of interests between the creditor and shareholder is reduced. Lenders usually lend to multiple borrowers simultaneously and institutional shareholders often hold stock of hundreds of companies. As such, they are unlikely to make merger decisions based on the factors related to a small set of firms. Therefore, the mergers between lenders and institutional shareholders are likely to satisfy both the relevance and the exclusion conditions.

To identify the effect of mergers between shareholders and creditors on the corporate hedging policy, we estimate the difference-in-differences specification as follows:

$$Y_{it} = \alpha_i + \alpha_t + \beta_1 Treat_i \times Post_{it} + \beta_2 \times Post_{it} + \gamma X_{it-1} + \varepsilon_{it},$$

Where Y_{it} are dummy variables that equal one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise. $Treat_i$ is a dummy variable equals one if the firm is treated, and zero otherwise. $Post_{it}$ is a dummy variable that equals one if the firm-year observation is after the announcement of the merger between the firm's shareholder and creditor. α_i is the firm fixed effects. $\alpha_t$is the year fixed effects. X_{it-1} is a vector of control variables including *Firm size*, *Leverage*, *Market-to-book ratio*, *Sales growth, ROA, R&D, Capital expenditure*, *Firm age*, *Tangibility*, *Non-debt tax shield*, and the *Altman's Z-score*. In the baseline DID regressions, $Treat_i$ is subsumed by the firm fixed effects. The coefficient estimate of $Treat_i \times Post_{it}$ captures the marginal effect of the mergers on the corporate hedging policy. We cluster the standard errors by the firm (Petersen, 2009).

We report the results of the DID regressions in Table 6. The odd and even number columns report the results without and with firm-level control variables. We estimate Equation (2) without and with control variables because the control variables may also be affected by the treatment. Similar to the OLS results in table 5, the DID coefficient estimates are all positive and statistically significant, except for columns (7) and (8) for commodity hedging.

Taking the estimate in column (2), treated firms are 4.5% more likely to hedge than control firms after the merger between the shareholders and creditors. Based on the results in columns (4) and (6), we find that treated firms are 4.9% and 3.9% more likely to hedge interest rate and foreign exchange rate risk than control firms after the merger. To the extent that the mergers are exogenous, these results suggest that dual holding is likely to have a causal effect on corporate hedging decisions.

4.2 Placebo test of hedging activities

In the hypothesis section, we suggest that If the institutions simultaneously hold significant positions in equity and debt, then these institutions will have incentives to monitor and prevent managers from opportunistic behaviors at the expense of creditors. In other words, dual-holding firms are more likely to hedge for risk managing purposes. To test this, we conduct a placebo test. Specifically, we run the regression for equation (2) by replacing the dependent variable with a dummy equals to one if the firm-year uses derivatives instruments for trading purposes. If the coefficient estimates of $Treat_i \times Post_{it}$ are statistically and economically insignificant, then we suggest that dual-holding firms are more likely to hedge for risk managing purposes. We provide the results in table 7.

From column (1) to (8) of table 7, we find that the coefficient estimates of $Treat_i \times Post_{it}$ are statistically and economically insignificant, suggesting that dual-holding firms are more likely to hedge for risk managing purposes. In other words, the reduced conflict between shareholders and creditors affects the firm's hedging behavior through the risk-managing channel.

4.3 Addressing identification challenges

A common concern for DID estimation is that the results could be driven by systematic differences between treated and control firms, that is, the outcome variables, hedging policy in this case, for treated and control firms may have different trends in the absence of treatment. To mitigate this concern, we conduct an event study to examine the timing of the effect. We use the sample of treated and control firms fives years before the merger between shareholder and creditor and five years after the merger between shareholder and creditor (t-5 to t+5). Specifically, we estimate the following specification,

$$Y_{it} = \alpha_i + \alpha_t + \alpha_j + \sum_{k=-4}^{k=4} \beta_k Treat \times Year_k + \gamma X_{it-1} + \delta Z_{ct} + \varepsilon_{it} \,, \qquad (3)$$

Where Y_{it} is the dummy variable for corporate hedging; $Year_k$ is a dummy variable equal to one if the observation is k years after the merger between the firm's shareholder and creditor, and zero otherwise; α_i is the firm fixed effects; α_t is the year fixed effects; and α_j is the merger deal year fixed effect. In this equation, $\beta_k's$ capture the difference between the effect of the merger between shareholders and creditors on corporate hedging policy in year k and the effect of the merger between shareholder and creditor on corporate hedging policy in four years before the merger between the firm's shareholder and creditor. If the baseline DID results are indeed driven by the mergers, instead of, the coefficient estimates of $Treat \times Year_k$ should be close to zero for k less than zero, and become positive for k greater than zero. Nevertheless, if our baseline DID results are driven by the pre-existing differences between the treated and control firms, the effect is likely to show up before the merger (k less than zero).

We plot the coefficient estimates and their corresponding 95% confidence intervals in Figure 1. The coefficient estimates on $Treat \times Year_k$ are small and statistically insignificant before the mergers between shareholders and creditors. After the merger, the coefficient estimates on $Treat \times Year_k$ becomes greater and statistically significant. These results suggest that the baseline DID estimation is unlikely to be driven by the pre-existing differences between the treated and control firms.

4.4 Financial distress and the effects of the mergers

The conflict of interest between the shareholders and creditors exacerbates when the firm is in financial distress. As such, aligning the interests of shareholders and creditors via the merger should have a stronger effect on firms already in financial distress. In this section, we test this conjecture to provide further support to the argument that the main results are driven by reduced conflict of interests between shareholders and creditors.

We split the DID sample based on whether the firm's *Leverage* immediately before the merger is above or below the industry (FF48)-year median. We then re-estimate Equation (2) on those two sub-samples and present the results in table 8. Panels A and B report the results for using the high-*Leverage* and low *Leverage* sub-samples. For the high *Leverage* sub-sample in panel A, except for column (8), all the coefficient estimates on $Treat_i \times Post_{it}$ are positive and significant. In contrast, all the coefficient estimates on $Treat_i \times Post_{it}$ are small and statistically insignificant for the low *Leverage* sub-sample. Also, the difference of coefficient estimates in column (1) vs (2) is statistically significant. In terms of economic significance, the treated firms that have above-median *Leverage* are 5.8% more likely to hedge than the treated firms that have below-median *Leverage* after the merger between shareholders and creditors.

In panel B, we report the sub-sample results divided by the industry-year median of *Distance to Default*. We construct the *Distance to Default* following Bharath and Shumway (2008). We find that the coefficient estimate of $Treat_i \times Post_{it}$ is positive and statistically significant for the low *Distance to Default* sub-sample. The difference between coefficient estimates in low and high sub-samples is statistically significant. For economic significance, the treated firms that have above-median *Distance to Default* are 4.3% less likely to hedge than the treated firms that have below-median *Distance to Default* after the merger between shareholders and creditors.

Overall, this table suggests that the alignment of the interest of shareholders and creditors has a stronger effect in mitigating the shareholder-creditor conflict when the firm is in financial distress. Hence, the results provide support to the argument that mergers affect the corporate hedging policy via their effects on the shareholder-creditor conflict.

5. The effect of the merger on the notional value of hedge

In previous sections, we use dummy variables to capture the extensive margin of firms' hedging policy. These variables are, however, unable to capture the intensity of hedging. In this section, we follow Bakke et al. (2016) to construct a quantitative measure of the firm's hedging policy-*Notional value of hedging* contracts. Because we have to hand collect the notional values of the hedging contracts, we only focus on firms in the oil and gas industry in this analysis. Considering the labor and time efficiency, we mainly focus on the effect of dual-holders on Notional value for the firms in the oil and gas industry-an industry regularly using financial instruments to hedge the firm's commodity price risk. 18 To collect this data, first, we get all the oil and gas firms (SIC code:13XX) from the sample used to test equation (2) from 1998 to 2017. We choose SIC 13XX firms, as these firms are relatively homogeneous in their exposure to commodity prices and use similar hedging strategies (see Jin and Jorion, 2006). These industry characteristics help minimize the problems of omitted variables or spurious correlations, or both, that we would face if we did a cross-industry study or focused on a more complex heterogeneous industry.

[18] Notional value of hedging contracts are being collected for the firms in the airline industry and will be used in future research

To quantify hedging behavior, we hand-collect financial derivatives positions and operational hedging contracts from 10-K, 10-Q, and Proxy statement filings on the SEC EDGAR System. Firms usually disclose derivative positions in item 7A of 10-K (sometimes disclose this information in other items). In the oil and gas industry, firms typically report their use of oil and gas derivative contracts clearly (most times in tabulated format). Firms also report fixed price delivery operational hedging contracts in item 7A and management footnotes. We collect the contract type (forward, future, call, put, swap, etc.), amount sold in the future (firms sometimes provide these figures on a per-day basis and sometimes in aggregate), and price of the commodity in the agreement. After we collect that information, we multiply the price of the commodity by the number of contracts outstanding in the fiscal year to get the *Notional value of hedging contracts*.

5.2 The effect of the merger on the notional values of hedging contracts

Once we get the *Notional value of hedging contracts*, we run the regression on two different levels-contract-year level and the firm-year level. First, we provide the summary statistics of the sample for the test of mergers between shareholders and creditors on the *notional value of hedging contracts* in table 9. Panel A reports the summary statistics for the contract-year level. Panel B reports the summary statistics for the firm-year level. Based on panel A, we find that 409 commodity hedge contracts are outstanding for oil and gas firms from 1998 to 2017 including forward, future, call, put, swap, etc. The mean of the contract's *Notional value* is 12,259.24 thousand dollars. When we aggregate our data on the firm-year level. We find 105 firm years have outstanding hedging contracts, the average *Notional value* on the firm-year level is 72,335.86 thousand dollars.

Next, we perform the DID regressions for the effect of mergers between shareholders and creditors on the *notional value of hedging contracts*. Specifically, we re-run equation (2) by replacing the dummy dependent variables with the *notional value of hedging contracts* divided by the firm's total assets. We report the results in table 10. Panels A and B report the results on the contract-year level and firm-year level.

We find that the coefficient estimates of $Treat_i \times Post_{it}$ are statistically significant in columns (2) of panels A and B. In terms of economic significance, take column (4) of panel B as an example, the contract used by the firm that experiences a merger between shareholders and creditors has a notional value almost 50% higher than the contract used by the firm that does not experience a merger between shareholders and creditors.

Overall, the results of this table are consistent with those of the previous tables, suggesting that the reduced conflict of interest between shareholders and creditor motivates firms to engage more in hedging activities.

6. Conclusion

This paper examines the effect of the shareholder-creditor conflict on the corporate hedging policy. Using the mergers between the firm's shareholder and creditor as an exogenous shock, we find a causal positive relation between reduced shareholder-creditor conflict and corporate hedging behavior. Specifically, we find that the treated firms who experience mergers between their shareholder and creditors are not only more likely to use financial instruments to hedge but also hedge more in terms of the notional value of the hedging contracts. Consistent with the argument that the shareholder-creditor conflict often becomes exaggerated when the firm is in financial distress, we find that the effect is stronger for financially distressed firms.

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Appendix: Keyword list
Interest rate derivatives:
"interest rate swaption" or "interest rate futures" or "interest rate option" or "interest rate agreement" or"forward rate agreement" or "interest rate floor" or "basis swap" or "Interest rate derivative" or "Interest rate hedging" or "Interest rate swap" or "Interest rate contract" or "Interest rate cap" or "Interest rate collar" or "Interest rate protection" or "Interest rate lock" or "Interest rate forward" or "Hedge interest rate risk using derivative" or "Mitigate our interest rate risk" or "Mitigates its interest rate risk" or "Mitigate interest rate risk" or "Manage our interest rate risk" or "Manage its interest rate risk" or "Manage interest rate risk" or "Hedge interest rate risk" or "Hedge our interest rate risk" or "Hedge its interest rate risk"

and not "Does not use interest rate derivative" and not "Does not utilize interest rate derivative" and not "Did not have any interest rate swap" and not "No interest rate derivative" and not "No interest rate swap" and not "Did not have any interest rate derivative" and not "Did not have any interest rate contract" and not "Does not hedge its interest rate risk" and not "Does not utilize interest rate contract" and not "Does not use any derivative contracts to hedge its interest rate risk" and not "No material interest rate risk" and not "Does not use derivative financial instruments, such as interest rate swap" and not "No open interest rate derivatives" and not "Manages its interest rate risk exposure by maintaining a mix of" and not "Manages interest rate risk exposure by maintaining a mix of" and not "Interest rate hedging master agreement" and not "Means any interest rate swap" and not "Do not use interest rate derivative" and not "The company may enter into certain foreign currency and interest rate derivative" and not "The company may enter into interest rate derivative" and not "The company may enter into interest rate swap" and not "The company may also enter into certain foreign currency and interest rate derivative" and not "The company may also enter into interest rate derivative" and not "The company may also enter into interest rate swap" and not "No outstanding currency swap, interest rate derivative" and not "Liabilities under interest rate swap" and not "Changes in fair value of interest rate swap" and not "No interest rate contract" and not "Termination of interest rate swap"
and not "Termination of related interest swap" and not "Termination of an interest rate swap" and not "no open interest rate derivative" and not "it is not the company policy to enter into derivative financial instruments" and not "it is not the company's policy to enter into derivative financial instruments"

Foreign exchange hedge:
"currency derivative" or "currency futures" or "currency contract" or "exchange forward" or "exchange future" or "exchange swap" or "exchange option" or "exchange contract" or "forward exchange contract" or "exchange agreement" or "currency forward" or "currency option" or "currency rate hedge" or
"foreign exchange forward" or "exchange rate contract" or "foreign exchange derivative" or "foreign exchange contract" or "foreign exchange rate contract" or "forward foreign exchange" or "exchange rate derivative" or "forward currency exchange contract" or "currency swap" or "cross-currency swap" or
"foreign currency hedge contract" or "manage its currency risk" or "manage currency risk" or "manage our currency risk" or "manage its exchange rate risk" or "manage our exchange rate risk" or "manage exchange rate risk" or "hedges its exchange rate risk" or "hedge our exchange

rate risk" or "hedge exchange rate risk" or "foreign currency exchange rates and utilize derivatives" or "forward contract"

and not "no currency forward" and not "no currency option" and not "no foreign exchange forward" and not "no exchange rate contract" and not "no foreign exchange derivative" and not "no foreign exchange contract" and not "no foreign exchange rate contract" and not "no forward foreign exchange" and not "no exchange rate derivative" and not "no foreign currency exchange rate" and not "no currency swap" and not "no cross-currency swap" and not "no foreign currency hedge contract" and not "does not have any exchange rate derivative" and not "does not have currency forward" and not "does not manage our currency risk" and not "does not have any currency derivative" and not "does not have any outstanding foreign exchange derivative" and not "does not have any outstanding exchange rate contract" and not "does not have any outstanding foreign currency forward contract" and not "does not utilize currency derivative" and not "does not use currency derivative" and not "does not utilize foreign currency derivative" and not "does not utilize currency forward" and not "no material exchange rate risk" and not "but continues to monitor the effects of foreign currency exchange rate" and not "no outstanding commodity derivatives, currency swap" and not "no outstanding interest rate derivatives, currency swap" and not "no outstanding interest rate derivatives, foreign exchange contract" and not "not directly subject to foreign currency exchange rate fluctuations" and not "not subject to foreign currency exchange rate fluctuations" and not "do not engage in forward foreign exchange" and not "no foreign currency forward contract" and not "does not currently have any significant foreign currency exposure" and not "it is not the company policy to enter into derivative financial instruments"
and not "it is not the company's policy to enter into derivative financial instruments"

Commodity hedge:
"commodity futures" or "commodities future" or "commodity option" or "commodity derivative" or
"commodity swap" or "commodity swaption" or "commodity agreement" or "derivative commodity instrument" or "manage commodity price risk" or "hedge commodity price" or "manage fuel price risk" or
"hedge fuel price risk" or "natural gas option" or "natural gas swap" or "crude oil hedge" or "oil futures" or "oil contract" or "jet fuel forward" or "gold contract" or "commodity forward" or "manage exposure to fluctuation in commodity prices" or "manage exposure to fluctuations in commodity prices" or "manage exposure to changes in commodity prices" or "manage exposure to change in commodity prices" or "manage electricity cost" or "aluminum forward" or "natural gas forward" or"utilizes commodity futures and options" or "diesel fuel hedge contract" or "fuel hedge"

and not "no commodity futures" and not "no commodities future" and not "no commodity option" and not "no derivative commodity instrument" and not "does not hedge its commodity price risk" and not "do not use any commodity derivative" and not "does not have any commodity derivative outstanding" and not "does not have material commodity price risk" and not "no commodities future contract" and not "has not used derivative commodity instruments" and not "manages commodity price risk through negotiated supply contract" and not "manages commodity price risk through supply contract" and not "manages commodity price risks through negotiated supply contract" and not "manages commodity price risks through supply contract" and not "no outstanding commodity derivative" and not "does not use financial instruments to hedge commodity prices" and not "we do not hold or issue derivatives, derivative commodity instruments" and not "company has not entered into any transactions using derivative financial instruments or derivative commodity instruments" and not "does not use derivative commodity instrument" and not "we do not use a derivative or other financial instruments or derivative commodity instruments to hedge" and not "not utilize derivative financial instruments, derivative commodity instrument" and not "not utilize derivative commodity instrument" and not "it is not the company policy to enter into derivative financial instruments" and not "it is not the company's policy to enter into derivative financial instruments"

Figure 1-Dynamic effects of hedging

We plot the regression results for equation (3). The coefficient estimates and 95% confidence interval of Treat×(Year)_k are displayed in this figure. We find that the coefficient estimates of Treat×〖Year〗_k are a little above or below 0.05 before the merger between shareholder and creditor takes place. After the merger, the coefficient estimates Treat×〖Year〗_k increase to approximately 0.1 and remain at a similar level afterward. These results suggest that the baseline DID estimation is unlikely to be driven by the pre-existing differences between the treated and control firms.

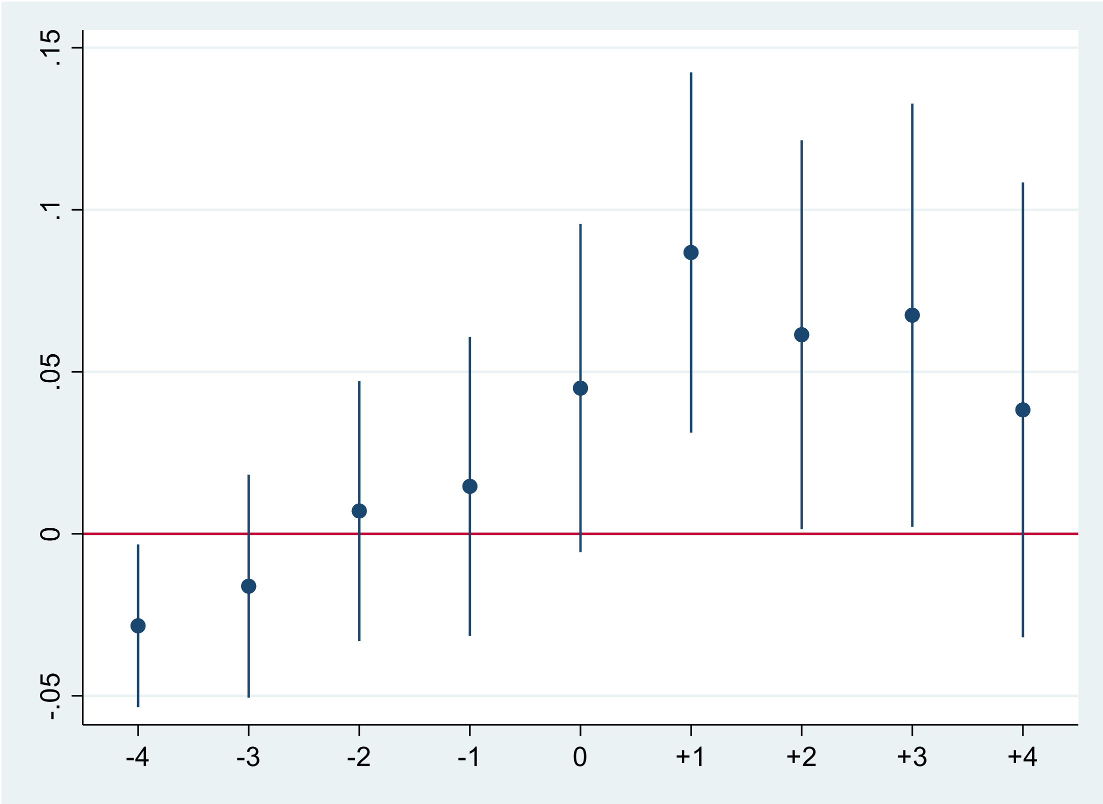

Table 1 Summary Statistics

We construct the sample to regression corporate hedging policy on the dummy variable $Dual_{it}$, which equals one if the firm-year has dual-holder(s). This sample is from 1994 to 2020. A hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise. Interest rate hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for interest rate risk but not for trading purposes, and zero otherwise. A foreign exchange hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for currency exchange risk but not for trading purposes, and zero otherwise. A commodity hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for commodity price risk but not for trading purposes, and zero otherwise. Dual is a dummy variable equals one if the firm-year has a dual-holder, and zero otherwise. We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*- the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D-Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield- the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat.

Variables	N	Mean	STD	P25	P50	P75
Hedge	39,139	0.572	0.413			
Interest rate hedge	39,139	0.452	0.484			
Foreign exchange hedge	39,139	0.382	0.409			
Commodity hedge	39,139	0.156	0.409			
Dual	39,139	0.471	0.499			
Firm size	39,139	7.030	1.851	5.725	6.947	8.252
Leverage	39,139	0.231	0.186	0.080	0.194	0.343
M/B	39,139	1.667	0.957	1.086	1.363	1.878
ROA	39,139	0.110	0.095	0.061	0.110	0.161
R&D	39,139	0.017	0.045	0.000	0.000	0.007
Capex	39,139	0.099	0.213	0.015	0.034	0.079
Non debt tax-shield	39,139	0.042	0.033	0.021	0.036	0.055
Altman's z	39,139	3.463	3.009	1.511	2.847	4.443
Cash	39,139	0.070	0.114	0.009	0.026	0.078
Tangibility	39,139	0.285	0.257	0.071	0.208	0.452
Firm age	39,139	16.729	10.000	8.000	16.000	24.000

Table 2 Probit Regression Results

The dependent variable of the Probit regression is a dummy variable equals one for the treated firm, and zero otherwise. The independent variables include firm size, *Leverage*, market-to-book ratio, sales growth, ROA, R&D, Capital expenditure, firm age, tangibility, non-debt tax shield, and Altman's Z-score. We include year-fixed effects in the Probit regression and cluster the standard errors at the firm level. We report the marginal effects and standard errors (In the parentheses) of the Probit regression in table 2. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. We report the marginal effects on top and robust standard errors in the parentheses.

	Merger
	(1)
Firm size	-0.040***
	(0.033)
Leverage	-0.011
	(0.299)
Market-to-book	-0.007
	(0.054)
Sales growth	0.001***
	(0.001)
ROA	-0.036
	(0.580)
R&D	0.154
	(0.703)
Capex	-0.012
	(0.050)
Firm age	0.038*
	(0.091)
Tangibility	0.054
	(0.211)
Non-debt tax shield	-0.759*
	(1.718)
Altman's Z	-0.002
	(0.018)
Year fixed effects	Yes
No. of Observations	4,661
Pseudo R-squared	0.145

Table 3-Summary Statistics for the DID Sample

Table 3 provides the summary statistics for the difference in differences (DID) sample. A hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise. Interest rate hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for interest rate risk but not for trading purposes, and zero otherwise. A foreign exchange hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for currency exchange risk but not for trading purposes, and zero otherwise. A commodity hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for commodity price risk but not for trading purposes, and zero otherwise.

Variables	N	Mean	Standard deviation	P25	Median	P75
Hedge	7,122	0.370	0.483			
Interest rate hedge	7,122	0.285	0.452			
Foreign exchange hedge	7,122	0.235	0.424			
Commodity hedge	7,122	0.072	0.258			
Treat	7,122	0.525	0.484			
Post	7,122	0.527	0.499			
Firm size	7,122	6.377	1.784	5.202	6.339	7.433
Leverage	7,122	0.335	0.234	0.164	0.315	0.453
M/B	7,122	1.570	0.867	1.062	1.293	1.733
ROA	7,122	0.126	0.093	0.080	0.125	0.175
R&D	7,122	0.011	0.033	0.000	0.000	0.003
Capex	7,122	0.102	0.197	0.018	0.039	0.086
Non debt tax-shield	7,122	0.046	0.031	0.026	0.041	0.058
Altman's z	7,122	3.308	5.647	1.809	2.822	4.034
Cash	7,122	0.070	0.114	0.009	0.026	0.078
Tangibility	7,122	0.334	0.253	0.123	0.274	0.514
Firm age	7,122	2.523	0.776	1.946	2.639	3.219

Table 4-Univariate Comparison

Table 4 provides the univariate comparison between treated and control firms. A hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise. Interest rate hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for interest rate risk but not for trading purposes, and zero otherwise. A foreign exchange hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for currency exchange risk but not for trading purposes, and zero otherwise. A commodity hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for commodity price risk but not for trading purposes, and zero otherwise. Treat is a dummy variable equals one for the treated firm. Post is a dummy variable equals one if after the merger. We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*- the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D-Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield- the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat.

	Treat firms		Control firms		Differences	
	N=3,739		N=3,383			
	Mean	Median	Mean	Median	Mean	Median
Hedge	0.385	0.000	0.346	0.000	0.039	0.000
Interest rate hedge	0.299	0.000	0.263	0.000	0.036	0.000
Foreign exchange hedge	0.242	0.000	0.224	0.000	0.018	0.000
Commodity hedge	0.065	0.000	0.084	0.000	-0.019	0.000
Post	0.533	1.000	0.517	1.000	0.017	0.000
Firm size	6.275	6.227	6.543	6.559	-0.268	-0.331
Leverage	0.336	0.313	0.333	0.317	0.003	-0.004
M/B	1.583	1.289	1.548	1.297	0.036	-0.008
ROA	0.126	0.123	0.126	0.127	0.000	-0.005
R&D	0.010	0.000	0.013	0.000	-0.002	0.000
Capex	0.098	0.038	0.108	0.042	-0.010	-0.004
Non debt tax-shield	0.044	0.039	0.048	0.043	-0.004	-0.004
Altman's z	3.420	2.866	3.120	2.718	0.300	0.148
Cash	0.068	0.025	0.074	0.029	-0.006	-0.005
Tangibility	0.327	0.271	0.345	0.284	-0.018	-0.013
Firm age	2.445	2.485	2.652	2.890	-0.207	-0.405

Table 5-OLS Regression Result

Table 5 provides the results for the regression corporate hedging policy on the dummy variable Dualit, which equals one if the firm-year has dual-holder(s). This sample is from 1994 to 2020. A hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise. Interest rate hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for interest rate risk but not for trading purposes, and zero otherwise. A foreign exchange hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for currency exchange risk but not for trading purposes, and zero otherwise. A commodity hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for commodity price risk but not for trading purposes, and zero otherwise. Dual is a dummy variable equals one if the firm-year has a dual-holder, and zero otherwise. We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*- the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D- Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield- the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. We report the robust standard errors in the parentheses.

	Hedge	Hedge	Interest hedge	Interest hedge	Exchange hedge	Exchange hedge	Commodity hedge	Commodity hedge
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dual	0.033***	0.015*	0.047***	0.026**	0.041***	0.019**	-0.009	-0.011
	(0.008)	(0.008)	(0.010)	(0.010)	(0.008)	(0.009)	(0.007)	(0.007)
Firm size		0.068***		0.071***		0.082***		0.034***
		(0.007)		(0.009)		(0.008)		(0.007)
Leverage		0.101***		0.253***		-0.012		0.031
		(0.031)		(0.036)		(0.033)		(0.024)
M/b		0.004		0.018***		-0.008		-0.005
		(0.006)		(0.007)		(0.006)		(0.004)
Sales growth		-0.001		0.006		-0.003		0.002
		(0.006)		(0.007)		(0.008)		(0.005)
ROA		0.099**		0.161***		-0.062		-0.047
		(0.045)		(0.053)		(0.047)		(0.035)
R&D		-0.031		0.071		-0.157		-0.252**
		(0.178)		(0.244)		(0.173)		(0.117)
Capex		-0.022		-0.007		-0.021		-0.010
		(0.020)		(0.024)		(0.025)		(0.018)

Table 5-OLS Regression Result, cont.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm age		-0.042*		-0.038		-0.041*		-0.041**
		(0.022)		(0.027)		(0.025)		(0.020)
Tangibility		0.022		-0.045		-0.010		-0.036
		(0.043)		(0.053)		(0.050)		(0.042)
Non-debt tax shield		-0.161		-0.303		0.142		-0.059
		(0.174)		(0.230)		(0.201)		(0.157)
Altman'z		-0.007***		-0.013***		0.001		0.005***
		(0.002)		(0.002)		(0.002)		(0.001)
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	45,421	39,139	45,421	39,139	45,421	39,139	45,421	39,139
Adjusted R-squared	0.504	0.514	0.500	0.513	0.572	0.585	0.597	0.594

Table 6-DID Regression Results

Table 6 provides the results for the DID regression. A hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise. Interest rate hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for interest rate risk but not for trading purposes, and zero otherwise. A foreign exchange hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for currency exchange risk but not for trading purposes, and zero otherwise. A commodity hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for commodity price risk but not for trading purposes, and zero otherwise. Treat is a dummy variable equals one for the treated firm. Post is a dummy variable equals one if after the merger. We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*-the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D- Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield-the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. We report the robust standard errors in the parentheses.

	Hedge	Hedge	Interest rate hedge	Interest rate hedge	Foreign exchange hedge	Foreign exchange hedge	Commodity hedge	Commodity hedge
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat*post	0.047**	0.045*	0.048**	0.049**	0.038*	0.039*	-0.015	-0.004
	(0.022)	(0.024)	(0.023)	(0.025)	(0.021)	(0.023)	(0.013)	(0.015)
Post	0.025	-0.016	0.003	-0.042*	0.030	0.010	0.021	0.019
	(0.021)	(0.021)	(0.023)	(0.025)	(0.020)	(0.021)	(0.014)	(0.015)
Control variables	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	7,677	7,122	7,677	7,122	7,677	7,122	7,677	7,122
Adjusted R-squared	0.591	0.623	0.514	0.538	0.523	0.565	0.482	0.513

Table 7-Placebo Test

Table 7 provides the results for the DID regression. A hedge is a dummy variable equals one if the firm-year uses the financial instrument for trading purposes, and zero otherwise. Interest rate hedge is a dummy variable equals one if the firm-year uses the interest-related financial instrument for trading purposes, and zero otherwise. A foreign exchange hedge is a dummy variable equals one if the firm-year uses the foreign exchange-related financial instrument for trading purposes, and zero otherwise. A commodity hedge is a dummy variable equals one if the firm-year uses the commodity-related financial instrument for trading purposes, and zero otherwise. Treat is a dummy variable equals one for the treated firm. Post is a dummy variable equals one if after the merger. We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*- the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D- Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield- the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. We report the robust standard errors in the parentheses.

	Hedge	Hedge	Interest rate hedge	Interest rate hedge	Foreign exchange hedge	Foreign exchange hedge	Commodity hedge	Commodity hedge
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat*post	0.034	0.037	0.034	0.044*	0.029	0.033	-0.001	0.013
	(0.022)	(0.024)	(0.022)	(0.024)	(0.020)	(0.022)	(0.013)	(0.014)
Post	0.004	-0.010	-0.003	-0.027	-0.006	-0.012	0.001	-0.011
	(0.020)	(0.021)	(0.022)	(0.024)	(0.019)	(0.021)	(0.014)	(0.014)
Control variables	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	7,677	7,122	7,677	7,122	7,677	7,122	7,677	7,122
Adjusted R-squared	0.558	0.584	0.498	0.515	0.514	0.552	0.485	0.505

Table 8-Sub-sample *Leverage* and distance to default

Table 8 provides the sub-sample results for the DID regression. Panel A is the high and low *Leverage* sub-samples. Panel B is the high and low distance to default sub-samples. We construct distance to default follow the KMV-Merton model. A hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge but not for trading purposes, and zero otherwise. Interest rate hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for interest rate risk but not for trading purposes, and zero otherwise. A foreign exchange hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for currency exchange risk but not for trading purposes, and zero otherwise. A commodity hedge is a dummy variable equals one if the firm-year uses the financial instrument to hedge for commodity price risk but not for trading purposes, and zero otherwise. Treat is a dummy variable equals one for the treated firm. Post is a dummy variable equals one if after the merger. We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*- the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D- Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield- the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. We report the robust standard errors in the parentheses.

Panel A	Hedge			Interest rate hedge			Foreign exchange hedge			Commodity hedge		
Leverage	Low	High	Diff	Low	High	Diff	Low	High	Diff	Low	High	Diff
	(1)	(2)	(1) vs (2)	(3)	(4)	(3) vs (4)	(5)	(6)	(5) vs (6)	(7)	(8)	(7) vs (8)
Treat*post	-0.000	0.058*	0.058**	0.035	0.066*	0.031	-0.006	0.066**	0.072**	0.001	-0.011	-0.012
	(0.034)	(0.034)	(0.024)	(0.034)	(0.034)	(0.036)	(0.031)	(0.027)	(0.032)	(0.25)	(0.013)	(0.011)
Post	-0.014	-0.035		-0.078**	-0.044		0.011	-0.013		0.023	0.018	
	(0.030)	(0.029)		(0.033)	(0.031)		(0.028)	(0.028)		(0.020)	(0.019)	
Control variables	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Year fixed effects	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Firm fixed effects	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
No. of observations	3,226	3,756		3,226	3,756		3,226	3,756		3,226	3,756	
Adjusted R-squared	0.654	0.630		0.533	0.573		0.633	0.542		0.504	0.545	

Panel B	Hedge			Interest rate hedge			Foreign exchange hedge			Commodity hedge		
Default to distance	Low	High	Diff	Low	High	Diff	Low	High	Diff	Low	High	Diff
	(1)	(2)	(1) vs (2)	(3)	(4)	(3) vs (4)	(5)	(6)	(5) vs (6)	(7)	(8)	(7) vs (8)
Treat*post	0.052**	0.009	-0.043*	0.017	0.034	0.017	0.065***	0.017	-0.048*	0.008	-0.019	-0.027
	(0.023)	(0.025)	(0.023)	(0.024)	(0.026)	(0.017)	(0.023)	(0.024)	(0.015)	(0.014)	(0.023)	(0.037)
Post	-0.024	0.014		-0.006	-0.043		-0.003	0.031		0.008	0.027	
	(0.024)	(0.026)		(0.025)	(0.026)		(0.024)	(0.024)		(0.015)	(0.022)	
Control variables	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Year fixed effects	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Firm fixed effects	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
No. of observations	3,298	3,666		3,298	3,666		3,298	3,666		3,298	3,666	
Adjusted R-squared	0.619	0.653		0.539	0.579		0.582	0.582		0.524	0.528	

Table 9 Summary statistics for the notional value sample

Table 9 provides the summary statistics for the notional value sample on contract level and firm level. Notional value is the notional amount of the hedging contract ($000). We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*- the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D- Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield- the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat.

Variable	N	Mean	STD	P25	p50	P75
Notional value	409	12,259.240	14,098.350	398.000	2,643.054	31,904.000
Notional value/firm size	409	0.109	0.504	0.000	0.002	0.015
Treat	409	0.195	0.397	0.000	0.000	0.000
Post	409	0.525	0.500	0.000	1.000	1.000
Firm size	409	7.930	1.946	6.201	8.141	9.464
Raw firm size						
Leverage	409	0.351	0.159	0.201	0.351	0.435
Market-to-book	409	1.552	0.449	1.204	1.479	1.756
ROA	409	0.147	0.096	0.109	0.153	0.205
Capex/sales	409	0.750	0.361	0.469	0.679	1.015
Non debt tax shield	409	0.092	0.035	0.073	0.082	0.094
Altman's Z	409	1.676	1.346	0.825	1.649	2.263
Cash	409	0.020	0.034	0.000	0.004	0.020
Tangibility	409	0.855	0.051	0.822	0.864	0.895
Firm age	409	24.357	12.781	12.000	26.500	37.000

Variable	N	Mean	STD	P25	Median	P75
Notional value	105	72,335.860	74,110.350	4,598.574	28,736.000	164,304.000
Notional value/firm size	105	0.023	0.017	0.011	0.026	0.026
Treat	105	0.321	0.469	0.000	0.000	1.000
Post	105	0.596	0.493	0.000	1.000	1.000
Firm size	105	7.324	1.645	6.121	7.135	8.594
Leverage	105	0.292	0.162	0.168	0.267	0.385
Market-to-book	105	1.512	0.446	1.184	1.397	1.739
ROA	105	0.136	0.192	0.109	0.158	0.205
Capex/sales	105	0.785	0.466	0.462	0.712	1.011
Non debt tax shield	105	0.109	0.051	0.077	0.090	0.133
Altman's Z	105	1.437	1.561	0.622	1.405	2.152
Cash	105	0.024	0.036	0.003	0.010	0.032
Tangibility	105	0.859	0.053	0.832	0.866	0.897
Firm age	105	20.604	12.767	10.000	17.500	31.000

Table 10-Notional value regression results

Table 10 provides the regression results for the notional value on the contract level ad firm level. Notional value is the notional amount of the hedging contract ($000) scaled by total assets. Treat is a dummy variable equals one for the treated firm. Post is a dummy variable equals one if after the merger. We also include control variables such as the Firm size-the natural logarithm of total assets (AT), *Leverage*- the sum of current liabilities and long-term debt (DLC+DLTT) scaled by total assets (AT), market-to-book ratio- the market value of total assets (PRCC_F×CSHO-CEQ+AT) divided by the book value of total assets (AT), ROA- the earnings Before Interest (EBITDA) divided by total assets (AT), R&D-Research and Development Expense (XRD) divided by total assets (AT), capital expenditure-Capital Expenditures (CAPX) divided by total sales (SALE), Non-debt tax shield- the ratio of depreciation (DP) to total assets (AT), Altman's Z-score, Cash holdings, Tangibility- total property, plant, and equipment (PPENT) scaled by total assets (AT), and Firm age- the natural logarithm of years firm exists in Compustat. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. We report the robust standard errors in the parentheses.

Panel A.	Notional value/Total assets	Notional value/Total assets
Contract level	(1)	(2)
Treat*Post	0.011	0.010*
	(0.008)	(0.006)
Post	0.002	-0.006
	(0.011)	(0.007)
Control variables	No	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
No. of observations	432	409
Adjusted R-squared	0.750	0.805
Panel B.	**Notional value/Total assets**	**Notional value/Total assets**
Firm level	(1)	(2)
Treat*Post	0.004	0.012*
	(0.006)	(0.007)
Post	0.003	-0.003
	(0.007)	(0.008)
Control variables	No	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
No. of observations	108	105
Adjusted R-squared	0.668	0.669