Hedge commitments and agency costs of debt: evidence from interest rate protection covenants and accounting conservatism

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Abstract We provide large sample evidence that credible hedge commitments reduce the agency costs of debt and that accounting conservatism enhances hedge commitments. We examine 2,338 bank loans entered into by 263 mandatory derivative users that are contractually obligated by interest rate protection covenants, 709 voluntary derivative users, and 1,366 non-users. We show that loan contracts are more likely to include interest rate protection covenants when borrowers are less likely to maintain the hedge position once the financing is completed. We find that borrowers who credibly commit to hedge using these covenants significantly reduce their interest rates. While we do not find an average interest savings for voluntary derivative users, we do find a reduction in their loan rates when they practice conservative financial reporting. Our results suggest that accounting conservatism helps borrowers resolve shareholder-creditor conflicts by committing to maintain their hedge positions after completing debt financing.

Keywords Accounting conservatism • Interest rate protection • Agency costs of debt • Hedge commitments

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1 Introduction

We investigate whether borrowers can reduce the agency costs of debt by credibly committing to hedge interest rate risk using derivatives that fix the interest rates on their floating-rate syndicated loans. Hedging reduces debt costs by decreasing default probabilities (Mayers and Smith 1982; Smith and Stulz 1985) and by generating more stable internal cash flows that alleviate underinvestment problems arising from reliance on costly external financing (Froot et al. 1993). Although hedging increases total firm value, it redistributes wealth from equity holders to debt holders making it difficult for borrowers to convince lenders that they will maintain the hedge position once the financing is completed (Smith and Stulz 1985). Risky borrowers have incentives to increase risk after debt issuance because of shareholders’ limited liability (Jensen and Meckling 1976). Doherty (2000) argues that the ability to obtain external financing may critically depend on whether firms can credibly commit to hedge.

We examine two hedge commitment mechanisms available to borrowers. Specifically, we consider interest rate protection covenants, which contractually obligate borrowers to use derivatives to fix the rates on their variable rate debt, and borrower accounting conservatism. Interest rate protection covenants provide a straightforward hedge commitment, since unwinding the required derivative contracts results in a covenant violation that allows lenders to call the debt. Accounting conservatism provides a more indirect hedge commitment, but we argue that there is more than one reason why accounting conservatism helps borrowers commit to hedge.

In some circumstances, the desire to increase reported earnings could provide borrowers with incentives to unwind their hedge positions. The incentive will be the strongest when lenders are most concerned with the borrower’s interest rate exposure, which occurs during rising interest rate environments, since an increase in interest rates leads to an unrecognized gain on variable-to-fixed rate swap hedges.1 Chen et al. (2007) show that firms with conservative accounting are less likely to engage in upward earnings management.2 Conservative accounting may also provide a hedging commitment by facilitating timely debt covenant violations that transfer control rights to creditors in the event of economic losses (Watts 2003a, b; Vasvari 2006; Zhang 2008; Beatty et al. 2008; Nikolaev 2010). This suggests that the benefit to shareholders of increasing risk decreases with accounting conservatism (Loktionov 2009). We expect that the relatively higher costs of altering accounting conservatism compared with derivative holdings will allow accounting conservatism to enhance the ability to commit to hedge positions.

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1 Since virtually all syndicated loans charge variable-rates, banks are more concerned about borrowers’ ability to fulfill interests payment obligations when interest rates increase.
2 They assume that information asymmetry prevents equity investors from completely adjusting the reporting bias resulting from accounting conservatism. Therefore, when accounting is conservative, low accounting earnings does not necessarily imply low true economic earnings, thereby reducing the benefits of upward earnings management.
We investigate the importance of commitment in reducing agency costs of debt by examining how derivative use affects syndicated loan interest rate spreads for two types of derivative users: those required by interest rate protection covenants to fix the rates on their syndicated loans (hereafter “mandatory users”), and those who voluntarily fix their debt rates in the absence of these covenants (hereafter “voluntary users”). We also consider whether derivative users’ interest rate savings vary cross-sectionally with their accounting conservatism. Since borrowers can choose to use derivatives and interest rate protection covenants, we first model borrowers’ choice of each of these possibilities versus the choice not to use derivatives. We control for these choices in our interest rate spread analyses. We examine borrowers’ derivative use choice using a bivariate Probit model that accounts for the interdependence between derivative use and the inclusion of interest rate protection covenants in the loan contracts. We adopt an instrumental variables approach and incorporate the estimates from these models in our analysis of whether a hedge commitment affects borrowing rates.

To account for endogeneity in derivative use choices, we rely on economic theories to identify three plausible instruments that are related to firms’ hedging decisions but are unrelated to loan pricing. Our first instrument for derivative use is the portion of before-financing marginal tax rate unexplained by profitability. Graham and Rogers (2002) suggest that a firm’s incentive to hedge to increase debt capacity is positively associated with its marginal tax rate. Since a firm’s profitability is related both to its marginal tax rate and to the interest rate charged on a loan, we develop our instrument by first parsing out profitability and use the remaining portion of the marginal tax rate as the instrument. Our second instrument related to the choice of fixed versus floating rate debt is the proportion of existing debt maturing in more than 1 year. A syndicated loan with an interest rate swap is equivalent to fixed rate debt with a call option. Previous research shows that the maturity of existing debt predicts both the choice of fixed rate debt over floating rate debt (Denis and Mihov 2003) and the choice to issue fixed rate debt that is callable for reasons other than interest rate changes (Thatcher 1985). The third instrument for derivative use is the difference in yields (basis points) between 10-year and 1-year Treasury bonds. This measure, which captures expected changes in future risk-free interest rates, should relate to a firm’s interest rate hedging decision. Since we measure loan rates as the spread over risk-free rates (risk premium), the yield curve should not directly affect current loan rates.

Consistent with previous research, we find larger firms with higher marginal tax rates and higher leverage ratios are more likely to use derivatives, suggesting that the decision to use derivatives is affected by scale economies, expected tax savings, and agency conflicts of debt. We extend the previous hedging literature by examining factors related to hedge commitments. Our bivariate Probit model explicitly examines why some loan contracts include interest rate protection covenants while others do not. We find that firms with a natural exposure to interest rate risk, captured by a negative correlation between sales and interest rate changes, are more likely to be mandatory users. We also examine the role of accounting conservatism in the derivative use decision and find that, consistent with what would be expected if conservatism serves as a commitment mechanism, the association between
derivative use and firms’ natural hedge position is dependent on the extent of accounting conservatism for voluntary users but not for mandatory users. We also predict that, since distressed firms are most subject to agency conflicts, they are more likely to need a credible commitment mechanism to convince lenders that they will continue to hedge after they enter the loan. Consistent with this prediction, we find that interest rate protection covenants are more likely for high default risk borrowers. In particular, mandatory users are smaller, less profitable firms with lower credit ratings. They also have stricter contract terms including a greater number of other covenants and a higher likelihood of a collateral requirement. Specifically, 91% of loans with interest rate protection covenants also require collateral, compared with 60% for non-users and 51% for voluntary users. Overall, these results suggest that hedging determinants and incentives differ for borrowers who hedge voluntarily compared with those with covenants requiring them to hedge.

If commitment is important in mitigating agency conflicts and the interest rate protection covenant serves as an effective commitment mechanism, then we expect to find reduced costs of debt for mandatory users. For voluntary users, we expect any interest rate reduction will likely depend on the extent of their commitment to hedge as reflected in their accounting conservatism. Using different measures of accounting conservatism, we find empirical results consistent with these predictions. Overall, we find that interest rates are lower for loans with interest rate protection covenants relative to both non-users and voluntary users. In contrast, we do not find evidence that voluntary users reduce their loan rates on average, despite their derivative use. Consistent with the argument that accounting conservatism enhances the hedge commitment, we find that the interest rate reduction for voluntary users increases with their accounting conservatism. In contrast, we do not find this effect for mandatory users. Finding that the costs of debt are reduced only for derivative users that can commit to hedge demonstrates that commitment is an important factor in solving conflicts between shareholders and debt holders.

Our study makes three contributions. First, by examining a setting where firms are contractually obligated to use derivatives, we provide the first large-sample evidence of the importance of a credible hedge commitment in reducing agency costs of debt. Previous research emphasizes the importance of hedge commitments and acknowledges that debt covenants might provide a credible commitment mechanism (Smith and Stulz 1985; Campbell and Kracaw 1990; Bessembinder 1991; Doherty 2000). However, explicit study of how a hedge commitment affects firms’ financing activities has been limited to Chidambaran et al. (2001), who examine a single gold mining firm’s pre-commit to hedge using commodity-linked bonds. We complement their study by investigating a broader setting that allows firms to achieve a similar commitment by including hedging covenants in their loan contracts.

Second, by separately studying firms contractually obligated to hedge versus firms that hedge voluntarily, we extend previous corporate risk management research that implicitly assumes that all derivative use is voluntary.3

3 An exception is Gezcy et al. (1997), who recognize that lenders may require borrowers to follow certain hedging strategies. They note that at least four of their sample firms have interest rate hedge covenants. However, they do not specifically investigate these mandatory derivative users.
Third, we contribute to the literature on the role of accounting conservatism in facilitating efficient debt contracting by identifying a new channel through which accounting conservatism reduces debt costs by enhancing hedge commitments for voluntary users.

The paper proceeds as follows. Section 2 provides background and a literature review. We develop our hypotheses in Sect. 3. Section 4 describes our sample selection and research design. We present the empirical results in Sect. 5 and conclude in Sect. 6.

2 Background and literature review

2.1 Background

2.1.1 Syndicated loan floating interest rates

Most syndicated loans charge floating interest rates. In the *Handbook of Loan Syndications and Trading*, Taylor and Sansone (2006) summarize the characteristics of syndicated loans as follows:

- **Floating Interest Rate**: The market convention today is a rate that is quoted as a spread over a floating-rate index. That index is the three- or six-month LIBOR (London Interbank Offered Rate). In the past, other indexes have been used, such as the prime rate, banker’s acceptance rates, or even the fed funds rate.

- **Prepayment without penalty**: Since the loans are floating rate, they carry the “free option” of being “called.” In other words, the loans can be repaid at any time without penalty. Those prepayments generally occur at interest payment dates to avoid the breakage cost of the index rate setting.

The handbook suggests that syndicated loans charge floating rates to facilitate prepayment without penalty. Public debt typically charges fixed rates and requires a call premium.

Vickery (2008) provides two alternative rationales for why banks might prefer to lend at floating rates. First, he argues that, in periods of rising rates, there is an outflow of deposits from the banking system, which banks cannot costlessly replace with other sources of finance. Lending at a floating rate would at least partially hedge this funding risk. Second, he argues that floating rate business loans can be used to hedge the maturity mismatch between deposits and long-term mortgage loans. Consistent with these arguments, Carey et al. (1993) suggest that economies of scope are probably the main reason for the observed division of lending between banks and other financial institutions such as insurance companies. This is because different financial institutions specialize in different liability-side lines of business at least partly due to regulatory restrictions and banks are more likely than other financial institutions to profit from short-term floating rate loans. We do not explore these alternative explanations for why banks virtually always lend at floating rates but instead take this as a given in the market we study.
2.1.2 Interest rate protection covenants

Interest rate protection covenants are affirmative covenants requiring borrowers to use derivative contracts to effectively convert at least some of their floating-rate debt into fixed-rate debt. Therefore, a bank loan contract that includes an interest rate protection covenant is in essence partially a fixed rate loan. *The Handbook of Loan Syndications and Trading* explains that “the credit agreement may compel the borrower to undertake a certain minimum amount of interest hedging in order to guard against swings in interest rates that could jeopardize the borrower’s ability to service interest on the loans.” The following is an example of a bank loan contract that requires interest rate protection. Lecroy’s Credit Agreement states that:

The Borrower will, within 90 days from the Funding Date, enter into one or more Interest Rate Protection Agreements covering the interest payable with respect to at least 50 percent of the outstanding principal amount of the Term Loan for a period of at least three years.

Where an

“Interest Rate Protection Agreement” shall mean any interest rate swap agreement, interest rate cap agreement, interest rate collar agreement, interest rate hedging agreement or other similar agreement or arrangement.

Although banks may hope to generate fee income by selling borrowers derivative products, interest rate protection covenants cannot require borrowers to enter interest rate protection agreements with the lending banks. In practice, borrowers may voluntarily enter “back-to-back” swap transactions with the lenders where borrowers swap to fixed rate with the lenders and lenders simultaneously enter into fixed-to-variable rate swaps with other swap dealers. Borrowers who do not have the in-house expertise to determine the best way to satisfy the interest rate protection requirements may engage in transactions with swap dealers through the help of derivative advisory companies. For example, Cardea partners state that:

Many commercial banks have made it common practice to include a mandatory hedging requirement as a pre-condition of obtaining a credit facility for borrowers. This specification generally details the percentage of the financing that needs to be hedged as well as the term of the hedge. … Borrowers do have choices and there are laws that restrict banks from tying certain products and services. Mitigating interest rate risk has clear benefits for both lender and borrower, but banks have shifted the burden of risk management onto the borrower’s shoulders. If your organization is required to hedge, [we] can identify a full suite of options available in the marketplace and can help you identify the most flexible, cost-effective solution.

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4 Section 106 of the Bank Holding Company Act Amendments of 1970 prohibits banks from conditioning the availability or terms of loans on the purchase of certain other products and services.

5 We thank Chris Hunt, Principal at Cardea Partners ([http://www.cardeapartners.com/](http://www.cardeapartners.com/)) for providing the institutional knowledge about deal arrangements and information about the hedge accounting treatment for derivative contracts that are entered to fulfill interest rate protection covenant requirements.
There are at least two reasons why banks prefer to lend at a variable rate and require the borrower to swap to a fixed rate rather than to lend at a fixed-rate and swap to a variable rate themselves. First, the majority of secondary loan market investors are fixed income investors who prefer to invest in floating rate loans. Floating rate loans provide secondary market investors a unique diversification opportunity because they are structurally different from bonds and have yields with a low correlation with other assets classes (Page et al. 2011). Second, variable rate loans combined with interest rate swaps provide more flexibility than simple fixed rate loans. For example, the covenant can require borrowers to fix the loan rates not only on the current borrowing but also on past or future borrowings. In fact, over 30% of the interest rate protection covenants require hedging of the firms’ entire outstanding debt. There are also cases where borrowers are required to hedge only when some contingent events happen, such as LIBOR increasing to a certain level or the borrower’s debt to cash flow ratio reaching a certain threshold.

2.1.3 Accounting for pay-fixed swaps

Hedge accounting for pay-fixed receive-variable interest rate swaps recognizes the current period cash flows from the swaps as an adjustment to the interest expense associated with the hedged debt. Before the adoption of FAS 133, swap fair values were not recognized on the balance sheet. After the adoption of FAS 133 in 2000, borrowers are required to recognize swap fair values on their balance sheets and have the option to designate pay-fixed receive-variable interest rate swaps as cash flow hedges if the hedge is highly effective. For both pre- and post-FAS 133 regimes, changes in the fair value of future swap payments are generally not recognized in income. However, under certain circumstances, borrowers could recognize gains on these contracts in the income statement. In the pre-FAS 133 regime, unrealized gains and losses can be recorded in income once the borrower settles the derivative contract. Similarly in the post-FAS 133 regime, unrealized gains and losses can be recorded immediately after the settlement of the swap if the borrower can argue that it is probable that the forecasted variable interest payments on the debt will not occur. In an increasing interest rate environment, the accounting treatment for the variable-to-fixed interest rate swap value increases provides an incentive for borrowers who want to increase reported earnings to settle the hedge position before maturity.

The incentives to undo hedge positions provided by hedge accounting occur in periods of rising interest rates when banks are the most concerned about the borrowers’ ability to make their interest payments. Banks are less likely to be

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6 The fact that interest rate protection covenants may require hedging for only part of the relevant debt outstanding for a period less than the maturity does not imply that the hedge is ineffective. In a discussion of cash flow hedges, FAS 133 paragraph 28 states: “An entity may designate a derivative instrument as hedging the exposure to variability in expected future cash flows that is attributable to a particular risk. That exposure may be associated with an existing recognized asset or liability (such as all or certain future interest payments on variable-rate debt) or a forecasted transaction (such as a forecasted purchase or sale).” FAS 133 paragraph 98 and 99 example 8 further demonstrates this point. Chris Hunt of Cardea Partners also verified this accounting treatment.
concerned with borrowers’ incentives to unwind hedge positions in a declining rate environment because the risk that borrowers cannot make their interest payments is lower when rates decline.\textsuperscript{7}

In short, the accounting treatment for interest rate derivatives related to a floating rate loan may exacerbate borrowers’ risk shifting incentives. Borrowers interested in managing earnings upward have greater incentives to unwind their hedge positions in a rising interest rate environment, a time when they need interest rate protection the most.

2.2 Literature review

2.2.1 Hedging, commitment, and agency costs of debt

The hedging literature includes several theories of how hedging can increase firm value by reducing creditor-shareholder conflicts. Smith and Stulz (1985) argue that hedging reduces the probability and cost of financial distress by reducing cash flow volatility. However, they point out that it is difficult for firms to convince creditors that they will maintain the hedge after the debt issuance because hedging also redistributes wealth from shareholders to debt holders. Froot et al. (1993) propose that the more stable cash flows created by hedging can mitigate underinvestment problems that arise when firms with investment opportunities face financial constraints. Doherty (2000) argues that the ability to obtain external financing may depend on whether firms can credibly commit to hedge.

Theoretical research on hedging suggests a positive association between firms’ financial constraints and hedging activities. However, the empirical evidence is mixed. For example, Nance et al. (1993) find that derivative users are larger and face more convex tax functions but find no evidence of higher leverage ratios that might suggest greater financial constraints. In contrast, Haushalter (2000) finds the leverage ratio to be the most significant factor explaining the hedge ratio for 100 oil and gas producers. In summarizing the findings for non-financial firms’ incentives to use derivatives, Bartram et al. (2009) note: “As a whole, the findings of empirical studies remain controversial because the conclusions are largely sample specific.” They argue that lack of power produces the mixed findings. Finally, a recent study by Campello et al. (2010) finds that using derivatives reduces borrowers’ costs of debt. But they do not examine how their results are affected by hedge commitments.

By focusing on debt covenants that obligate firms to hedge interest rate risk and the potential reduction in borrowing rates, our paper provides a powerful setting to examine whether hedge commitments reduce the agency costs of debt. Prior conflicting findings could reflect the fact that these studies have largely ignored the commitment issue, which Smith and Stulz (1985) argue to be important given firms’ strong incentives to unwind hedges once financing is obtained. Creditors who know this ex ante will not factor the credit enhancement into the debt pricing unless the

\textsuperscript{7} In an interest-decreasing environment, borrowers may want to unwind the pay-fixed receive-floating hedge position and recognize a loss in order to smooth their earnings.
firm can credibly commit to maintain the hedge. Interest rate protection covenants provide us the setting to address the commitment issue.

One study that recognizes the importance of commitment is Chidambaran et al. (2001). They study Freeport McMoran’s (a gold mining company) gold-linked depository shares issued in 1993 and 1994. The gold-linked bonds essentially bundle financing and hedging together to address the commitment problem. Despite being financially constrained, Freeport McMoran successfully raised $359 million at a favorable rate through the gold-denominated bonds. Chidambaran et al. (2001) focus on a special case that allows a commodity company to pre-commit to hedge through commodity-linked bonds. We complement their study by investigating a more widespread mechanism that allows firms to achieve the same commitment by accepting hedging covenants in their loans.

2.2.2 Accounting conservatism and debt

Watts (2003a, b) argues that one of the most important economic rationales for accounting conservatism is to improve the efficiency of debt contracts. Consistent with this argument, Chen et al. (2007) theorize that, when accounting numbers serve both an equity valuation role and a stewardship role, managers have incentives to engage in earnings management and such manipulation leads to inferior risk sharing. They show that, when the accounting regime is unbiased and there is uncertainty about the future payoff of the firm, managers have incentives to manage accounting earnings upward to induce more favorable investor beliefs about the firm’s prospects. However, the degree of earnings manipulation is lower in the conservative accounting regime because observing a low accounting earnings number does not necessarily mean that the true economic earnings are as low. The reduction in earnings management improves risk sharing and hence contract efficiency.

Under hedge accounting, gains or losses due to price fluctuations on pay-fixed receive-floating swaps are not recognized in income. Kanageratnam et al. (2009) find that the equity market does not price hedge gains and losses not recorded in income. This provides managers with an incentive to settle hedges to produce immediate accounting gains included in net income.

Empirical research has identified several channels through which accounting conservatism mitigates agency costs of debt. For example, Ahmed et al. (2002) find that accounting conservatism mitigates bondholder-shareholder conflicts over dividend policy. Vasvari (2006) examines the effects of accounting conservatism on loan pricing, conditional on the managerial incentive structure. He finds that accounting conservatism decreases loan spreads when managers receive below-average equity compensation but that conservatism leads to larger loan spreads when managers receive above-average equity compensation. Beatty et al. (2008) find that accounting conservatism complements conservative contract modifications in loan contracts, suggesting that contract modifications alone do not fulfill the contracting demand. Loktionov (2009) shows that conservative reporting reduces risk shifting in distressed firms. Zhang (2008) documents that, in the event of economic losses, conservative accounting produces more timely transfers of control.
rights to banks via covenant violations. Her findings suggest that, by recognizing bad news more quickly, conservative financial reports facilitate the role of covenants and thus reduce creditor risk. Nikolaev (2010) provides evidence in the bond markets that firms with more public debt covenants exhibit higher levels of accounting conservatism.

Our study adds to the literature by identifying a new channel through which conservative financial reporting enhances debt contracting. In contrast to previous studies, we examine the interaction between accounting conservatism and commitment to risk management in alleviating shareholder-creditor conflicts. We show that accounting conservatism enhances borrowers’ ability to commit to hedge and therefore reduces their costs of debt.8

3 Hypotheses development

We examine the role of a commitment to hedge in reducing agency costs of debt. Hedging reduces cash flow variability, resulting in lower default risk and higher debt capacity. However, economic theories suggest that firms with higher default risk tend to engage in risk-shifting activities after the debt financing is completed. Specifically, risky borrowers have incentives to unwind hedge positions ex post. Both borrowers and creditors acknowledge this tendency and design mechanisms to address this issue. An interest rate protection covenant provides one such mechanism. By ensuring borrowers’ commitments to maintain hedge positions ex post, interest rate protection covenants mitigate agency conflicts between creditors and shareholders and therefore should reduce agency costs of debt. We hypothesize that, by accepting the covenants, mandatory users credibly commit to hedge and enjoy lower funding costs.

H1 Borrowers that commit to maintain hedge positions through interest rate protection covenants enjoy lower interest rates relative to both non-users and voluntary users.

For voluntary users, we examine whether accounting conservatism enhances their ability to commit to hedge. Without covenant restrictions, the use of derivatives to reduce cash flow volatility is not credible because of borrowers’ incentives to unwind their positions once debt financing is completed. Lenders recognize this and will not factor the hedging activities into debt pricing. However, accounting conservatism increases the likelihood that earnings will reflect the economic losses resulting from increases in the volatility of cash flows. Lower earnings and financial numbers will trigger covenant violations, allowing lenders to intervene and take remedial actions. Therefore, the cost of risk-shifting activities increases in the level of accounting conservatism. Consistent with this argument, Loktionov (2009) finds that distressed firms with more conservative accounting systems are less likely to

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8 Biddle et al. (2011) document that accounting conservatism reduces the downside risk of operating cash flows through increased cash holdings, reduced customer bargaining power, and increased hedge usage. We differ from Biddle et al. (2011) by separately analyzing mandatory users and voluntary users and by examining how accounting conservatism serves as a commitment mechanism.
engage in risk-shifting activities. In addition to the risk-taking incentives, borrowers may also unwind their hedge positions to recognize gains in the income statement when interest rates increase. Chen et al. (2007) show that firms with conservative accounting are less likely to engage in income increasing earning management. Therefore, we expect borrowers with conservative accounting will be less likely to unwind their hedge positions after they complete their financing.

For accounting conservatism to serve as a hedge commitment mechanism, conservatism cannot be changed ex post. Previous research suggests that changing financial reporting conservatism is costly, at least relative to the cost of changing derivative positions. For contracting purposes changing conservatism may not be possible under “fixed GAAP”, where the impact of changes in accounting methods on financial numbers are excluded when calculating covenant violations (Mohrman 1996; Beatty et al. 2002). In addition, litigation risk may increase when a firm’s accounting practice becomes more aggressive, especially when default risk is high. Finally, a reduction in ex ante debt costs due to accounting conservatism implicitly supports the argument that borrowers can pre-commit to certain conservatism levels. Consistent with these arguments, Beatty et al. (2008) do not find that firms reduce their conservatism level after entering loan contracts. In summary, we expect voluntary users with more conservative accounting systems to be better able to commit to hedge, thereby enjoying reduced debt costs.

H2 The interest savings for voluntary users relative to non-users are positively associated with accounting conservatism.

Note that we do not have a directional prediction comparing the interest savings between mandatory users and voluntary users who also engage in conservative reporting. Both derivative users commit to hedge, one using an interest rate protection covenant and the other using conservative accounting practices. If by being conservative, voluntary users achieve the same commitment level as mandatory users, we would expect these two groups of borrowers to have the same magnitude of interest savings. In contrast, if conservatism is not as strong of a commitment mechanism as interest protection covenants, we would expect mandatory users to achieve bigger interest savings than voluntary users who employ conservative accounting.

4 Data and research design

4.1 Sample selection

We use Loan Pricing Corporation’s Dealscan and SEC’s EDGAR databases to construct our sample. The Dealscan “Tear Sheets” provide extensive covenant information for a sub-sample of loans in the database. We identify interest rate protection covenants in 445 of the 2,188 Tear Sheets from 1995 to 2005. We supplement the Tear Sheet sample by searching all credit agreements included as material contract exhibits in 10-K and 8-K filings during the same period. We identify 10,059 credit agreements, of which 1,188 have interest rate protection
covenants. We manually verify the accuracy of the search results by reading the covenant section of the 1,188 credit agreements. We further require our sample firms to be nonfinancial firms covered by LPC and COMPUSTAT. Using these selection criteria, we obtain a sample of 4,018 loans, of which 415 include interest rate protection covenants (mandatory users).

For the 3,603 loans without an interest rate protection covenant, we read the companies’ 10-K filings both in the year immediately before the borrowing and in the year of the borrowing to identify voluntary users. First, we identify firms that already have interest rate derivative instruments outstanding at the time of the loan contract. We expect that, if commitment is not an issue, banks will factor the borrower’s existing derivative positions into the loan pricing. Second, we consider the possibility that companies may hedge after the loan origination and identify firms that enter new variable to fixed rate derivative instruments (including swaps, caps, and collars) to hedge the new loan. We include both types of voluntary users in our analysis.

After requiring data for constructing at least one accounting conservatism measure and other non-missing information on firm and loan characteristics used in the regression analysis, we have in total 2,338 bank loans consisting of 263 mandatory users, 709 voluntary users, and 1,366 non-users. Table 1 Panel A reports the sample selection process. All sample loans are based on floating rates that vary with the LIBOR. Table 1 Panel B reports the industry distribution for mandatory users, voluntary users, and non-users, respectively. Mandatory users represent a smaller percentage of firms in the mining and construction industry (5.32 %) relative to voluntary users (9.73 %) and non-users (11.56 %). The transportation, communication, and utilities industry includes more mandatory users (19.39 %) and voluntary users (15.79 %) than non-users (13.47 %). Finally, the personal and business services industry is comprised of more mandatory users (14.45 %) than voluntary users (8.60 %) and non-users (12.66 %). Overall, all three groups consist of firms across various industries and exhibit similar industry representation.

4.2 Research design

4.2.1 Determinants of derivative use and mandatory derivative use

Directly estimating an OLS regression of loan spreads on derivative use and mandatory derivative may suffer from an endogeneity bias because factors affecting derivative use and interest rate protection covenant use may be related to loan interest spreads. For example, if mandatory derivative users have higher credit risk, which is not perfectly controlled for, this could lead to the incorrect inference that these covenants lead to no interest rate saving or even to interest rate increases. We

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9 We can clearly identify voluntary users when firms explicitly disclose the purpose of the new derivative contracts in their 10-K filings. When firms do not disclose the purpose of their derivative contracts, we examine the change in the notional amount of the variable-to-fixed derivative instruments (swaps, caps, and collars) between the fiscal year of loan origination and the fiscal year prior to loan origination. If the change in the notional amount is positive, we consider the loan to have been (at least partially) swapped to fixed-rate.
believe unobservable factors are likely to be very important in our setting, suggesting that methods, such as propensity score matching, that do not accommodate unobservable factors may not be appropriate. In addition, the joint nature of derivative use and mandatory derivative use poses additional challenges in using this type of approach. While we appreciate that there are trade-offs in the methods used to address endogeneity, we believe that in our setting the benefits of an instrumental variable approach exceed those of other approaches. Therefore, we use instrumental variables to address the endogeneity concern when testing our main hypothesis that hedge commitments reduce interest rates. We build a bivariate Probit model to first examine the incentives to use derivatives and the incentives to include interest rate protection covenants in the syndicated loan contracts. A bivariate model has the advantage of incorporating all the information in the second stage loan spread model and thus increases the power of the test. This advantage comes from the fact that a bivariate model allows us to obtain for each borrower the predicted probability that such a borrower uses derivatives and the joint probability that such a borrower not only uses derivatives but uses derivative mandatorily.

| Panel A: Sample selection                                                                 |
|------------------------------------------------------------------------------------------|---|
| Total credit agreements identified with 10-K wizard and Tear Sheets from 1995 to 2005     | 10,059 |
| Credit agreements with COMPUSTAT coverage                                                | 4,018  |
| Credit agreements with at least one accounting conservatism measure and other non-missing variables | 2,338  |
| Number of loans (firms) with interest rate protection covenant (mandatory users)          | 263 (229) |
| Number of loans (firms) without interest rate protection covenant but with interest rate derivatives in place at time of loan initiation (voluntary users) | 709 (491) |
| Number of loans (firms) without interest rate protection covenant or interest rate derivatives at time of loan initiation (non-users) | 1,366 (958) |

| Panel B: Industry distribution of mandatory users, voluntary users and non-users          |
|------------------------------------------------------------------------------------------|---|
| 01–09 Agriculture                                                                       | Mandatory users (%) | Voluntary users (%) | Non-users (%) |
| 10–19 Mining and construction                                                            | 0.00                  | 0.14                | 0.15           |
| 20–27 Food, paper, and finished goods                                                    | 12.16                 | 11.28               | 10.83          |
| 28–29 Chemicals and pharmaceuticals                                                      | 3.80                  | 6.34                | 5.34           |
| 30–34 Rubber, leather, and metal works                                                   | 7.22                  | 9.73                | 6.44           |
| 35–36 Machinery and electronics                                                          | 11.02                 | 11.86               | 10.86          |
| 37–39 Other equipment and machinery                                                      | 7.98                  | 8.46                | 7.54           |
| 40–49 Transportation, telecom and utilities                                              | 19.39                 | 15.79               | 13.47          |
| 50–51 Wholesalers                                                                       | 3.42                  | 5.41                | 4.83           |
| 52–59 Retailers                                                                         | 9.50                  | 9.87                | 10.54          |
| 70–79 Personal and business services                                                     | 14.45                 | 8.60                | 12.66          |
| 80–99 Other services                                                                    | 5.70                  | 3.95                | 5.85           |
| Total                                                                                   | 100                   | 100                 | 100            |
These two predicted probabilities make incorporating all user types in the second stage possible.\textsuperscript{10}

\[
\begin{align*}
\text{USE} &= \beta_0 + A \times \text{Instruments} + \beta_1 \text{NATURAL}_P + \beta_2 \text{NATURAL}_N \\
&\quad + \beta_3 \text{CONSERV} + \beta_4 \text{CONSERV} \times \text{NATURAL}_P \\
&\quad + \beta_4 \text{CONSERV} \times \text{NATURAL}_N \\
&\quad + C \times \text{Firm Characteristics} + D \times \text{Loan Characteristics} + u
\end{align*} 
\]

\[
\begin{align*}
\text{MAND} &= \gamma_0 + A' \times \text{Instruments} + \gamma_1 \text{NATURAL}_P + \gamma_2 \text{NATURAL}_N \\
&\quad + \gamma_3 \text{CONSERV} + \gamma_4 \text{CONSERV} \times \text{NATURAL}_P \\
&\quad + \gamma_5 \text{CONSERV} \times \text{NATURAL}_N \\
&\quad + C' \times \text{Firm Characteristics} + D' \times \text{Loan Characteristics} + v
\end{align*} 
\]

USE equals 1 for mandatory users or voluntary users, 0 for non-users. MAND equals 1 for mandatory users, 0 for voluntary users or non-users.

We identify three instruments that are related to the borrower’s propensity to use derivatives but are not directly related to the interest rates charged on the syndicated loans. Our first instrument is the portion of before-financing marginal tax rate unexplained by profitability (MTR\_Resi). Leland (1998) proposes that hedging increases debt capacity and that the associated increase in interest deductions reduces tax liabilities and therefore increases firm value. Graham and Rogers (2002) empirically test this prediction and find that firms hedge to increase their debt capacity and this incentive is positively associated with marginal tax rates. Thus we expect the marginal tax rate to be positively associated with a firm’s hedge decision. Since profitable firms tend to have higher marginal tax rates and profitability may reduce loan rates, we construct our instrument by first parsing out profitability. Specifically, we first calculate the before-financing marginal tax rate (MTR) following Graham and Mills (2007) for the loan initiation year. Since the input variables to calculate MTR include an indicator variable for whether a firm has an operating loss carry forward and an indicator variable for whether a firm incurs pre-tax losses, MTR can potentially affect the risk premium. We then regress MTR on the above two indicator variables and operating income before interest, tax, depreciation and amortization scaled by lagged total assets. We use the residuals from the regression to capture the tax incentive to hedge that is unrelated to loan interest rates.

Our second instrument is the proportion of existing long-term debt maturing in more than 1 year (PROP) measured at the fiscal year end prior to loan initiation. Thatcher (1985) shows that the maturity of existing debt predicts a firm’s choice to issue fixed rate debt that is callable for reasons other than interest rate changes. Denis and Mihov (2003) show that the maturity of existing debt predicts the choice of fixed rate debt over floating rate debt. Since syndicated loans with

\textsuperscript{10} An alternative modeling choice is to separately compare non-users with voluntary users, non-users with mandatory users, and voluntary users with mandatory users. However, comparing only two groups at a time ignores the information contained in the third group, thereby reducing the power of the empirical tests. We conduct robustness checks using this alternative design in subsection 5.4, where we discuss any difference in the results.
variable-to-fixed rate swaps incorporate both the fixed-rate and the callable features, we expect the maturity of existing debt to be positively associated with the propensity of derivative use. Almeida et al. (2010) argue that, although the choice between long-versus short-term debt is correlated with firm characteristics, current long-term debt maturity structures are affected by hard-to-reverse decisions that may have been made several years earlier and it is unlikely for firms to keep optimal debt maturities at all times. Consistent with this argument, Barclay and Smith (1995) find little evidence that firms use maturity structure to signal credit quality. Thus we do not expect the existing debt maturity to be directly related to loan interest rates.

The third instrument is the difference in yields between a 10-year Treasury bond and a 1-year treasury bond measured in the month of loan initiation. The yield spreads capture expected changes in future risk-free interest rates. Since lenders’ main concern is that borrowers cannot fulfill their interest payment obligations in an increasing interest rate environment, we expect the association between yield spreads and inclusion of interest rate protections covenants in loan contracts to be positive. Although yield spreads might be correlated with loan spreads if both spreads are affected by general macro-economic conditions, we control for macro-economic conditions by including year fixed effects in all models. We also measure loan spreads using the current risk premium that already parses out the risk free rate (loan interest rates above LIBOR), and thus we do not expect yield spreads (which capture changes in risk free interest rates) to be directly associated with loan rates.

We include firms’ natural hedge positions in the bivariate Probit model. Similar to Vickery (2008), we measure natural hedge positions (NATURAL) as the sum of the coefficients on current and one period lagged 12-month treasury rates from a regression of sales scaled by total assets on these variables, as well as a constant, time trend, and log time trend. The regression is estimated at the 2-digit SIC industry level. We expect firms to be less likely to hedge interest rate risk if they have a natural hedge against such risk (i.e., a negative coefficient on NATURAL). We allow separate coefficients for negative natural hedge positions (NATURAL_N), when sales revenue decreases with increases in interest rates, and for positive natural hedge positions (NATURAL_P), when sales revenue increases with increases in interest rates. If banks are primarily concerned with borrowers’ ability to make interest payments in an increasing interest rate environment, we expect the negative association between derivative use and the natural hedge position to be stronger for firms with negative natural hedge positions.

We include accounting conservatism in the first stage bivariate Probit model to examine the role of conservatism in enhancing the hedge commitment. We follow prior literature and employ multiple accounting conservatism measures in our tests. Our first measure, CONSERV_KW, follows Khan and Watts (2009) and is constructed for each firm-year based on size, leverage ratio, and book-to-market ratio. Our second measure, CONSERV_SK, is the difference between the skewness in operating cash flows and earnings before extraordinary items (Givoly and Hayn 2000; Beatty et al. 2008). We measure skewness using cash flows and earnings information from the previous 12 quarters, requiring at least five quarters of data prior to entering into the loan. CONSERV_AC is our third measure of accounting conservatism and is the average non-operating accruals scaled by total assets over
the 3-year period prior to loan origination (Givoly and Hayn 2000). Finally, we extract the principal component of the above three measures as our fourth measure of accounting conservatism (CONSERV).\textsuperscript{11} We rank all these conservatism measures into deciles with higher levels indicating more conservative reporting. We also interact accounting conservatism with firms’ natural hedge positions to allow the possibility that not all voluntary users are hedging. Previous research finds firms may use derivatives to speculate (Faulkender 2005; Geczy et al. 2007). If true, accounting conservatism may not be directly related to derivative use. Firms with negative natural hedge positions are more subject to interest rate fluctuation risk and may be less likely to speculate. Therefore these firms are more likely to use conservative accounting to commit to hedge.

The previous literature suggests that firm size, leverage, profitability, and growth options affect derivative use (Mian 1996; Haushalter 2000; Geczy et al. 1997). We include the following controls: the natural log of sale revenue (SIZE), the ratio of total debt to total assets (LEV), profit margin (PM), and research and development expense scaled by sales (RD). We also control for whether the borrower is rated (RATE) and its S&P credit ratings (SPRATE), which ranges from 1 for AAA to 22 for D for firms with ratings and equals 0 for firms without ratings. All of these firm characteristics are measured at the fiscal-year end before loan contract initiation. Since the derivative use is associated with the new borrowing, we also include a set of loan characteristics: collateral requirements (SECURE), maturity (MATURE), loan type (TERM), secondary sales (SECOND), loan purpose (TAKEOVER), the number of financial covenants (NCOV), the number of lenders (NLENDER), borrowing amount scaled by total assets (LOANSIZE), and performance pricing (PERFORM).\textsuperscript{12} All of these firm and loan controls are also expected to affect the loan rates in the second stage. We provide detailed variable definitions in “Appendix”.

4.2.2 Interest rate spread model

We estimate the following regression to test our first hypothesis that a commitment to hedge through interest rate protection covenants reduces costs of debt.

\[ AISD = \alpha_0 + \alpha_1 \text{UŠE} + \alpha_2 \text{MÅND} + E \times \text{Firm Characteristics} \\
+ F \times \text{Loan Characteristics} + \varepsilon \]  

\textsuperscript{11} The principal components analysis shows that only the first eigenvalue is significantly greater than 1. Therefore, one factor captures much of the common variations among the three conservatism measures.

\textsuperscript{12} Consistent with previous research, such as Vasvari (2006) and Zhang (2008), we treat these other loan characteristics as exogenous in our models. While we appreciate that all of these characteristics might be endogenously determined, we believe that their choice is not a first order concern in addressing our focal issue of hedge commitment. The large dimensionality of the loan characteristics that we control for makes it undesirable to model all of these characteristics as endogenous choices. For example, if we want to simultaneously model the inclusion of 4 different covenants (sample mean of NCOV is 4) and the security requirement, we need to estimate a system that requires numerical integration over a 5 dimensional normal density to obtain the maximum likelihood. This is a numerically infeasible task. In fact, Freedman (2009) states that “finding maxima in high-dimensional spaces is something of a black art; and the higher the dimensionality, the blacker the art.”
AISD is the loan spread above LIBOR for each deal. Following Sufi (2007), we conduct the analysis at the deal level rather than the facility level, because syndicated loan contracts are drafted at the deal level and the interest rate protection covenants apply to all facilities in a deal. If one deal consists of multiple facilities, AISD is measured as the average across all facilities.\(^{13}\) Since the derivative use decision is likely to be endogenously determined, we include the predicted probability of USE \((\hat{U}SE)\) from the first stage bivariate Probit model (Eqs. (1) and (2)). To account for the fact that mandatory users are a subgroup of derivative users, M\(\overline{AND}\) \(\text{in Eq. (3)}\) equals the predicted joint probability of both \(USE = 1\) and \(MAND = 1\) from the first stage bivariate Probit model. Control variables include all the exogenous variables from the first stage except for the three instruments.

In Eq. (3), \(x_1\) captures the difference in interest rates between voluntary users and non-users, and \(x_2\) captures the difference in interest rates between mandatory users and voluntary users. If a commitment to hedge is important in reducing agency costs of debt and interest rate protection covenants serve as a credible commitment mechanism, we expect mandatory users to enjoy lower interest rates relative to both voluntary users and non-users \((x_2 < 0\) and \(x_1 + x_2 < 0\)). In addition, we do not expect voluntary users to receive lower interest rates \((x_1 = 0)\).

To test our second hypothesis that accounting conservatism facilitates voluntary users’ hedge commitments, we estimate the following regression.

\[
\begin{align*}
\text{AISD} &= \delta_0 + \delta_1\hat{U}SE + \delta_2\hat{M}\overline{AND} + \delta_3\hat{CONSERV} + \delta_4\hat{USE}\hat{CONSERV} \\
&\quad + \delta_5\hat{MAND}\hat{CONSERV} + E' \ast \text{Firm Characteristics} \\
&\quad + F' \ast \text{Loan Characteristics} + \varepsilon \\
\end{align*}
\]

Similar to Eq. (3), in Eq. (4) is the predicted probability of \(USE = 1\) from the first stage bivariate Probit model, and is the predicted joint probability of both \(USE = 1\) and \(MAND = 1\) from the bivariate Probit model. Since \(USE\) and \(MAND\) are endogenous, their interaction terms \(USE\ast\hat{CONSERV}\) and \(MAND\ast\hat{CONSERV}\) are endogenous as well. As pointed out in Beaver et al. (2012), the accounting and finance literature usually instruments a function of the endogenous variable, not through building a separate first-stage, but via directly plugging in the predicted value of the endogenous variable in the function. This approach is referred to as a “forbidden regression” in Wooldridge (2010), which may result in biased coefficient estimates. Following Wooldridge (2010) and Beaver et al. (2012), we build the following separate first-stage models for \(USE\ast\hat{CONSERV}\) and \(MAND\ast\hat{CONSERV}\).

\[
\begin{align*}
USE \ast \hat{CONSERV} &= \alpha \hat{U}SE \ast \hat{CONSERV} + \Psi X + \varepsilon \\
MAND \ast \hat{CONSERV} &= \beta \hat{M}\overline{AND} \ast \hat{CONSERV} + \theta X + \varepsilon \\
\end{align*}
\]

\(X\) is the set of exogenous variables including the constant, three instruments (MTR_Resi, PROP, and YIELD), and all firm and loan characteristics.

\(^{13}\) In our sample, 55% of the deals contain only one facility. Our results are robust to alternative specifications such as using only the facility with the largest borrowing amount or using a weighted average of all facilities in the deal where the weights equal the borrowing amounts. See subsection 5.4 Sensitivity Tests for more discussions.
USE\textsuperscript{C3} CONSERV in Eq. (4) refers to the fitted values from Eq. (5) and MAND\textsuperscript{C3} CONSERV in Eq. (4) refers to the fitted values from Eq. (6).

In Eq. (4), $\delta_4$ captures how interest savings for voluntary users vary with accounting conservatism. If accounting conservatism enhances voluntary users’ ability to commit and a credible hedge commitment reduces interest rates, we expect $\delta_4$ to be negative. $(\delta_4 + \delta_5)$ captures how interest savings for mandatory users vary with accounting conservatism. Since mandatory users have committed to hedge positions through the interest rate protection covenants, they do not need conservatism as a commitment mechanism. Therefore we expect $(\delta_4 + \delta_5)$ to be insignificant. Since $\delta_5$ captures the differential impact of accounting conservatism on loan rates between voluntary users and mandatory users, we expect it to be positive.

Finally, we include industry and year fixed effects in all empirical models to control for the effects of industry and macro-economic conditions on the dependent variables.

## 5 Results

### 5.1 Descriptive analysis

Table 2 reports Pearson correlations between the main variables. We find that larger firms are more likely to be rated and have higher before-financing marginal tax rates. Consistent with prior research, we find that derivative use is positively correlated with firm size and leverage ratios. However, mandatory derivative use is negatively correlated with firm size, suggesting mandatory users and voluntary users might differ. We find firms with higher accounting conservatism are smaller, less profitable, have higher leverage ratios, and are less likely to be rated. We also find that higher interest rates are imposed on borrowers that are smaller, less profitable, and have higher leverage. These borrowers are also more likely to be required to provide collateral. Overall, these correlations are consistent with the prior literature.

Table 3 Panel A reports univariate analyses of firm characteristics and loan attributes for mandatory users, non-users, and voluntary users. We report the mean value of each variable; results based on the median values yield similar inferences and are not reported. Comparisons of MTR\textsubscript{Resi} indicate that voluntary users have the highest incentive to hedge due to tax reasons among the three groups of borrowers. We find that the debt mix for both mandatory users and voluntary users has a longer maturity relative to non-users, suggesting that these firms may prefer fixed rate callable debt. Inconsistent with the argument that firms with natural hedge positions are less likely to hedge, we find the natural hedge position for voluntary users is significantly higher than both mandatory users and non-users. We do not find the natural hedge position to be different between mandatory users and non-users.

We find that mandatory users have higher default risk measured at both firm and loan levels. Specifically, at the firm level mandatory users are smaller, less profitable, and have higher leverage ratios and lower credit ratings relative to either non-users or voluntary users. Using the existence of a rating as a proxy for access to
|   | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-----|
| USE (1) | 1.00 |   |   |   |   |   |   |   |   |       |       |     |
| MAND (2) | 0.42 | 1.00 |   |   |   |   |   |   |   |       |       |     |
| AISD (3) | 0.00 | 0.24 | 1.00 |   |   |   |   |   |   |       |       |     |
| MTR_Resi (4) | 0.03 | -0.05 | -0.20 | 1.00 |   |   |   |   |   |       |       |     |
| PROP (5) | 0.10 | 0.05 | -0.09 | -0.02 | 1.00 |   |   |   |   |       |       |     |
| NATURAL_P (6) | 0.03 | -0.04 | -0.07 | 0.05 | 0.07 | 1.00 |   |   |   |       |       |     |
| NATURAL_N (7) | 0.06 | -0.04 | -0.09 | 0.11 | 0.04 | 0.46 | 1.00 |   |   |       |       |     |
| CONSERV (8) | -0.06 | 0.07 | 0.42 | -0.06 | -0.12 | -0.12 | -0.04 | 1.00 |   |       |       |     |
| SIZE (9) | 0.17 | -0.14 | -0.40 | 0.20 | 0.11 | 0.13 | 0.24 | -0.33 | 1.00 |       |       |     |
| LEV (10) | 0.13 | 0.11 | 0.30 | -0.16 | 0.16 | 0.06 | -0.01 | 0.24 | -0.05 | 1.00 |       |     |
| PM (11) | 0.02 | -0.06 | -0.19 | -0.06 | 0.16 | 0.02 | -0.20 | -0.23 | -0.07 | 0.04 | 1.00 |     |
| RATE (12) | 0.13 | -0.08 | -0.17 | 0.01 | 0.24 | 0.12 | 0.08 | -0.18 | 0.57 | 0.25 | 0.12 | 1.00 |
| SPRATE (13) | 0.10 | -0.01 | 0.04 | -0.08 | 0.25 | 0.07 | 0.03 | -0.03 | 0.39 | 0.37 | 0.07 | 0.92 |
| RD (14) | -0.05 | -0.04 | -0.03 | 0.05 | -0.15 | -0.09 | 0.01 | 0.01 | -0.03 | -0.18 | -0.10 | -0.06 |
| SECURE (15) | 0.00 | 0.22 | 0.66 | -0.17 | -0.04 | -0.10 | -0.06 | 0.36 | -0.44 | 0.21 | -0.11 | -0.22 |
| MATURE (16) | 0.15 | 0.20 | -0.01 | -0.07 | 0.16 | -0.01 | 0.06 | -0.03 | -0.10 | 0.06 | 0.08 | -0.03 |
| SECOND (17) | 0.18 | 0.32 | 0.41 | -0.12 | 0.06 | 0.02 | 0.04 | 0.10 | -0.03 | 0.17 | -0.05 | 0.06 |
| TERM (18) | 0.17 | 0.34 | 0.44 | -0.13 | 0.03 | 0.00 | 0.00 | 0.13 | -0.19 | 0.19 | -0.03 | -0.07 |
| NCOV (19) | 0.05 | 0.25 | 0.18 | -0.08 | 0.08 | -0.07 | 0.01 | 0.17 | -0.28 | 0.07 | -0.04 | -0.20 |
| NLENDER (20) | 0.23 | 0.04 | -0.31 | 0.06 | 0.15 | 0.11 | 0.09 | -0.24 | 0.51 | 0.10 | 0.12 | 0.41 |
| TAKEOVER (21) | 0.06 | 0.14 | 0.11 | -0.01 | 0.03 | -0.02 | 0.01 | 0.00 | -0.01 | 0.03 | 0.01 | 0.01 |
| PERFORM (22) | 0.08 | -0.01 | -0.23 | 0.07 | 0.09 | -0.01 | 0.06 | -0.13 | 0.08 | -0.08 | 0.14 | 0.05 |
| LOAN_SIZE (23) | -0.07 | 0.06 | 0.06 | -0.10 | -0.06 | -0.08 | -0.10 | 0.23 | -0.51 | -0.03 | -0.05 | -0.32 |
| YIELD (24) | 0.04 | -0.08 | 0.10 | 0.01 | -0.02 | 0.01 | 0.00 | -0.03 | 0.15 | -0.01 | -0.01 | 0.12 |
This table presents Pearson correlation coefficients among the main variables. All variables are defined in “Appendix”. Numbers in bold indicate 1% or less level of significance.
bond markets (Faulkender and Petersen 2006), we find that mandatory users are the least likely to have access to bond markets (36 %) compared with non-users (44 %) and voluntary users (64 %). At the loan level, mandatory users are charged much higher interest rates and endure more restrictive covenant conditions than both voluntary users and non-users. The average interest rate charged for mandatory users is 78.3 basis points higher than the rate for non-users and 103 basis points higher than the rate for voluntary users. Mandatory users are also more likely to be required to provide collateral and to have a higher number of covenants in their contracts. Finally, we find that bank loans with interest rate protection covenants are more likely to be repackaged and sold on the secondary loan market (48 % compared with 9 % of non-users and 14 % of voluntary users).

Table 3 Panel B reports the distribution of the main variables. On average, borrowers have capital structures with 34 % leverage and 81 % of their existing debt matures after 1 year. Half of the borrowers have credit ratings. Collateral is required for 61 % of the loans and 59 % of the loans have performance pricing provisions. Loan contracts have on average 4 financial covenants and 10 participating lenders.

Overall Table 3 suggests that loan contracts are more likely to include interest rate protection covenants when borrowers exhibit higher default risk. These borrowers are charged a higher interest rate on the loan and are subject to more restrictive covenant conditions. The difference in various characteristics between mandatory and voluntary users suggests that the two groups are likely to have very different incentives for entering derivative contracts.

5.2 Incentives for derivatives use and mandatory derivative use

Table 4 Panel A presents the first-stage bivariate Probit model estimation results where accounting conservatism is measured as the principal component of the Khan and Watts (2009) measure, the earnings skewness measure, and the non-operating accruals measure. We present the results under three different specifications. Consistent with the tax incentive to hedge, we find derivative users have higher pre-financing marginal tax rates. We do not find the marginal tax rate to be significant for mandatory users, suggesting the tax incentive to hedge is not associated with the probability of including interest rate protection covenants in the loan contracts. Consistent with the argument that syndicated loans swapped to fixed rate reflect borrowers’ preference for fixed rate callable debt, we find the proportion of existing debt maturing after 1 year predicts both derivative use and mandatory derivative use. Consistent with the explanation that the loan contracts are more likely to include interest rate protection covenants when the expected future interest rates are high, we find that the yield spread is positively associated with mandatory derivative use.

We follow Larcker and Rusticus (2010) and Wooldridge (2010) to assess the statistical validity of our instruments. First, all our instruments are statistically related to either USE or MAND, and we can successfully reject the null hypothesis that the estimated coefficients on the three instruments are jointly zero across all model specifications. For example, for model (1), the Chi-square statistic equals 23.73 (p value <0.001). The pseudo $R^2$ increases from 18 to 21 % after including the three instruments in the first stage model. This increase in $R^2$ is comparable with

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Table 3 Descriptive statistics

| Variables | Means for mandatory users | Means for voluntary users | Means for non-users | Mandatory users versus voluntary users | Mandatory users versus non-users | Voluntary users versus non-users |
|-----------|---------------------------|---------------------------|---------------------|----------------------------------------|----------------------------------|---------------------------------|
| Instrumental variables | | | | | | |
| MTR_Resi | −0.0081 | 0.0059 | −0.0012 | *** | ** | *** |
| PROP | 0.8542 | 0.8379 | 0.7852 | *** | *** | |
| YIELD | 0.8057 | 1.1586 | 0.9759 | *** | *** | *** |
| Firm characteristics | | | | | | |
| SIZE | 5.874 | 7.211 | 6.2955 | *** | *** | *** |
| LEV | 0.4244 | 0.3625 | 0.3058 | *** | *** | *** |
| PM | 0.1281 | 0.1803 | 0.1611 | *** | *** | *** |
| RATE | 0.3650 | 0.6417 | 0.4399 | *** | *** | *** |
| COMPRATE | 13.000 | 9.683 | 10.604 | *** | *** | *** |
| RD | 0.0084 | 0.0116 | 0.0141 | * | ** | |
| CONSERV | 6.056 | 5.013 | 5.645 | ** | *** | *** |
| NATURAL_P | 0.0064 | 0.0090 | 0.0077 | *** | ** | |
| NATURAL_N | −0.0087 | −0.0064 | −0.0082 | *** | *** | *** |
| Loan characteristics | | | | | | |
| AISD | 242.3 | 139.3 | 164.0 | *** | *** | *** |
| SECURE | 0.9087 | 0.5077 | 0.6032 | *** | *** | *** |
| MATURE | 4.043 | 3.732 | 3.639 | *** | *** | *** |
| TERM | 0.8060 | 0.3074 | 0.2738 | *** | *** | * |
| SECOND | 0.4753 | 0.1382 | 0.0915 | *** | *** | *** |
| NLLENDER | 11.283 | 13.119 | 8.744 | *** | *** | *** |
| NCOV | 5.182 | 3.689 | 3.908 | *** | *** | *** |
| TAKEOVER | 0.0837 | 0.0183 | 0.0168 | *** | *** | *** |
| LOAN_SIZE | 0.3856 | 0.2624 | 0.3432 | *** | *** | *** |
| PERFORM | 0.5779 | 0.6657 | 0.5571 | ** | *** | *** |

Panel B: Distribution of main variables

| Variables | N | Mean | STD | 25 % | 50 % | 75 % |
|-----------|---|------|-----|------|------|------|
| MTR_Resi | 2,338 | 0 | 0.0538 | −0.0168 | 0.0121 | 0.0377 |
| PROP | 2,338 | 0.8090 | 0.2604 | 0.7407 | 0.9255 | 0.9849 |
| YIELD | 2,338 | 1.0101 | 0.9181 | 0.3900 | 0.7400 | 1.2000 |
| NATURAL_P | 2,338 | 0.0079 | 0.0123 | 0 | 0 | 0.0132 |
| NATURAL_N | 2,338 | −0.0077 | 0.0108 | −0.0270 | −0.0026 | 0 |
| SIZE | 2,338 | 6.526 | 1.649 | 5.459 | 6.455 | 7.798 |
| LEV | 2,338 | 0.3363 | 0.2506 | 0.1789 | 0.3081 | 0.4411 |
| PM | 2,338 | 0.1632 | 0.1619 | 0.0849 | 0.1397 | 0.2187 |
| RATE | 2,338 | 0.4927 | 0.5001 | 0 | 0 | 1 |
| SPRATE | 2,338 | 5.144 | 5.669 | 0 | 0 | 10 |
the $R^2$ increase associated with other commonly deemed important variables such as size or credit ratings. These results suggest that the identified instrumental variables are relevant in explaining borrowers’ hedge decisions and the inclusion of interest rate protection covenants in the loan contracts. Second, over-identifying restrictions test suggests that the three instruments are not correlated with the error term of the second stage interest rate model (Chi-square statistic $= 2.23$ with p value $= 0.14$). Since these instruments satisfy both relevance and exclusion restrictions, they appear to be valid instruments.

For mandatory derivative use, we do not find an association between firms’ natural hedge positions and the propensity of using derivatives if sales revenue increases in a rising interest rate environment (positive natural hedge position as indicated by NATURAL_P). However, we find a significantly negative association between the natural hedge position and mandatory derivative use when borrowers’ sales revenue decreases in a rising interest rate environment (negative natural hedge position as indicated by NATURAL_N). Borrowers with negative natural hedge positions and variable rate debt suffer the most from the mismatch of the interest rate exposure from the assets side and the liability side. The asymmetric association between mandatory derivative use and borrowers’ natural hedge positions suggests that the borrower’s natural hedge position is important in determining interest rate protection covenant use. In contrast to mandatory derivative use, we find no association between derivative use and natural hedge positions, suggesting that some voluntary users may use derivatives to speculate.\textsuperscript{14}

Table 3 continued

| Variables | $N$ | Mean | STD | 25 % | 50 % | 75 % |
|-----------|-----|------|-----|------|------|------|
| RD        | 2,338 | 0.0127 | 0.0327 | 0 | 0 | 0.0088 |
| AISD      | 2,338 | 165.3 | 112.8 | 75 | 150 | 250 |
| SECURE    | 2,338 | 0.6086 | 0.4881 | 0 | 1 | 1 |
| MATURE    | 2,338 | 3.712 | 0.568 | 3.584 | 3.871 | 4.094 |
| TERM      | 2,338 | 0.3438 | 0.4751 | 0 | 0 | 1 |
| SECOND    | 2,338 | 0.1488 | 0.3560 | 0 | 0 | 0 |
| NLENDER   | 2,338 | 10.356 | 9.147 | 3 | 8 | 14 |
| NCOV      | 2,338 | 3.984 | 1.740 | 3 | 4 | 5 |
| TAKEOVER  | 2,338 | 0.0248 | 0.1556 | 0 | 0 | 0 |
| LOANSIZE  | 2,338 | 0.3244 | 0.3426 | 0.1210 | 0.2236 | 0.4013 |
| PERFORM   | 2,338 | 0.5923 | 0.4914 | 0 | 1 | 1 |

Panel A presents descriptive statistics (means and differences in means) for three types of borrowers. Mandatory users are borrowers whose loan contracts contain interest rate protection covenants and are required to hedge interest rate risk. Voluntary users are borrowers who choose to hedge interest rate risk related to the borrowing. Non-users are borrowers who do not hedge the new borrowing’s interest rate risk. Panel B presents distribution of main variables. All variables are defined in “Appendix”. ***, **, and * represent 1, 5, and 10 % level of significance, respectively.

\textsuperscript{14} Faulkender (2005) also finds no association between derivative use and the firm’s natural hedge positions.
|                      | (1)    | (2)    | (3)    |
|----------------------|--------|--------|--------|
|                      | USE    | MAND   | USE    | MAND   | USE    | MAND   |
| USE                  |        |        |        |        |        |        |
| MTR_Resi             | 1.087* | 0.191  | 1.265* | 0.272  | 1.331**| 0.371  |
|                      | [1.747]| [0.246]| [1.928]| [0.308]| [2.039]| [0.460]|
| PROP                 | 0.306**| 0.399**| 0.258**| 0.333* | 0.263**| 0.292  |
|                      | [2.530]| [2.217]| [2.051]| [1.814]| [2.044]| [1.611]|
| YIELD                | 0.017  | 0.510***| −0.011 | 0.497**| −0.025 | 0.497**|
|                      | [0.160]| [3.339]| [−0.102]| [3.053]| [−0.234]| [3.422]|
| NATURAL_P            | 1.485  | −0.581 | 0.846  | −2.616 | −9.521 | 11.696 |
|                      | [0.368]| [−0.108]| [0.195]| [−0.433]| [−1.273]| [0.963]|
| NATURAL_N            | −5.621 | −9.666 | −5.323 | −11.472*| 15.324*| −20.211*|
|                      | [−1.158]| [−1.632]| [−1.029]| [−1.676]| [1.652]| [−1.669]|
| CONSERV              | −0.002 | −0.010 | −0.002 | −0.010 | −0.040**| 0.010  |
|                      | [−0.124]| [−0.586]| [−0.124]| [−0.586]| [−2.055]| [0.367]|
| CONSERV*NATURAL_N    | −3.365***| 0.800  | −2.750 | [0.511]|        |        |
| CONSERV*NATURAL_P    | 1.754  | −1.902 | [1.497]| [−1.137]|        |        |
| Firm characteristics |        |        |        |        |        |        |
| SIZE                 | 0.112***| −0.100**| 0.107***| −0.126**| 0.101***| −0.116**|
|                      | [3.068]| [−1.989]| [2.715]| [−2.477]| [2.598]| [−2.467]|
| LEV                  | 0.778***| 0.342* | 0.698***| 0.175  | 0.712***| 0.121  |
|                      | [4.039]| [1.769]| [3.610]| [0.859]| [3.595]| [0.571]|
| PM                   | −0.108 | −0.364 | 0.013  | −0.212 | 0.083  | −0.215  |
|                      | [−0.447]| [−1.150]| [0.046]| [−0.642]| [0.290]| [−0.615]|
| Table 4 continued |
|-------------------|-------------------|-------------------|-------------------|
|                     | (1)               | (2)               | (3)               |
|                     | USE               | MAND              | USE               | MAND              | USE               | MAND              |
| RATE               | 0.658***          | −0.909***         | 0.680***          | −0.860**          | 0.675***          | −0.927**          |
|                    | [2.860]           | [−2.437]          | [2.864]           | [−2.496]          | [2.783]           | [−2.414]          |
| SPRATE             | −0.066***         | 0.050*            | −0.066***         | 0.051*            | −0.066***         | 0.057*            |
|                    | [−3.457]          | [1.709]           | [−3.437]          | [1.940]           | [−3.362]          | [1.919]           |
| RD                 | −1.284            | −0.589            | −1.055            | −0.414            | −1.071            | −0.924            |
|                    | [−1.224]          | [−0.428]          | [−0.919]          | [−0.256]          | [−0.953]          | [−0.611]          |
| Loan characteristics |
| SECURE             | 0.084             | 0.292**           | 0.078             | 0.354***          | 0.081             | 0.369***          |
|                    | [1.067]           | [2.332]           | [0.936]           | [2.627]           | [0.980]           | [2.975]           |
| MATURING           | 0.195***          | 0.193             | 0.178***          | 0.247*            | 0.173***          | 0.225**           |
|                    | [3.086]           | [1.620]           | [2.676]           | [1.914]           | [2.598]           | [1.979]           |
| SECOND             | 0.237**           | 0.408***          | 0.164             | 0.366***          | 0.191*            | 0.355***          |
|                    | [2.236]           | [3.320]           | [1.516]           | [2.884]           | [1.748]           | [2.839]           |
| TERM               | 0.348***          | 0.538***          | 0.392***          | 0.545***          | 0.380**           | 0.577***          |
|                    | [4.169]           | [4.312]           | [4.516]           | [4.212]           | [4.443]           | [4.579]           |
| NCOV               | 0.054***          | 0.145***          | 0.056**           | 0.156***          | 0.056**           | 0.154***          |
|                    | [2.582]           | [4.666]           | [2.555]           | [4.909]           | [2.522]           | [4.776]           |
| NLENDER             | 0.016***          | 0.019***          | 0.019***          | 0.021***          | 0.019***          | 0.020***          |
|                    | [3.505]           | [3.358]           | [3.876]           | [3.552]           | [4.017]           | [3.526]           |
| TAKEOVER            | 0.116             | 0.378*            | 0.161             | 0.403*            | 0.186             | 0.425*            |
|                    | [0.602]           | [1.840]           | [0.816]           | [1.864]           | [0.882]           | [1.887]           |
| LOAN SIZE           | 0.066             | 0.020             | 0.093             | 0.001             | 0.052             | 0.037             |
|                    | [0.572]           | [0.153]           | [0.761]           | [0.006]           | [0.435]           | [0.289]           |
| PERFORM             | 0.157***          | 0.053             | 0.134*            | 0.047             | 0.133*            | 0.054             |
|                    | [2.231]           | [0.597]           | [1.804]           | [0.540]           | [1.780]           | [0.589]           |
Table 4 continued

| Variable      | Panel A | Panel B | Panel C | Panel D | Panel E | Panel F |
|---------------|---------|---------|---------|---------|---------|---------|
|                | USE     | MAN     | USE     | MAN     | USE     | MAN     |
| Intercept     | -2.773*** | -3.587*** | -2.605*** | -3.699*** | -2.319*** | -3.840*** |
| MTR_Resi      | 1.277** | 0.629 | 1.399*  | 0.879  | 1.081*  | 0.018  |
| PROP          | 0.296** | 0.346** | 0.312** | 0.280** | 0.398** | 0.273** |
| YIELD         | 0.004  | 0.042  | 0.002  | 0.003  | 0.005  | 0.008  |
| NATURAL_P     | 0.620  | -2.192 | 0.117  | 0.004  | 0.001  | 0.000  |
| NATURAL_N     | -0.331 | -5.958* | 0.566** | -0.273 | -1.097 | -0.085 |
| NATURAL_P*CONSERV | -4.771*** | -2.401 | -4.771*** | -2.401 | -4.771*** | -2.401 |
| NATURAL_N*CONSERV | 0.232  | 0.232  | 0.232  | 0.232  | 0.232  | 0.232  |
| CONSERV       | 0.021  | 0.028  | 0.021  | 0.021  | 0.021  | 0.021  |
| CONSERV_SK    | 0.021  | 0.028  | 0.021  | 0.021  | 0.021  | 0.021  |
| CONSERV_KW    | 0.021  | 0.028  | 0.021  | 0.021  | 0.021  | 0.021  |
| CONSERV_AC    | 0.021  | 0.028  | 0.021  | 0.021  | 0.021  | 0.021  |

Panel B: Bivariate probit model regression results based on alternative conservatism measures

| Variable      | Panel A | Panel B | Panel C | Panel D | Panel E | Panel F |
|---------------|---------|---------|---------|---------|---------|---------|
|                | USE     | MAN     | USE     | MAN     | USE     | MAN     |
| Intercept     | -4.869  | 2.138  | -5.271  | 2.125   | -5.108  | 2.125   |
| Industry FE   | Yes     | Yes     | Yes     | Yes     | Yes     | Yes     |
| Year FE       | Yes     | Yes     | Yes     | Yes     | Yes     | Yes     |
| Observations  | 2,338   | 2,338   | 2,125   | 2,125   | 2,125   | 2,125   |
Table 4  continued

| CONSERV_KW | CONSERV_SK | CONSERV_AC |
|------------|------------|------------|
| USE        | MAND       | USE        | MAND       | USE        | MAND       |
| Controls   | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        |
| Industry FE| Yes        | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        |
| Year FE    | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        | Yes        |
| Observations| 2,292     | 2,292      | 2,292      | 2,292      | 2,243      | 2,243      | 2,243      | 2,216      | 2,216      | 2,216      | 2,216      |

The table reports bivariate Probit model regression results. Panel A presents estimation results when accounting conservatism is measured as the principal component of the three accounting conservatism measures: Khan and Watts (2009), differences in skewness of earnings and cash flows, and non-operating accruals. Panel B presents estimation results using alternative conservatism measures. Estimated coefficients on firm and loan characteristics are omitted in Panel B for presentation purpose. z-stats are in brackets. All variables are defined in "Appendix". ***, **, and * represent 1, 5, and 10 % level of significance, respectively.
On average, we do not find conservative financial reporting to be associated with derivative use (specification (2)). However, this result could be due to the fact that some borrowers use derivatives to speculate. To further examine how conservative financial reporting affects firms’ hedging decisions, we include the interaction term between conservatism and firms’ natural hedge positions in specification (3). For mandatory users, the estimated coefficients on CONSERV*NATURAL_P and CONSERV*NATURAL_N are not significant, suggesting the role of accounting conservatism in enhancing hedge commitments is minimal given the existence of interest rate protection covenants. For derivative use in general, we find a significantly negative coefficient on CONSERV*NATURAL_N ($z = -2.75$). Thus, the association between derivative use and firms’ natural hedge positions is more negative for firms with conservative financial reporting, suggesting conservatism may be important only for borrowers with negative hedge positions.

Our results on conservatism and hedging are different from Biddle et al. (2011) in that we do not find an overall positive association between conservative reporting and hedging activities. Instead, we find that conservative financial reporting increases borrowers propensity to hedge only when firms have negative natural hedge positions. This asymmetric association is consistent with the interpretation that, in an interest-rising environment, firms with negative natural hedge positions have stronger incentives to manage earnings upwards because their sales revenue decreases with higher interest rates. Conservatism enhances their hedge commitment by reducing their incentive to unwind their hedge positions to recognize gains in the income statement.

Our other control variables suggest that larger firms are more likely to use interest rate derivatives, consistent with prior studies that find derivative use exhibits economies of scale (Gezcy et al. 1997; Mian 1996). We also find that firms with higher leverage ratios and better credit ratings are more likely to use derivatives. The coefficients on most of the loan specific variables are significant and consistent with the univariate results in Table 3. We find borrowers are more likely to swap to fixed rates for loans that have longer maturities, higher number of lenders, more financial covenants, as well as for term loans and those sold on the secondary market. We observe that the incentives for mandatory derivative use are very different from the incentives for derivative use generally. For example, we find that mandatory users are smaller, less likely to be rated, have lower credit ratings when rated, and are more likely to require collateral. These characteristics indicate that mandatory users are higher risk borrowers.

Table 4 Panel B reports the bivariate Probit model estimation results using alternative conservatism measures. The results are largely consistent with the results reported in Panel A. Across all specifications in Table 4, the results of Wald test reject the hypothesis that the correlations between the error terms equal zero. This

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15 Ai and Norton (2003) argue that it can be difficult to interpret an interaction term in non-linear models if the objective is to assess the marginal effect of an independent variable at a point other than the center of the distribution. Since the purpose of the interaction terms in our bivariate Probit model is to examine whether the impact of the natural hedge position on derivative use varies with conservatism, rather than the absolute marginal effect of conservatism, we can rely on the interaction terms to draw inferences (Kolasinski and Siegel 2010).
suggests our design choice of a bivariate model is warranted. Overall the results in Table 4 show that banks especially care about borrowers’ hedge commitments when the borrowers’ sales revenue negatively co-moves with interest rates. Such borrowers are most subject to interest rate fluctuation risk. The commitment mechanism can be either the interest rate protection covenant or conservative financial reporting. In the next section, we explore whether hedge commitments reduce firms’ funding costs.

5.3 Effect of hedge commitments on interest rates

If the commitment to hedge is important in enhancing a borrower’s credit quality, the borrower should enjoy a reduction in its funding costs after credibly committing to hedge. We investigate this issue using an instrumental variables approach. We use the predicted probability of USE and the predicted joint probability of both USE = 1 and MAND = 1 from the first stage bivariate Probit model and estimate OLS regressions with all the first stage explanatory variables, except for the three instrumental variables, MTR_Resi, PROP, and YIELD.

Table 5 Column (1) reports the second stage OLS regression results without considering accounting conservatism. Consistent with our first hypothesis, we find that borrowers that use derivatives voluntarily do not enjoy reduced interest rates on average. The estimated coefficient on \(-35.044\) but is statistically insignificant \((t = -0.705)\). Consistent with our first hypothesis, we find that borrowers who credibly commit to hedge by accepting the interest rate protection covenants in their loan contracts enjoy significant reductions in interest rates of 52.513 basis points \((t = -2.000)\) relative to voluntary users and reductions of 87.6 basis points \((F = 2.81, p \text{ value} = 0.09)\) relative to non-users. These results highlight the importance of a credible commitment to hedge in reducing funding costs. The results also show that an interest rate protection covenant serves as a credible commitment mechanism.

Table 5 Columns (2) through (5) report test results of our second hypothesis on whether accounting conservatism enhances the hedge commitment for voluntary users. We find significantly negative coefficients on the interaction terms between accounting conservatism and voluntary derivative use for all four conservatism measures. This result suggests that conservatism enhances voluntary users’ ability to commit, resulting in lower costs of debt. Voluntary users who practice conservative reporting are less likely to engage in risk-shifting activities, such as unwinding the hedge positions in rising interest rate environments. Creditors recognize this and thus factor the credit improvement into debt pricing.

The interaction terms between accounting conservatism and mandatory derivative use are mostly positive and significant (except for Column (5)), offsetting the negative coefficients on USE\(\times\)CONSERV. We conduct F-tests on the sum of the coefficients on USE\(\times\)CONSERV and MAND\(\times\)CONSERV, which indicates whether mandatory users save interest costs by practicing conservative reporting. The bottom of Table 5 reports the results. We find that being conservative does not reduce interest rates for mandatory users (except for Column (5)). This is not surprising because mandatory users do require conservative reporting to commit to hedge.
Table 5  Effects of interest rate protection covenants and accounting conservatism on the interest rates of syndicated loans

| Variables                  | (1)        | CONSERV   | (2)        | CONSERV_KW | (3)        | CONSERV_SK | (4)        | CONSERV_AC | (5)        |
|----------------------------|------------|-----------|------------|------------|------------|------------|------------|------------|------------|
| USE                       | -35.044    | 40.232    | 10.189     | 34.553     | 24.121     |
|                           | [-0.705]   | 0.776     | 0.205      | 0.646      | 0.454      |
| MAND                      | -52.513**  | -97.673***| -79.781**  | -83.077*** | -46.558    |
|                           | [-2.000]   | -2.793    | -2.206     | -2.653     | -1.419     |
| USE\ \times CONSERV      | -14.041*** | -14.918***| -11.807*** | -7.553***  | -1.974     |
|                           | [-3.431]   | -3.319    | -3.235     | -2.653     | -1.419     |
| MAND\ \times CONSERV     | 9.340**    | 9.145**   | 6.010*     | -0.516     | -0.139     |
|                           | [2.285]    | 2.064     | 1.743      | -0.139     |            |
| CONSERV                   | 8.175***   | 12.145*** | 6.323***   | 2.486      | 1.583      |
|                           | [4.701]    | 6.282     | 3.939      |            |            |
| Firm characteristics     |            |           |            |            |            |
| SIZE                      | -11.017*** | -9.900*** | -3.420     | -11.764*** | -11.506*** |
|                           | [-3.728]   | [-3.130]  | [-1.031]   | [-3.939]   | [-3.493]   |
| LEV                       | 71.804***  | 65.238*** | 62.602***  | 69.119***  | 70.289***  |
|                           | [4.598]    | 4.271     | 4.233      | 4.251      | 4.407      |
| PM                        | -93.510*** | -73.545***| -72.613*** | -88.636*** | -92.105*** |
|                           | [-6.748]   | [-4.903]  | [-5.466]   | [-6.092]   | [-6.045]   |
| RATE                      | -77.048*** | -77.416***| -64.709*** | -76.474*** | -83.529*** |
|                           | [-4.883]   | [-4.583]  | [-3.970]   | [-4.475]   | [-5.201]   |
| SPRATE                    | 6.430***   | 6.438***  | 5.429***   | 6.410***   | 6.953***   |
|                           | [4.381]    | 4.157     | 3.581      | 4.105      | 4.584      |
| RD                        | -81.326    | -78.026   | -11.495    | -81.273    | -68.108    |
|                           | [-1.439]   | [-1.427]  | [-0.201]   | [-1.473]   | [-1.194]   |
| Variables | (1)   | CONSERV | (2)   | CONSERV_KW | (3)   | CONSERV_SK | (4)   | CONSERV_AC | (5)   |
|-----------|-------|---------|-------|------------|-------|------------|-------|------------|-------|
| NATURAL_P | -62.252 | 121.162 | -182.655 | 129.380 | -89.718 |
|           | [-0.351] | [0.642] | [-1.033] | [0.687] | [-0.508] |
| NATURAL_N | -31.296 | -49.842 | -197.590 | -50.517 | 55.917 |
|           | [-0.127] | [-0.192] | [-0.798] | [-0.211] | [0.211] |
| Loan characteristics | | | | | | | | | |
| SECURE    | 82.083*** | 78.380*** | 74.692*** | 81.128*** | 80.681*** | 80.681*** | 80.681*** | 80.681*** | 80.681*** |
|           | [19.977] | [18.578] | [17.987] | [19.308] | [19.236] | [19.236] | [19.236] | [19.236] | [19.236] |
| MATURE    | -22.102*** | -22.146*** | -18.874*** | -21.382*** | -23.428*** | -23.428*** | -23.428*** | -23.428*** | -23.428*** |
|           | [-4.634] | [-4.548] | [-3.999] | [-4.426] | [-4.675] | [-4.675] | [-4.675] | [-4.675] | [-4.675] |
| SECOND    | 60.562*** | 56.950*** | 60.736*** | 58.570*** | 57.012*** | 57.012*** | 57.012*** | 57.012*** | 57.012*** |
|           | [7.346] | [7.197] | [7.606] | [7.224] | [6.852] | [6.852] | [6.852] | [6.852] | [6.852] |
| TERM      | 38.156*** | 40.110*** | 39.849*** | 38.213*** | 38.423*** | 38.423*** | 38.423*** | 38.423*** | 38.423*** |
|           | [4.965] | [4.620] | [5.278] | [4.748] | [4.446] | [4.446] | [4.446] | [4.446] | [4.446] |
| NCOV      | 3.055**  | 2.907*  | 3.572**  | 2.531  | 2.792*  | 2.792*  | 2.792*  | 2.792*  | 2.792*  |
|           | [2.003] | [1.842] | [2.417] | [1.586] | [1.757] | [1.757] | [1.757] | [1.757] | [1.757] |
| NLENDER   | -0.342 | -0.277 | -0.039 | -0.319 | -0.399 | -0.399 | -0.399 | -0.399 | -0.399 |
|           | [-0.926] | [-0.650] | [-0.103] | [-0.754] | [-0.994] | [-0.994] | [-0.994] | [-0.994] | [-0.994] |
| TAKEOVER  | 34.756*** | 36.386*** | 34.033*** | 34.769*** | 36.914*** | 36.914*** | 36.914*** | 36.914*** | 36.914*** |
|           | [3.916] | [3.776] | [3.694] | [3.953] | [3.889] | [3.889] | [3.889] | [3.889] | [3.889] |
| LOANSIZE  | -14.663** | -18.506** | -14.063** | -17.697** | -15.621** | -15.621** | -15.621** | -15.621** | -15.621** |
|           | [-2.164] | [-2.475] | [-2.083] | [-2.545] | [-2.111] | [-2.111] | [-2.111] | [-2.111] | [-2.111] |
| PERFORM   | -19.593*** | -17.560*** | -14.657*** | -19.103*** | -19.856*** | -19.856*** | -19.856*** | -19.856*** | -19.856*** |
|           | [-4.505] | [-4.092] | [-3.314] | [-4.320] | [-4.549] | [-4.549] | [-4.549] | [-4.549] | [-4.549] |
### Table 5 continued

| Variables        | CONSERV | CONSERV_KW | CONSERV_SK | CONSERV_AC |
|------------------|---------|------------|------------|------------|
| INTERCEPT        | 290.073*** | 234.682*** | 169.801*** | 254.844*** | 283.421*** |
|                  | [10.077] | [7.241]    | [4.677]    | [8.361]    | [8.939]    |
| Year FE          | Yes     | Yes        | Yes        | Yes        | Yes        |
| Industry FE      | Yes     | Yes        | Yes        | Yes        | Yes        |
| Adj $R^2$        | 0.643   | 0.648      | 0.650      | 0.647      | 0.641      |
| Observations     | 2,338   | 2,125      | 2,292      | 2,243      | 2,216      |
| $F$ test of $USE\times CONSERV + MAND\times CONSERV = 0$ | $F = 1.15$ | $F = 1.86$ | $F = 2.57$ | $F = 5.15**$ |

The table reports analysis of the impact of interest rate protection covenants and accounting conservatism on loan interest rates (as a spread over LIBOR). The dependent variable is loan spread. We use an instrumental variables approach to address the endogeneity problem. We employ three instruments: marginal tax rate unexplained by profitability (MTR_Resi), proportion of existing debt maturing after 1 year (PROP), and yield spread between 10-year and 1-year Treasury bonds (YIELD). See Table 4 for the first stage results. All variables are defined in “Appendix”. Reported in brackets are $t$ statistics calculated based on White heteroskedastic consistent standard errors and adjusted for clustering by company. ***, **, and * represent 1, 5, and 10 % level of significance, respectively.
The coefficient on CONSERV is in general positive and significant, suggesting that non-users with higher default risk are more likely to have conservative financial reporting due to debt contracting demands.\textsuperscript{16} In contrast, the sum of the coefficients on CONSERV and USE\textsuperscript{C3}\textsubscript{CONSERV} is generally negative and significant, suggesting that for voluntary users conservatism helps to reduce funding costs.\textsuperscript{17} Finally, the sum of the coefficients on CONSERV, USE\textsuperscript{C3}\textsubscript{CONSERV}, and MAND\textsuperscript{C3}\textsubscript{CONSERV} is generally insignificant, suggesting that for mandatory users, conservative reporting is not associated with loan rates.\textsuperscript{18} The results for other control variables are consistent with those found in previous research. Specifically, smaller borrowers and borrowers that have high leverage, low profitability, and low credit ratings are charged a higher rate. We find larger spreads for loans that require collateral, for term loans, for loans later sold in the secondary market, and for loans used for takeovers. We also find that loans with a longer maturity are charged a lower interest rate.

In summary, Table 5 shows that borrowers do not reduce their funding costs by voluntarily taking hedge positions without a credible commitment to hedge. An interest rate protection covenant serves as a credible commitment device and so does conservative reporting. Accounting conservatism enhances voluntary users’ hedge commitment but is not important for mandatory users.

5.4 Sensitivity tests

The inclusion of interest rate protection covenants could arise from certain lead arrangers’ preferences rather than borrowers’ characteristics. We consider this possibility by examining whether mandatory users share the same lead arrangers. We identify 219 unique banks serving as lead arrangers for the entire sample of 2,338 loans. The 263 deals with interest rate protection agreements are arranged by 75 banks, and the 2,075 deals without interest rate protection agreements are arranged by all 219 banks. There is no lead arranger that only arranges deals with interest rate protection covenants. These results suggest that the inclusion of interest rate protection covenants does not merely reflect a specific lead arranger’s preference.

We conduct our main analysis at the deal level because the interest rate protection covenant applies to all facilities in a deal. To account for the fact that a deal may contain multiple facilities with different loan characteristics, we rerun the analysis using facility level data. Following Ball et al. (2008), for deals with multiple tranches, we select characteristics of the facility with the largest borrowing

\textsuperscript{16} Zhang (2008) finds a negative association between loan spreads and accounting conservatism only for a sub-sample of loans without performance pricing in her main test. Similarly, Vasvari (2006) documents a negative association between loan spreads and accounting only when managers have below average equity compensation.

\textsuperscript{17} Except that when conservatism is measured by Khan and Watts (2009) (i.e., column (3)) the sum of the coefficients on CONSERV and USE\textsuperscript{C3}\textsubscript{CONSERV} is insignificant (p value = 0.39).

\textsuperscript{18} This conclusion applies to conservatism measures CONSERV and CONSERV\_SK (columns (2) and (4)). When conservatism is measured as CONSERV\_KW (column (3)) and CONSERV\_AC (column (5)), the sum of the coefficients on CONSERV, USE\textsuperscript{C3}\textsubscript{CONSERV}, and MAND\textsuperscript{C3}\textsubscript{CONSERV} is significant at 5 % level.
amount. Our main results are robust to this alternative design choice. Specifically, we do not find significant interest savings for voluntary users on average. We find mandatory users enjoy significant reductions in interest rates of 69 basis points ($t = -2.022$) relative to voluntary users. The interest savings increase to 132 basis points ($p$ value = 0.025) when we compare mandatory users with non-users. We also find that voluntary users who practice conservative accounting enjoy higher interest reductions and this relationship does not exist for mandatory users. Our results are also not sensitive to using a weighted average of loan facilities for each deal where the weights equal the borrowing amount.

Although we argue that the bivariate Probit model increases the power of the tests by incorporating all information in one system, we adopt alternative empirical modeling strategies by separately analyzing only two groups at a time (i.e. non-users and voluntary users, non-users and mandatory users, and voluntary users and mandatory users). Consistent with our hypotheses, relative to non-users, we find significant interest reductions for mandatory users ($-62$ basis points with $t = -2.27$) but not for voluntary users ($-16$ basis points with $t = -0.78$). We also find the interest savings are positively associated with accounting conservatism for voluntary users but not for mandatory users. However, the incremental interest savings for mandatory users relative to voluntary users are not statistically significant if we only include voluntary users and mandatory users in the model and ignore non-users.

6 Conclusion

We study how credible hedge commitments affect agency costs of debt by examining three types of borrowers: those required to hedge interest rate risk due to interest rate protection covenants, those who voluntarily hedge interest rate risk, and those who do not hedge interest rate risk. We find that loan contracts are more likely to require borrowers to hedge interest rate risk when borrowers exhibit high default risk and when borrowers’ sales revenues decrease in a rising interest rate environment. We find hedge commitments through interest rate protection covenants reduce interest rates charges on the syndicated loans. In contrast, we do not find interest savings on average for voluntary users. However, we find accounting conservatism enhances voluntary users’ ability to commit to hedge and thus results in lower loan rates.

Our finding provides large sample evidence on the importance of credible hedge commitments in reducing agency costs of debt. The finding is consistent with Smith and Stulz’s (1985) conjecture that, due to conflicts between creditors and shareholders, the benefits of hedging are only realizable when borrowers can credibly commit to maintain the hedge positions once the financing is completed. The study also extends the literature on corporate risk management. We show that the assumption that derivative use is a voluntary firm choice is not always valid. Many bank loan agreements explicitly include interest rate protection covenants requiring borrowers to use derivatives to hedge interest rate risk. Reasons for mandatory derivative use can be very different from reasons for voluntarily derivative use. It is thus important for researchers to consider whether the derivative use is out of contractual obligations when conducting risk management research.
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Appendix: Variable definitions

AISD  Loan spreads over LIBOR calculated for each deal. If one deal consists of multiple facilities, AISD is measured as the average spreads across all the facilities

COMPRATE  S&P rating ranging from 1 for AAA to 22 for D for firms with ratings. Set to missing value for firms without ratings

CONSERV_KW  Decile ranking of the accounting conservatism constructed for each firm-year based on Khan and Watts (2009)

CONSERV_AC  Decile ranking of the accounting conservatism measured as the average non-operating accruals scaled by total assets over the 3-year period before the loan origination

CONSERV_SK  Decile ranking of the accounting conservatism measured as the difference between the skewness of operating cash flows scaled by total assets and the skewness of income before extraordinary items scaled by total assets. The skewness of earnings and cash flows are calculated for the firm-year before the loan origination using information from the previous 12 quarters with minimum 5 quarters data

CONSERV  Decile ranking of the principal component of the three accounting conservatism measures based on non-operating accruals, difference in the skewness of cash flows and earnings, and Khan and Watts (2009)

LEV  Book leverage measured as the sum of the long-term debt and debt in current liabilities divided by total assets

LOANSIZE  Total borrowing amount scaled by lagged assets

MAND  Indicator variable that equals 1 if a bank loan includes an interest rate protection covenant (i.e., mandatory users), 0 for non-users and for voluntary users

MAND  Predicted joint probability of USE = 1 and MAND = 1 from the bivariate Probit model (Eqs. (1) and (2)), where the explanatory variables include the three instrumental variables and all other exogenous variables

MATURE  Natural log of number of months between the loan start and end dates

MTR_Resi  We first calculate the before-financing simulated marginal tax rate (MTR) using the coefficients estimated in Graham and
Mills (2007) for predicting pre-financing marginal tax rate. MTR_Resi is the residual calculated from regressing MTR on multiple measures of profitability (i.e., operating loss carry forward, pre-tax loss, and operating income before interest expense, tax, depreciation, and amortization scaled by lagged total assets). We use MTR_Resi to capture hedge incentives arising from marginal tax rate that is unrelated to AISD

**NATURAL** Firms’ natural hedge position measured as the sum of the coefficients on current and one period lagged 12-month treasury rates from a regression of sales scaled by total assets on these variables, as well as a constant, time trend, and log time trend. The regression is estimated at 2-digit SIC industry level. This measure is similar to the natural hedge position measured in Vickery (2008)

- **NATURAL_P** Equals NATURAL if NATURAL > 0 and set to 0 otherwise
- **NATURAL_N** Equals NATURAL if NATURAL < 0 and set to 0 otherwise
- **NCOV** Number of financial covenants
- **NLENDER** Number of lenders involved in the syndicated loans
- **PERFORM** Indicator variable that equals 1 if the loan includes performance pricing, 0 otherwise
- **PM** Gross profits scaled by sales revenue
- **PROP** Proportion of existing debt maturing after 1 year
- **RATE** Indicator variable that equals 1 if a borrower has S&P credit ratings prior to loan origination, 0 otherwise
- **RD** Research and development expense scaled by sales. Set to 0 when research and development expense data is missing
- **SECOND** Indicator variable that equals 1 if a “Term Loan” is followed by letter A-H, 0 otherwise
- **SECURE** Indicator variable that equals 1 if the loan is secured, 0 otherwise
- **SIZE** Natural log of sales revenue
- **SPRATE** S&P rating ranging from 1 for AAA to 22 for D for firms with ratings and equal to 0 for firms without ratings
- **TAKEOVER** Indicator variable that equals 1 if the loan is used for takeover purpose, 0 otherwise
- **TERM** Indicator variable that equals 1 if any facility is a term loan, 0 otherwise
- **USE** Indicator variable that equals 1 if a borrower uses derivative contracts to fix the borrowing rate (both voluntary users and mandatory users), 0 for non-users
- **USE** Predicted probability of USE = 1 from the bivariate Probit model (Eqs. (1) and (2)), where the explanatory variables include the three instrumental variables and all other exogenous variables
- **USE_CONSERV** Fitted value from regression Eq. (5)
YIELD  Difference in yields (basis points) between a 10-year Treasury bond and a 1-year Treasury bond measured in the month of loan initiation

All accounting variables are measured at the end of the fiscal year prior to loan origination, except for MTR_Resi. Before-financing marginal tax rate (MTR_Resi) is measured at the end of the fiscal year of the loan origination.

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