Firm Value and Mandatory Hedging: Evidence from Interest Rate Protection Covenants in Syndicated Loan Agreements

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Abstract

This paper examines the impact of interest rate derivatives enforced by creditors and interest rate derivatives used voluntarily on firm value, separately in a sample of 3881 firm-years from 1998 to 2005. Voluntary hedging positions include derivatives for corporate risk management practices and those for private benefit of managers. Consequently, these derivatives might not have the positive impact on firm value predicted by risk management theories. However, there is no managerial incentive in the use of derivatives mandated by credit agreements. Therefore, shareholders refer to mandatory term of derivatives obliged by creditors and classify these instruments as real risk management practices and reward such positions by a premium on firm value. This argument is strongly supported by the results of this empirical research in which I find an economically large and statistically significant positive impact from mandatory interest rate derivatives on firm value and no significant impact from voluntary ones.

1. Introduction

Theories state that risk management increases firm value in an imperfect capital market by reducing expected tax liabilities and financial distress costs, and by increasing firms' debt capacity.[1] However, the results of empirical research on the relation between the use of derivatives, one of the main tools of risk management, and firm value is not conclusive.[2]

Several studies document that firms may use financial instruments for speculation (Géczy, Minton, and Schrand, 2007), and managers may hold derivative positions for their own advantage that might not be in parallel with shareholders' benefit (Stulz, 1984 and Smith and Stulz, 1985). The pooling of speculative, self-interest, and hedging in derivative positions makes investors cautious in valuing derivative contracts used by firms. However, an efficient monitoring of corporate management shifts the use of derivatives toward sound risk management practices and reduces the conflict of interest between shareholders and managers in the use of financial instruments. Through an efficient controlling system in the use of derivatives, investors are able to identify the motive behind the use of derivatives and gain their confidence in real purpose of such financial decisions. Existing empirical evidence is consistent with this prediction. Nain (2004) shows how product market and competition reduces the conflict of interest between managers and shareholders in the use of foreign exchange derivatives. She documents that foreign exchange derivatives increase firm value when the use of such derivatives is common among the competitors. Allayannis, Lel, and Miller (2012) concentrate on monitoring pressure on managers from shareholders and its impact on value implication of derivatives. They find that the use of derivatives increases firm value in well-governed firms, where managers have limited power to exert financial instruments for speculation or self-interests.

In the same spirit, I focus on the monitoring role of creditors and their influence on the agency cost between equity-holders and managers in the use of derivatives. In this paper, I distinguish voluntary use of interest rate (IR) derivatives from those enforced by private credit agreements, and evaluate the impact of each group on firm value, separately. I hypothesize that shareholders refer to the mandatory term of using IR derivatives in credit agreements and perceive these positions as "hedging" instruments. Therefore, creditors'

[1] Smith and Stulz (1985), Bessembinder (1991), Froot, Scharfstein, and Stein (1993), Nance, Smith, and Smithson (1993), Géczy (1997), and Leland (1998)

[2] For instance, Allayannis and Weston (2001), Graham and Rogers (2002), Carter, Rogers, and Simkins (2006) and Adam and Fernando (2006) find positive impact of hedging on firm value, while Tufano (1996), Jin and Jorion (2006), Lookman (2009a) and Bartram et al. (2011) document that this impact is not significant.

request for IR hedging reduces the conflict of interest between managers and equity-holders in the use of IR derivatives, making these positions completely aligned with corporate risk management practices. As predicted by risk management theories, I argue that investors reward the use of such derivatives by a positive premium on firm value. Since voluntary positions include IR derivatives both for corporate risk management and for private benefits, such premium on firm value from these financial instruments is not expected.

By focusing on mandatory interest rate hedging, I diminish the likelihood of speculation or manager's self-benefit in using derivatives, since the decision-making for such hedging strategies is outside the shareholders' and managers' reaches. A derivative position obliged by creditors is not speculative and the borrower cannot terminate this position unless it bears the cost of breaching a covenant. Indeed, this technical default is not in the interest of managers and shareholders.

Mandatory interest rate hedging, usually called Interest Rate Protection Covenant (IRPC), complies with risk management theories as well. As discussed in Froot, Scharfstein, and Stein (1993) and Leland (1998), firms commit themselves to hedge to increase their debt capacity and grant the credit facility to harvest the tax advantage of debt. In addition, commitment to hedge reduces the agency conflicts between debt- and equity-holders (Campbell and Kracaw, 1990) and mitigates underinvestment problem (Bessembinder, 1991; Nance, Smith, and Smithson, 1993; and Géczy, 1997).[3]

It may be argued that because of agency conflicts between debt- and equity-holders, creditors usually impose covenants to minimize their risk at the cost of shareholders; consequently, mandatory hedging might not be optimal for the firm. This argument does not necessarily hold for hedging covenants. Many affirmative covenants such as complying with accounting rules, paying taxes, or buying insurance are in parallel to sound corporate management practices, and completely aligned with shareholders' interests. IRPC also is an affirmative covenant that delivers the benefit to both creditors and shareholders. Smooth payment of the interests and principal amount of the loan is banks' main concern. Thus, the main purpose of mandatory hedging is to secure the cash flows of the borrower in the states of the economy in which it would not be able to meet its payment obligation without hedging. As a result, IRPC reduces the probability of default, which is in the interest of the shareholders as well. Moreover, IRPCs do not

[3] In parallel to these theoretical studies, Campello, Lin, Ma, and Zou (2011) and Beatty, Chen, and Zhang (2011) empirical researches document a significant reduction in cost of debt (LIBOR spread) by interest rate hedging in syndicated loans, particularly by IRPCs.

restrict the borrower to specific derivative contracts and are flexible in terms of the notional amount, maturity and type of the contracts[4]. Hence, it is less likely that an IRPC deviates substantially from an optimal contract and its "mandatory" term does not weaken my hypothesis about value implication of derivatives obliged by creditors.

To investigate the impact of IRPCs on firm value, I focus on interest rate protection covenants in private credit agreements in the syndicated loan market[5]. Hedging covenants are more prevalent in the bank loans than in bond indenture, since banks' monitoring resources are more concentrated than those of individual bondholders (see Lookman, 2009b). Interest rate hedging covenants are also more common than currency or commodity hedging covenants as it is more difficult for nonfinancial firms to pass-through or naturally hedge interest rate exposure compared to the risk of the price of commodities or exchange rate fluctuations[6].

Syndicated loan agreements have clear and detailed terms and covenants. Due to the material impact of these agreements on firms' capital structure and operation, firms report terms and covenants of syndicated loan agreements in their SEC filings, enabling to extract details and conditions of IRPCs and classify interest rate hedging positions as voluntary or mandatory,[7] clearly.

I construct my sample from the dataset used in Nini, Smith, and Sufi (2009) [8]. My empirical analysis is based on hand collected data on interest rate (IR) hedging contracts and detailed private credit agreements from Securities and Exchange Commission (SEC) filings, and accounting and market data from COMPUSTAT and CRSP databases. The dataset includes 3881 firm-year observations all exposed to interest rate risk from year 1998 to 2005. 1164 observations are voluntary, 458 observations are mandatory IR derivative users, and 2259 observations are nonusers[9]. With this sample, I examine the

[4] IRPCs usually oblige borrower to fix the interest rate of at least 50% of its total indebtedness for 2 to 3 years, not contradictory to a typical interest rate risk management. Banks also set a minimum credit quality for hedging counterparties and almost no restrictions for the type of hedging contracts. They also usually set a 60- to 90-day period after the agreement for entering into interest rate derivatives.

[5] A syndicated loan is a credit facility offered by a group of lenders and managed by a commercial or investment bank as the lead lender.

[6] For commodities, fuel surcharges in transportation industry or floating prices in gas stations are examples of pass-through or natural hedging. For foreign exchange, borrowing in foreign currency or supply and sell with the same currency are examples of the natural hedging strategies.

[7] As an example, here is the IRP of Donnelley Corporation 2004 credit agreement:
"In the case of the Borrower, within 90 days after the Closing Date, enter into, and thereafter maintain, such Hedge Agreements as are necessary to provide (together with any existing Hedge Agreements entered into prior to the date hereof) that at least 50% of the aggregate principal amount of all Funded Debt at such time is subject to either a fixed interest rate or interest rate protection for a period of not less than three years, which Hedge Agreements shall have terms and conditions reasonably satisfactory to the Administrative Agent"

[8] I appreciate Amir Sufi for providing these data in his website (http://faculty.chicagobooth.edu/amir.sufi/data.html).

[9] I use mandatory (voluntary) IR hedgers and mandatory (voluntary) IR derivative users, or nonhedgers and nonusers, interchangeably in the rest of the paper.

impact of mandatory and voluntary interest rate risk management on firm value both in cross-sectional and within-industry dimensions (industry fixed-effect).

Using Q ratio as a proxy for the firm value, I find that mandatory IR hedging increases the firm value, and this premium is statistically and economically significant. Based on my model, on average, IRPC increases the Q ratio by 8.2% relative to an IR derivative nonuser counterfactual. Voluntary IR hedging does not demonstrate any significant impact on firm value in my empirical test. In addition, in a sample of mandatory and voluntary IR derivative users, I find that the impact of interest rate derivatives mandated by creditors on firm value is 10% larger than that of voluntary ones, on average. These findings suggest that investors perceive mandatory term of using IR derivative as a strong signal for a sound risk management practice and reward the IR derivatives mandated by creditors, while they are cautious to price the impact of voluntary derivatives whose real purpose is not clear.

It is unlikely that banks impose IRPC on firms with higher value. Nevertheless, the special characteristics of the firms with IRPC, and firms' acceptance of this covenant in the credit agreement leave minor simultaneity concern. This concurrence is not neglected in this paper and is scrutinized by carefully analyzing the IRPCs and implementing instrumental variables (IV) approach and propensity score matching for endogeneity and selection bias concerns. I use banks' expected loss from borrowers' default as the instrument for IRPC and find positive and statistically significant impact from mandatory use of IR derivatives on firm value. I also find that firms with IRPC have 10.5% (13.9%) higher value than propensity-score matched nonusers (voluntary users), on average.

Syndicated loans usually have other covenants beside IRPC. My results are robust to the existence of other covenants in the credit agreements. These covenants impose different restrictions on such liquidity, capital expenditures or net worth assets. With such influences on firm's operation, these covenants may impact firm value in parallel to or independently from what IRPC does. Using a dummy variable for 19 different covenants and their interactions with IRPC, I find similar results to those in the baseline model without controlling these variables.

This research contributes to hedging literature by providing new evidence on the importance of investors' perception about the use of derivatives in value implication of such financial instruments, consistent to the findings in Allayannis et al. (2012). It is also one step forward to unbiased estimation of the influence of derivatives on firm value by focusing on hedging imposed by creditors rather than those decided by managers in so far empirical researches. In the loan literature, it complements the empirical studies on the relation between mandatory hedging and cost of debt. Beatty, Chen, and Zhang (2011) find that creditors reward the commitment of the firms in hedging interest rate (IRPC) by reducing the interest rate charged in credit agreements. I show such reward from shareholders' point of view by documenting a positive impact from IRPCs on firm value. Moreover, consistent to Nini, Smith, and Sufi (2012), this study illustrates that despite the existence of conflicts of interest between shareholders and debt-holders, there are cases such as imposing IRPC in which creditors' indirect influence on financial decision-making is in the interest of shareholders and increases the value of the firm.

The remainder of the paper is organized as follows. In section 2, I review the literature and develop the hypothesis. Section 3 describes the construction of the sample. Section 4 explains the empirical models and reports the results for the impact of IRPC and voluntary IR hedging on firm value. Section 6 describes the robustness checks to endogeneity and confounding factors. Section 7 concludes the paper.

2. Related literature and developing hypothesis

Allayannis and Weston (2001) is the pioneering empirical study on the relation between firm value and derivatives use. They show a positive impact from foreign exchange derivatives on firm value. Among others, Carter, Rogers, and Simkins (2006) in airlines, MacKay and Moeller (2007) in refineries, or Kim et al. (2006) in exporters extend this literature by testing the impact of commodity, interest rate, or foreign exchange derivatives on firm value and find a positive relation between the Q ratio and derivatives use.[10] However, studies such as Jin and Jorion (2006) or Bartram, Brown, and Conrad (2011) find no or weak results in this relation.

Theories in the context of principal-agent conflict of interests explain this empirical evidence by focusing on managers' motivation for hedging. Stulz (1984), and Smith and Stulz (1985) explain the incentive of risk-averse managers to hedge when they can mitigate the risk of their own interests in the firm by hedging the same risk at corporate-level.

Several empirical studies support these theories. In their confidential survey, Géczy et al. (2007) highlight the issue of speculation in the use of derivatives. They document that managers can inflate their performance-based compensation by using financial instruments. More importantly, they show that investors are not able to distinguish between speculative and nonspeculative positions based on firms' disclosures. Lel (2011)

[10] I refer the reader to Smithson and Simkins (2005), and Aretz and Bartram (2010) for a comprehensive literature review of hedging and firm value studies.

shows that well-governed firms use currency derivatives for hedging while weakly governed firms have managerial incentives in using these financial instruments. Faulkender (2005) finds a strong relation between the slope of the yield curve and interest risk management that indicates the speculative use of derivatives. In Bodnar, Graham, Harvey, and Marston (2011) risk management survey, 49% of nonfinancial and 54% of American firms indicate that their forecast for interest rate is very important or important in their interest rate hedging decisions. Borokhovich, Brunarski, Crutchley, and Simkins (2004) show the impact of outside directors on the level of using interest rate derivatives.

In the light of this evidence, researchers aim to clarify derivatives used as *real* hedging by focusing on mechanisms through which shareholders are able to control or identify managers' motivation in the use of derivatives. This clarification resolves the issue of mixed results of empirical studies in value implication of risk management.

Literature suggests product market and competition, corporate governance, and creditors' controls as the main instruments in decreasing conflict of interest between managers and shareholders in financial decisions including in the use of derivatives.

In the context of competition, Nain (2004) shows that the use of foreign exchange (FX) derivatives increases the value of the firm when many of its competitors use FX derivatives. When the use of FX is common in a particular industry, investors identify the risk of currency exchange rates in the industry and perceive the use of FX derivatives as an efficient risk management instrument.

Corporate governance is the other monitoring tool but in general, it does not demonstrate as an efficient instrument in reducing the conflicts of interest between managers and equity-holders in the use of derivatives. In fact, only those classified as high standard corporate governance system in researches such as Allayannis et al. (2012) look promising as a remedy for managerial incentives in the use of derivatives. Allayannis et al. (2012) document that the use of currency derivatives is associated with higher firm value in well firm- and country-level corporate governance regimes. Fauver and Naranjo (2010) find that derivatives negatively influence the value of the firms that have high level of agency problems and weak corporate governance system. While these studies shed light on how the use of derivatives in a well-governed firm generates wealth for the shareholders, they magnify the common issue of endogeneity in firm value and hedging researches, as corporate governance itself has a direct impact on firm value (see La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 2002) and quality of disclosures[11] (see Eng and Mak, 2003).

In this paper, I complement the recent studies by focusing on creditors' control in the use of derivatives. By imposing covenants in credit agreements, creditors effectively limit the managers' opportunism in over-investment or exerting corporate assets for personal benefits. Nini et al. (2012) state that creditors influence the corporate governance indirectly by restricting financial decision-making. This action is rewarded by shareholders and increases firm value. Creditors' influence on corporate decision-making is not limited to restrictions and encompasses affirmative covenants such as mandatory use of derivatives for interest rate risk management. Mandatory use of IR derivatives relaxes the "no managerial incentive" assumption in value implication of using derivatives, making them completely aligned with risk management theories. Banks impose hedging for reducing the risk of default and bankruptcy, in parallel to shareholders' benefit. Borrowers accept this term in credit facility to increase their debt capacity, diminish underinvestment problem, and take the tax advantage of the leverage.

Taken together, I hypothesize that the commitment to use IR derivatives in a credit agreement is a strong signal to the shareholders that the purpose of these instruments is not for private benefit. Same as creditors, shareholders identify these positions as corporate risk management instruments and consider a premium for firm value from these hedging practices. The average impact on firm value from voluntary IR derivatives whose application is not clearly identified by the shareholders is not expected to be significant.

It is a question that instead of offering a loan with floating interest rate and imposing IRPC, why banks do not offer a fixed rate loan. Vickery (2008) explains the issue of maturity mismatch in banks' holdings that makes banks to incline toward floating rate lending. I extend this argument in syndicated loan agreements. Since more than one bank is involved in syndicated lending, the issue of maturity mismatch is more complicated than for a single lender. In addition, almost all syndicated loans have the repayment option that amplifies the issue of maturity mismatch in this type of lending if banks offer a fixed rate loan.

It is also at the benefit of the borrower to have a floating rate loan with IRPC instead of a fixed rate one, if it expects an improvement in its credit quality that is not observable by

[11] For instance, in Allayannis et al. (2012) firms with weak corporate governance system, particularly in country-level, may not disclose derivative positions that might bias the results. In their research, the number of derivative users in low and high quality corporate governance system is not reported separately that makes it hard to justify that the positive but insignificant result of the impact of currency derivatives for low quality governance system is from investors' perception about the use of derivatives or from the number of observations in the test.

creditors. The credit spread of a fixed rate loan is evaluated based on information available at the time of initiation and may burden an extra cost of debt on borrower if its credit quality improves before the maturity of the loan, assuming that fixed rate loans have no or expensive repayment (call) option. Therefore, firms can borrow in floating rate and have the benefit of performance-based interest charges in these types of agreements and fix the interest rate with financial instruments[12]. This argument provides an additional support for value implication of IRPCs in credit agreements.

3. Sample Description

I construct my sample based on the dataset used in Nini et al. (2009). This is a unique sample of 3720 syndicated loan agreements of 1939 firms from 1996 to 2005. It includes the text of the credit agreement and classification of the covenants for each contract.

First, I drop financial institutions and utilities from the sample, 149 firms (375 contracts) in total, due to their special capital structure and regulatory system. Then, I manually search for “term loan”, “term-loan”, “term agreement”, “term contract”, and “prime rate” keywords in the text file of each agreement. In this stage, I short list firms which have at least one term loan during 1996-2005 period and the index of the term loan is not the prime rate. I work on term loans since these credit agreements have an explicit value, repayment schedule, and maturity. The interest rate risk of the term loans is more expected to be hedged compared to that of line of credits whose credit limit and outstanding amount fluctuate frequently. In addition, I remove term loan agreements in which prime rate is the index used for interest rate calculation; because, interest rate derivatives are based on LIBOR and firms that pay interest based on prime rate and use IR derivative, face a basis risk coming from uncorrelated movement of two indexes. In this stage, I find 787 individual firms which have at least one term loan based on LIBOR from 1996 to 2005.

For each 787 short listed firms from previous stage, I extract the 10-K[13] filing of the firm from Electronic Data Gathering, Analysis and Retrieval system (EDGAR) of SEC from 1998 to 2005. I start from 1998 because FRR-48 statement, also called item 7a, of SEC is effective from July 15, 1998. This statement obliges firms to disclose quantitative information for their derivative positions and market risks in their 10-K filings. The

[12] One may argue that the borrower pays higher swap or collar rate instead. Since these financial instruments exchange the net amount of position not the notional, they have lower credit risk spread than in lending the same notional amount with fixed rate. Even with equal credit spread, borrower still saves the extra cost of the call option of a fixed rate lending.

[13] Including 10-K405 and 10-KSB filings but I use only “10-K” in the text for brevity.

quantitative disclosure assures that all derivative positions are disclosed in the filings while market risk disclosure reconfirms that the sample firm is exposed to interest rate risk.

In each 10-K filing, I search for “credit facility”, “credit agreement”, “term loan”, “term-loan”, “term contract”, “term agreement”, and “bank loan” keyword. By doing so, I make sure that the firm-year has a term loan credit facility and that term loan has an outstanding amount and is not repaid. Although the syndicated loan agreements with interest rate based on prime rate are excluded in the previous stage, it is possible that a firm issues a syndicated loan with prime rate in addition to other loan agreements. Therefore, in this stage, I also recheck that the interest rate of the term loan is not based on prime rate. The sample firm-year is dropped if it does not issue a syndicated term loan or issues such loans only with interest rate based on prime rate. This process generates 3976 firm-year (784 firms) observations.

Next, I collect accounting and market information such as net income, book value of assets, long-term debt and share price[14] from COMPUSTAT and CRSP databases for all 3976 firm-years generated in last stage. I look at the data of firm-years whose total assets, stock price, sales, return on assets, leverage, and Q ratio[15] are outside the 1st and 99th percentile to check for outliers. Among these firm-years, I remove 87 firm-year observations (3889 firm-years remain) due to the negative stock price, bankruptcy, or Chapter 11 filing.

Finally, I manually collect the notional and type of IR hedging derivatives (float to fixed or reversed) by searching relative keywords[16] in the 10-K filing of each firm-year of the 3889 firm-year observations, and reading the text surrounding them. I also conduct my search with the same keywords in the body of all firm’s term-loan agreements in Nini et al. (2009) dataset issued on or before the date of the filing to find whether the credit agreement includes an interest rate protection covenant. I classify an interest rate derivative found in the 10-K filing as mandatory, if the report indicates that banks require the firm for this hedging or if an IRPC exists in the matched term loan agreement of the firm-year. IRPCs are all float to fixed IR derivatives while voluntary derivatives sometimes are a combination of fixed to float and reversed contracts. In case of mixed IR

[14] Share prices are at the end of fiscal years. I also conduct my test based on share prices at the end of calendar years and the results are qualitatively similar.
[15] Detailed explanation of variables is available in Appendix.
[16] The list of keywords is: “hedg”, “risk management”, “derivative”, “swap”, “collar”, “rate cap”, “rate floor”, “rate option”, “rate protection”, “rate contract”, and “rate agreement”.

derivative positions, I calculate the net position of the contracts[17]. I normalize the total net notional amount of all interest rate derivatives by total assets of the firm-year. A firm-year is an interest rate derivative nonuser, if it explicitly indicates that it does not use IR derivatives or if my search does not find any related keyword in 10-K filing. In this stage, I also drop 8 firm-years for which I could not find the notional value or type of the IR derivative in their 10-K filings. The final sample includes 3881 firm-years (728 firms) with 458 firm-years (149 firms) mandatory and 1164 firm-years (361 firms) voluntary interest rate derivative users, and 2259 firm-years (611 firms) nonusers.

Table 1 provides the number of nonusers, mandatory, and voluntary IR derivative users for each industry in my sample. As presented in the table, my sample offers a wide distribution in different industries. Firms in communication industry have the highest number of mandatory and voluntary IR derivative users[18] followed by retail, in voluntary IR hedging, and business services, in mandatory ones.

[Table 1]

Panel A, B, and C of Table 2 provide statistics of firms' characteristics for IR derivative nonusers, voluntary, and mandatory users, respectively. Description of all variables and their resources are provided in the Appendix.

My sample offers substantial variation in firms' assets with $76.46M and $3348.90M for nonusers, $171.76M and $9114.00M for voluntary users, and $93.87M and $3780.47M for mandatory users, in 10^{th} and 90^{th} percentile, compared to minimum $500M assets in Allayannis and Weston (2001) sample.

[Table 2]

Table 3 compares firms' characteristics in three subgroups, mandatory and nonusers, voluntary and nonusers, and voluntary and mandatory users of IR derivatives. Panel A reports the difference in mean, while Panel B exhibits the differences in median of each variable. The median of R&D and advertisement expenses is 0 for all subgroups and consequently are not reported in Panel B. The significant level reported for each variable is based on *t*-test for mean and Wilcoxon rank-sum *Z*-test for median comparison. Consistent to previous researches, both mandatory and voluntary hedgers are larger in size than nonhedgers. However, voluntary hedgers are larger than mandatory ones. Mandatory hedgers are more levered, less profitable and have higher default risk (measured by

[17] I examine the impact of these contracts by adding the notional amount of contract and also by separating fixed to float and reverse ones, explained in the robustness test section of this paper.

[18] The high number of observations from communication industry may raise the concern of bias in my empirical test from this particular industry. I remove observations from communication industry and conduct my tests. The results are qualitatively similar to findings with these observations.

KMV-Merton distance to default). They also have lower R&D expense and capital expenditures (CAPEX) compare to voluntary and nonhedgers. Following Allayannis and Weston (2001), I use log of Q ratio as a proxy for firm value. The mean and median of log of Q ratio of mandatory hedgers is not significantly different from those of voluntary and nonusers.

[Table 3]

These univariate results shed light on specific characteristics of mandatory hedgers in my sample. These characteristics are consistent to what risk management theories predict (Nance et al., 1993) for hedgers. Moreover, these special factors of mandatory hedgers such as lower profitability and investment, and higher default risk have no or negative influence on firm value. This fact substantially reduces the concern of endogeneity in my empirical tests explained in the next section.

4. Empirical tests and main results

Impact of IRPCs on firm value

To test the impact of mandatory use of IR derivatives (IRPC) on firm value in cross-sectional and within-industry, I implement an industry fixed-effect model as follows:

$$Q_{i,t} = \alpha + \beta \times IR\ derivatives_{i,t} + \sum_j \delta_j \times \text{control variables}_{i,t} + \eta_t + \omega_i + \varepsilon_{it} \qquad (1)$$

in which, *i* and *t* subscripts refer to firm *i* at year *t*. The dependent variable is the log of Q ratio and represents firm value in my model.

IR derivatives is the hedging intensity of interest rate derivatives which is the net amount of all IR derivative positions normalized by total assets. Using intensity of hedging is more informative than a dummy variable for hedger and nonhedger since it represents the extent of hedging in the model as well. In addition, a simple classification of hedger and nonhedger increases the endogeneity concerns by ignoring the impact of the level of the hedging on firm value.

Firm value is affected by many factors which are generally classified as profitability, growth options, and risk. To isolate the impact of IR derivatives on firm value from these factors, I use the control variables used in Allayannis and Weston (2001). They use return on asset as a proxy for profitability, log of assets, dividend dummy which is 1 if firm-year pays dividend and 0 otherwise, and capital expenditures divided by total assets as proxies for growth options. Debt to equity and credit rating are used as proxies for firm's risk in their control variables. They also have geographical and industrial diversification dummies as other factors with potential impact on firm value in their model.

I do not use industrial diversification dummy as this factor does not show significant variation in my sample firms. Most of the firms in my sample do not have credit rating. As a substitute, I use KMV-Merton distance to default explained in Crosbie and Bohn (2003) which takes into account the volatility of assets and debt level. Altman (1968) Z-Score is an alternative but this measurement has variables such as profitability in common with control variables in my model that potentially reduces its explanatory power. Beside the capital expenditure, I use advertisement and R&D expenditures normalized by total assets, and two-year sales growth as other proxies for growth options. Researches address the issue of tangibility in growth options. Tangible assets are also more valued for collateral in credit agreements. Therefore, I employ tangibility in my model and use net amount of properties, plant and equipments divided by total assets as a substitute for this variable. η_t and ω_i are time and industry fixed-effects classified as 2-digit Standard Industrial Classification (SIC) code, respectively that represent the marginal impact of these effects on the intercept of my model.

I conduct my test in a sample of mandatory IR derivative users and nonusers and estimate heteroskedasticity consistent standard errors clustered at industry level. Industry fixed-effect in my model circumvents the impact of time-constant unobserved industry's characteristic on firm value that partially reduces the endogeneity concern from industry-specific parameters. However, time varying unobserved heterogeneity among industries is not addressed.

Column (1) of Table 4 exhibits the result of the test with industry fixed-effect. IRPC's coefficient is positive and highly significant, consistent to my hypothesis. If I apply the average IRPC intensity reported in Table 2 into the model, I have 0.183×0.354=0.079 as the impact of mandatory hedging on firm value. Since I use the log of Q ratios in my model, the coefficients in the model represent the elasticity of each variable. Therefore, an average mandatory IR derivative user has a Q ratio 8.2% ($e^{.079}$ -1) higher than nonusers, which is also economically significant. The sign of coefficients of control variables are in parallel to what is expected except for log of assets which is positive and statistically significant. Tangibility has a large negative impact on Q ratio while profitability, capital expenditures, advertisement and R&D expenses, dividend dummy, and distance to default have positive and significant impact on firm value.

I also conduct my test as a pooled OLS without industry fixed-effect. Since many industries have naturally higher or lower Q ratios, I add the *Global industry Q* to my model in case that control variables have weak explanatory power for industry-specific characteristics of the firm-years. The coefficients and heteroskedasticity consistent standard errors clustered at the firm level are reported in column (2) of Table 4. IRPC shows a positive and significant impact on firm value similar to what I find in the first test. The coefficients of the control variables have the same sign as those in the fixed-effect model.

These findings suggest that shareholders perceive IRPCs as efficient interest rate hedging instruments and set a positive premium on firm value from these financial instruments.

[Table 4]

Impact of voluntary IR derivatives on firm value

So far, I find a positive and significant impact from IRPCs on firm value. While mandatory term of IRPCs sends a strong signal about the purpose of using such derivatives for hedging interest rate risk, the real purpose of voluntary use of IR derivatives is not as clear for shareholders. Therefore, such positive impact of IRPCs on firm value is not expected from voluntary IR derivatives.

To test the impact of voluntary use of IR derivatives, I conduct my test based on equation (1) but on a sample of voluntary IR derivative users and nonusers. I also conduct my test without industry fixed-effect as a pooled OLS and add *Global industry Q* to my model. Columns (3) and (4) of Table 4 report the results of these tests. As expected, voluntary IR derivatives do not demonstrate any significant impact on firm value in both models. The sign of coefficient of control variables is similar to my test on IRPCs, except the sign of Debt to Equity in pooled OLS model though is not significant. These results explain that shareholders are cautious in pricing IR derivatives when the real purpose of such derivatives is not clear.

IRPC and value implication of IR derivatives

Previously, I isolate mandatory and voluntary IR derivatives and document a strong impact from IRPC and no significant impact from voluntary ones on firm value. The conflict of interest between shareholders and managers, and the mandatory term of using IR derivatives in IRPC clearly explain these results. IRPC significantly reduces the information asymmetry between shareholders and managers about the motive behind the use of IR derivatives, making such derivatives completely aligned with sound risk management practices.

In this section, I turn my attention to signaling effect of mandatory term in IRPCs. To determine whether investors perceive an IRPC as a signal for no managerial incentives embedded in the use of IR derivatives, I estimate whether their evaluation of IR derivatives differs between voluntary and mandatory use of derivatives. To do so, I make a distinction between IR derivatives mandated by credit agreements and those applied voluntarily by managers, and define my model as follows:

$$Q_{i,t} = \alpha + \beta_1 \times IRPC\ dummy_{i,t} + \beta_2 \times IR\ derivatives_{i,t} + \beta_3 \times IRPC\ dummy_{i,t} \times IR\ derivatives_{i,t} + \sum_j \delta_j \times \text{control variables}_{i,t} + \eta_t + \omega_i + \varepsilon_{it} \qquad (2)$$

Dependent and control variables are similar to those in equation (1). *IRPC dummy* is a dummy variable which is 1 if the IR derivative is mandatory and 0 otherwise. The coefficient of interaction term between *IRPC dummy* and *IR derivatives* explains the investors' perception about the mandatory term of the IR derivatives. Based on my hypothesis and previous findings, I conjecture a positive and significant value for this coefficient. I conduct my test on a sample of mandatory and voluntary users of IR derivatives. Similar to my previous tests, I also add *Global industry Q* to control variable and test the model without industry fixed-effect.

Table 5 reports the results of both models. The average impact of IR derivatives on firm value is positive but not significant. However, I observe that mandatory term of using IR derivatives has a significant effect on investors' valuation of IR derivatives. In fact, shareholders put a substantial premium on the IR derivatives mandated by creditors. The coefficient of *IR dummy × IR derivatives* is large (0.5), positive, and statistically significant. This estimate explains the signaling effect of mandatory term of using IR derivatives. If I apply the average intensity of IRPCs reported in Table 2 in my model, it reveals that on average, the impact of IR derivatives mandated by creditors on firm value is 10% ($e^{0.51\times0.188}$-1) higher than that of voluntary ones.

[Table 5]

5. Robustness tests

5.1. Endogeneity

The results in section 4 strongly support my hypothesis and document a positive and significant impact from mandatory IR hedging on firm value and no significant influence from voluntary ones. However, it is possible that mandatory IR hedging is an endogenous factor in the model. Almost all researches in financial decision including hedging have the reverse causality concern, since these decisions are firm-choice and the special characteristics of these firms might bias the result of empirical tests.

Mandatory hedging is creditors' rather than firm's decision. In addition, as discussed in Campello, Lin, Ma, and Zou (2011), there is a substantial "institutional mismatch" between hedging counterparties and lenders particularly, when 85% of IR hedging contracts is provided by five financial institutions, according to Fed's regulatory 2002 statistical information. However, creditors may impose IRPC on firms with special characteristics. For instance, firms with more growth options are more subject to asset substitution; consequently, these firms are more vulnerable to be enforced by the banks to hedge while their growth options accounts for their higher value. Moreover, it is firm's choice to accept a credit agreement with IRPC that exacerbate simultaneity in my model.

The univariate analysis explained in Table 3 does not clarify this concern. While firms with IRPC have less tangible assets than voluntary IR derivative users', they have less R&D expense relative to voluntary IR derivative users and nonusers and less capital expenditure than those of voluntary IR derivative users. However, Table 3 shows that mandatory IR derivative users have lower (higher) distance to default (leverage) than that of voluntary and nonusers.

To alleviate the issue of endogeneity, I implement an instrumental variable approach in my test on the impact of IRPCs on firm value. An instrumental variable, which explains the mandatory hedging but does not directly impact firm value, mitigates this problem in my tests.

I develop a proxy for what banks expect to lose in case of payment default which is theoretically identified as the main concern of the lender and rationale for imposing IRPC. Moreover, the elements of bank's expected loss, leverage, tangibility and probability of default, are in parallel to my univariate analysis reported in Table 3. I calculate one-year probability of default of the firm-year based on KMV-Merton model, which is:

$$\pi_{default} = N(-DD) \qquad (3)$$

in which, *N(.)* is cumulative standard normal distribution function and *DD* is KMV - Merton distance to default measure. I assume that creditors can recover part of the debt from tangible assets in place, as a result the proxy for banks' loss expectation is:

$$Bank\ Loss = \pi_{default} \times (Debt - Tangible\ Asset) \qquad (4)$$

in which *Debt* is long term debt and *Tangible asset* is net amount of property, plant and equipment. Since I normalize the notional amount of IR derivatives by total assets of the firm in the baseline model, I divide *Bank Loss* by total assets as the final instrument. This factor is expected to have high correlation with imposing IRPCs when banks expect more losses from borrowers with higher probability of default, higher debt and lower tangibility[19], and impose IRPC on these firms to reduce the probability of default and expected losses. Therefore, this factor meets the inclusion condition of an instrumental

[19] Although, it does not accurately show the real banks' losses since bank may not be the only debt holder, its share in debt and seniority of its claim is not in the model, book value of tangible assets is not the real recovery from collaterals, default time horizon is fixed at 1 year, and discount factor is not included.

variable. *Bank Loss* is not expected to have correlation with firm value since it is a nonlinear function of the leverage and represents a dual edge sword from shareholders' point of view. Based on trade-off theory, on one hand, high leverage increases the potential costs of distress and probability of default which is unfavorable for shareholders. On the other hand, shareholders benefit from tax advantage of leverage. Therefore, I do not expect a first-order impact from this factor on firm value, making it complied with exclusion condition of instruments[20].

I conduct the instrumental variable estimations in two stages. First, I regress IR derivatives intensity on instrumental and independent variables of the baseline model (equation (1)). Second, I use the predicted values of IR derivatives intensities from the first stage regression in the baseline model. Similar to my test of IRPCs with the baseline model, I conduct this 2SLS test in a sample of mandatory IR derivative users and nonusers, and estimate heteroskedasticity consistent standard errors clustered at the industry level with industry fixed-effect and at the firm level without this fixed-effect.

Column (1) and (2) of Table 6 report the coefficients of these tests, respectively. Consistent with the results in the baseline model, mandatory hedging has significant and positive impact on firm value. Control variables in both IV models demonstrate expected signs and consistent with the results in tests without instruments. It indicates that the instrument used treats endogenous variable exclusively with limited impact on explanatory power of other control variables.

[Table 6]

First stage *F*-test in the industry fixed-effect model is 8.02 (*p*-value 0.65%). In the pooled OLS model, this value is 11.08 (*p*-value 0.09%). KP statistics (Kleibergen and Paap, 2006) for under-identification test are presented. The null hypothesis in this test is that instruments used in the model are weak. The null is rejected with 2.83% and 0.00% *p*-values for with and without fixed-effect tests, respectively.

I also conduct the Hansen J over-identification test in which the null hypothesis states that instruments used are *not* over-identified and have *no* correlation with error terms in the main model. It means that a high value of this test rejects the null hypothesis and casts

[20] I evaluate other instruments as well and find *Bank Loss* as the best candidate for my IV test. For instance, I investigate conditional IRPCs in which creditors set a threshold for imposing IRPC. EBIT (Earnings Before Interest and Taxes) to Debt, interest rate coverage ratio, and fixed-charges coverage ratio are the main scales for imposing IRPCs. EBIT as the main parameter in all three factors is indirectly controlled in return on assets in the baseline model. On top of that, all three factors have a direct impact on firm value and fail in exclusion restriction of instrumental variables. I test these variables as an instrument in my model and all fail in Hansen J over-identification tests, as expected. However, I use EBIT to Debt ratio as a control variable in propensity score matching explained in the next section.

doubt on exclusion condition of the instruments. For both models the value of the test is 0.000, indicating that equations are exactly identified.

Taken together, these results suggest that mandatory hedging has a significant and positive impact on firm value. While industry fixed-effect partially minimizes the issue of endogeneity by controlling industries' time-constant characteristic, using *Bank Loss* as a valid instrument for mandatory hedging cleans out the time variant unobserved factors and supports the robustness of the results of this empirical study.

5.2. Selection bias

In previous section, I implement an IV approach to mitigate the issue of reverse causality in the impact of IRPC on firm value. However, the issue of selection bias is not addressed, particularly, in the evaluation of the impact of IRPC on value implication of IR derivatives. Banks enforce firms with special characteristics to hedge interest rate risk. Therefore, there is a concern for selection bias from unobservable characteristics of the firms without IRPC, when I test the impact of IR derivatives in this particular group of hedgers. To address this concern, I conduct a propensity score matching for IRPC treatment in two mandatory-nonuser and mandatory-voluntary subgroups.

Bartram et al. (2011) use the same methodology to compare the Q ratio of hedgers and nonhedgers. Since I have a subgroup of mandatory hedger in my test, I setup two separate tests for a robust conclusion of the results. Based on my hypothesis, I define two distinct treatments, the impact of mandatory IR derivatives on firm value and the impact of mandatory term of using IR derivatives on investors' evaluation of such derivatives. For testing the first treatment, I match mandatory hedgers with nonusers of interest rate derivatives and compare the Q ratios while for the latter I conduct my test by matching mandatory hedgers with voluntary ones.

For each of test, I generate propensity scores with a *logit* model, using a dummy variable for mandatory users of IR derivatives as the dependant variable and a set of variables as determinant of imposing IRPCs and firm-year's characteristics.

Size, growth opportunities, leverage, and default risk are the main determinant of hedging according to risk management theories and have a potential impact on firm value as well. Therefore, for matching mandatory IR derivative users with nonusers, I use *log of assets, Debt to equity* as well as *CAPEX, R&D* and, *Advertisement* expenditures all scaled by total assets as substitutes for growth opportunities. *KMV-Merton* measure is also used as a proxy for default risk. I use *EBIT to Long-term Debt* ratio as an additional parameter for mandatory hedging since it is the most common parameter in conditional IRPCs. In matching mandatory hedgers with voluntary ones, I replace this variable with IR derivatives intensity. In fact, by adding IR derivatives intensity, I test the difference between the firm value of mandatory IR hedgers with that of voluntary IR hedgers which have the closest characteristics to the sample firm, including the level of the use of IR derivatives. *Global industry Q* and year dummies are also included in both tests for industry-specific and time variation of the variables. To suppress biases from other value generation factors, I add *Return on assets* and *Tangibility* to control variables as well.

After generating propensity scores for each test, I conduct my analysis by matching each treated firm-year with those from controlling samples that their propensity score is maximum 0.01 different from that of treated. Then, I compare the Q ratio of treated, which are mandatory hedgers in my test, with propensity-score-weighted average of the Q ratios of the matched firm-years.

To assess the quality of matching, I report the bias of variables before and after of the matching calculated as follows:

$$BIAS(\%) = \left| \frac{(\mu_T - \mu_M)}{\sqrt{\sigma_T^2 + \sigma_M^2}} \right| \times 100 \qquad (5)$$

in which, $\mu_T(\mu_M)$ and $\sigma_T(\sigma_M)$ is the mean and standard deviation of each variable used in matching procedure for treated(matched) samples, respectively. The comparison of *BIAS* before and after matching depicts that to what extent the matching procedure reduces the selection bias of firm's characteristics in my sample.

Panel A of Table 7 reports the result of matching between mandatory IR derivative users and nonusers. On average, mandatory hedgers have 10.56% (1.591/1.439-1) higher value than nonhedgers with 1.71% *p*-value of the *t*-test. It indicates that this difference is economically and statistically significant. This result supports my findings in the baseline model and IV tests and suggests that interest rate risk management embedded in the IRPC accounts for the higher firm value of mandatory hedgers and this premium is not biased by special characteristics of mandatory hedgers. Figure 1.A graphically exhibits the level of biases (non-absolute value) before and after the matching. As demonstrated, the matching significantly reduces the bias of variables where the maximum bias is 4.17% compare to 29.63% before the matching.

[Table 7]

[Figure 1]

In the next step, I analyze the impact of mandatory term of using IR derivatives on value implication of such financial instruments. Panel B of Table 7 exhibits the results.

Consistent to my findings in the baseline model, the result shows that the firm value of mandatory hedgers is 13.91% (1.596/1.401-1) higher than that of voluntary hedgers, on average, and the difference is highly significant (0.55% *p*-value). Since, the level of using IR derivatives is also included in control variables, this result clearly explains that investors evaluate mandatory IR derivatives with a premium compare to voluntary ones whose purpose is not transparent for shareholders. Figure 1.B demonstrates the biases (non-absolute value) before and after the matching. Variables before the matching are highly biased, 46.91% at maximum, while this bias is significantly reduced to 10.11% maximum level after the matching, supporting the success of matching in limiting the impact of biases on my inference of the results in this test.

5.3. Impact from other covenants

IRPCs are not the only covenants in private credit agreements. Therefore, it is possible that IRPCs are bonded to other types of covenants whose impact on firm value is not controlled in my model. There is also a possibility of a tradeoff between relaxing such covenants and accepting IRPCs that misleads my inference about the results of my empirical tests. To be sure about the robustness of my results to the correlation of IRPCs with other covenants in the syndicated loan agreements, I use the classification of covenants in Nini et al. (2009) sample[21]. I control the impact of these terms by adding a dummy variable for each covenant which is 1 if the firm-year is subject to the covenant and 0 otherwise to my baseline model. To investigate the interplay between these covenants and IRPCs, the interaction between IRPC and each covenant dummy is also added.

I conduct my test on a sample of mandatory IR derivative users and nonusers. The results are in column (1) and (2) of Table 8 for tests with and without industry fixed-effect, respectively. For the space saving, I report only the coefficient of covenants and their interaction with IRPC terms that are statistically significant.

[Table 8]

First, the estimates show that after controlling for the presence of other covenants and their interaction with IRPC, mandatory use of IR derivatives still has positive and significant impact on firm value and the magnitude of the impact (*IR derivatives'*

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[21] Covenants in this classification are as follows:
CAPEX restriction, Current ratio, Debt service coverage ratio, Debt to capitalization, Debt to cash flow, Debt to net worth, Fixed charge coverage ratio, Interest coverage ratio, Net worth, Other balance sheet, Other coverage, Other liquidity, Quick ratio, Senior debt to cash flow, Stockholder's equity, Tangible net worth, Working capital, Debt to balance sheet, and Cash flow/earnings based covenants.

coefficient) is not dramatically changed either. It means that the positive impact from IRPC is independent from the other covenants. Second, the interaction term of three types of covenants including quick ratio, liquidity, and senior debt to cash flow covenants have statistically significant coefficient. These coefficients deliver a clear insight about the real purpose of IRPC and its impact on firm value.

The coefficients of interaction term between IRPC and liquidity, and IRPC and quick ratio covenants are negative, stating that liquidity-control covenants reduce the positive impact of IRPC on firm value. In fact, hedging secures the cash flows in unfavorable states of the economy and stabilizes liquidity. It also diminishes the probability of generating excess cash vulnerable to be used for private benefit of managers. Since a liquidity covenant addresses the same risks in credit agreements, it reduces the positive impact of IRPC on firm value, demonstrated by the negative sign of its interaction with IRPC.

The coefficient of interaction term between IRPC and senior debt to cash flow covenant complements this argument. Senior debt to cash flow covenant has a negative and significant coefficient in my estimates, while its interaction with IRPC is positive and statistically significant. It means that the stable cash flows resulted from interest rate risk management significantly reduces the probability of technical default in this covenant and the positive interaction of IRPC with senior debt to cash flow covenant compensates the negative impact of this covenant on firm value.

The analysis of interaction terms between IRPC and covenants not only provides solid evidence about the independent value implication of IRPCs from other covenants but also demonstrates that IRPCs are complied with risk management purpose of using interest rate derivatives.

5.4. Impact from creditors' control rights

In the context of creditors' control rights out of states of bankruptcy, Nini et al. (2012) explains that when firms violate a covenant of a credit agreement, creditors actively get involved in corporate management and influence corporate governance quality. They also show that this influence has a positive impact on firm value. Therefore, it is possible that imposing IRPC is a result of a technical default and the positive impact from IRPC on firm value is biased from other factors of creditors' involvement in management. However, my analysis of firms with IRPC and violation of covenant states that my results are not influenced by technical defaults. Nini et al. (2009) identify credit agreements in which the borrower has a violation of a covenant in the year before the date of the contract. I match these credit agreements with contracts with IRPC and find only 12 firms in my sample which have an IRPC in their credit agreements and a record of technical default in the year before. I remove these firms from my sample and test the baseline model. The unreported results (available upon request) are qualitatively similar to what I find for the whole sample. Therefore, the technical default does not influence the impact of IRPC on firm value in my test.

5.5. Impact form cost of debt

Beatty et al. (2011) document that IRPCs reduce the LIBOR spread in syndicate loans and this reduction is more significant than that of voluntary IR hedging. Therefore, the positive impact of IRPC on firm value might be from the reduction of the cost of debt rather than investors' evaluation of mandatory IR derivatives. To test this confounding factor, I add the LIBOR spread of firm-year's term loan agreement to the baseline model along with its interaction with IR derivatives and test the model on mandatory IR derivative users and nonusers with and without industry fixed-effect. The coefficient of the interaction term represents the impact of cost of debt on value implication of IRPC. The coefficient of interaction between LIBOR spread and IRPCs is positive (0.03) but is not significant (*p*-value 56%). Therefore, the reduction in cost of debt does not account for the premium from IRPC on firm value.

5.6. Impact form type of IR derivatives

Almost 10% of voluntary hedgers in my sample have a combination of fixed to float and float to fixed contracts. Therefore, I analyze the potential biases of my results from type of contracts as well. As explained in the construction of my sample, I assume the net position of interest rate derivatives, if the firm-year holds both types of contract in its IR derivatives portfolio. Since all IRPCs are variable to fixed interest rate derivatives, the difference in the impact on firm value between voluntary and mandatory use of IR derivatives might be from type of hedging agreements. Since float to fixed contracts are more complied with risk management theories than reverse ones, shareholders' might overweight the impact of float to fixed derivatives, resulting in larger impact from IRPC on firm value. To clarify this issue in my tests, I split fixed to float and float to fixed contracts in voluntary hedging and conduct my initial test on a sample of voluntary IR derivative users and nonusers. The unreported result of this test (available upon request) shows that neither fixed to float nor float to fixed voluntary contracts demonstrate any significant impact on firm value, rejecting the potential biases from type of IR derivatives in my inference of empirical results.

Last, instead of netting the fixed to float and float to fixed contracts, I add the notional amount of contracts to test the robustness of my results to the calculation of combined positions. The unreported results (available upon request) show no significant changes in the impact of voluntary positions on firm value.

6. Conclusion

In the studying of welfare implication of using derivatives, empirical research so far aims to use instruments such as corporate governance to isolate positions not complied with hedging practices. In this study, I go beyond the shareholders' and managers' decision for hedging and focus on the use of derivatives mandated by creditors. These financial instruments have a distinct position from derivatives implemented by managers who might have incentives rather than corporate risk management in the use of derivatives, not necessarily at the shareholders' benefit. Shareholders address the *real* hedging practice of mandatory use of derivatives and set a premium from these positions on firm value in parallel to risk management theories.

I choose Interest Rate Protection Covenant in private credit agreements as one of the most common mandatory hedging instruments and find a positive and significant impact from these derivatives on firm value. The impact of voluntary interest rate hedging on firm value is studied in parallel to mandatory ones and no significant impact on firm value from these derivatives is found in my research.

In sum, this study provides a new insight into the value implication of risk management and highlights the critical role of shareholders' perception about derivative positions in value generation of financial instruments. It also complements the empirical studies in reduction of cost of debt by mandatory use of IR derivatives and documents the ultimate positive impact of these derivatives on firm value. The result of this research is also a true example of cases in which shareholders value the indirect influence of creditors on financial decisions despite the existence of conflict of interest between debt- and equity-holders.

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Appendix: Data Definitions

Variable name	Description	COMPUSTAT Item
Q ratio	(Market value of equity at fiscal year-end + total assets – book value of equity)/Total Assets	(Item 199 × Item 25 + Item 6 – Item 60)/Item 6
Total Assets	Book value of total assets	Item 6
R&D/Total Assets	Research and development expenses divided by total assets	Item 46/Item 6
Dividend Dummy	Dividend dummy = 1 if Common dividends >0	Equal 1 if Item 21>0
Debt/Equity	Long term debt to market value of equities	Item 9/(Item 199 × Item 25)
ROA	Return On Assets – net income divided by total assets	Item 172/Item 6
CAPEX/Total Assets	Capital expenditures divided by total assets	Item 128/Item 6
Advertisement /Total Assets	Advertising Expense divided by total assets	Item 45 / Item 6
Sales Growth	Two-year sales growth divided by total assets	(Item $12_{(t)}$-Item $12_{(t-2)}$)/Item 6
Global industry Q	Sum of market value of all firms with the same 2-digit SIC code in COMPUSTAT universe plus the sum of the assets minus the sum of book value of the equities divided by the sum of the assets of those firms for each year.	
EBIT	Earnings Before Interest and Taxes	Item 172 + Item 15 + Item 16
Tangibility	Net Properties, Plant and Equipment divided by total assets	Item 8 / Item 6
Geographical dummy	Dummy variable =1 if foreign tax =1	Equal 1 if Item 64>0
Distance to Default	Distance-to-default (Crosbie and Bohn, 2003) based on KMV-Merton model = $(V_a\text{-}D)/V_a\sigma_a$ where V_a is the value of the assets, D is half of long term debt plus debt in current liabilities. σ_a is the volatility of the assets. Since V_a and σ_a are not observable, I approximate them by solving Merton's (1974) model of pricing firm's debt and value of the equity for 1-year period: $V_e= V_aN(d_1)\text{-}e^{-r}DN(d_2)$ and $\sigma_e=N(d_1)\ V_a\sigma_a/\ V_e.$ $d_1=(\ln(V_a/D)+r+0.5\sigma_a^2)\ \sigma_a$ and $d_2=d_1\text{-}\ \sigma_a$	
IR Derivatives	Net notional value of interest rate derivatives divided by total assets	
IRPC dummy	Equal 1 if the IR derivative is enforced by creditors and 0 otherwise	
List of Covenants based on Data used in Nini et al. (2009)	CAPEX restriction covenant Current ratio covenant Debt service coverage ratio covenant Debt to capitalization covenant Debt to cash flow covenant Debt to net worth covenant Fixed charge coverage ratio covenant Interest coverage ratio covenant Net worth covenant Other balance sheet covenant Other coverage covenant Other liquidity covenant Quick ratio covenant Senior debt to cash flow covenant Stockholder's equity covenant Tangible net worth covenant Working capital covenant Debt to balance sheet covenant Cash flow/earnings based covenant	

Table 1: Description of Sample by Industry Distribution

This table provides the number of firm-years for mandatory interest rate (IR) derivative users, voluntary IR derivative users, and nonusers for each industry in the sample. Industry classification is based on Fama-French 48-industry classification.

Industry	Nonusers	Mandatory Users	Voluntary Users
Agriculture	2	0	0
Aircraft	29	0	7
Apparel	51	3	35
Automobiles and Trucks	42	1	42
Beer & Liquor	6	2	13
Business Services	268	49	49
Business Supplies	54	5	21
Chemicals	38	11	38
Coal	6	6	5
Communication	90	99	83
Computers	50	9	4
Construction	72	2	17
Construction Materials	59	0	38
Consumer Goods	71	6	31
Defense	3	3	0
Electrical Equipment	32	9	30
Electronic Equipment	141	10	41
Entertainment	91	23	65
Fabricated Products	13	0	0
Food Products	25	17	18
Healthcare	82	17	39
Machinery	102	10	54
Measuring and Control Equipment	51	8	31
Medical Equipment	50	20	20
Non-Metallic and Industrial Metal Mining	12	0	4
Personal Services	24	27	30
Petroleum and Natural Gas	164	14	55
Pharmaceutical Products	80	5	22
Precious Metals	0	0	5
Printing and Publishing	25	10	12
Real Estate	0	0	1
Recreation	30	0	6
Restaurants, Hotels, Motels	66	20	27
Retail	111	12	78
Rubber and Plastic Products	26	9	5
Shipbuilding, Railroad Equipment	2	2	12
Shipping Containers	11	4	18
Steel Works Etc	43	9	33
Textiles	35	1	26
Transportation	85	15	75
Wholesale	117	20	74
Total	2259	458	1164

Table 2: Descriptive Statistic of Sample

Panel A describes the sample of interest rate (IR) derivative nonusers with 2259 firm-year observations. Panel B(C) describes the sample of voluntary (mandatory) IR derivative users with 1164(458) firm-year observations. IR derivatives intensity is the net notional amount of IR derivatives divided by total assets. Total assets represent the book value (BV) of assets. Q ratio is defined as (market value at fiscal year-end + BV of assets –BV of Equities)/BV of total assets. Debt to Equity is Long-term debt to market value. CAPEX is capital expenditures. Advertisement and R&D are advertisement and research and development expenses, respectively. Tangibility is net properties, plant and equipment divided by total assets. Distance to Default is KMV-Merton measure explained in Appendix.

	Mean	SD	10th Percentile	Median	90th Percentile
Panel A: Firms' Characteristics - IR derivative Nonusers (2259 firm-years)					
Total assets ($m)	1697.609	6603.773	76.466	518.231	3348.903
Q ratio	1.611	0.982	0.851	1.320	2.753
Leverage (Debt to Equity)	1.206	4.828	0.019	0.362	2.478
Tangibility	0.311	0.245	0.057	0.240	0.707
CAPEX/Assets	0.060	0.067	0.011	0.038	0.138
Advertisement/Assets	0.012	0.038	0.000	0.000	0.038
R&D/Assets	0.016	0.036	0.000	0.000	0.050
Distance to Default (KMV-Merton Model)	0.271	0.567	-0.024	0.194	0.876
Panel B: Firms' Characteristics - Voluntary IR derivative users (1164 firm-years)					
IR derivatives intensity	0.116	0.170	0.016	0.080	0.238
Total assets ($m)	3993.276	10202.860	171.761	1138.192	9114.000
Q ratio	1.473	0.806	0.883	1.272	2.235
Leverage (Debt to Equity)	1.343	3.217	0.097	0.554	2.850
Tangibility	0.355	0.237	0.089	0.300	0.735
CAPEX/Assets	0.060	0.060	0.014	0.044	0.126
Advertisement/Assets	0.012	0.040	0.000	0.000	0.034
R&D/Assets	0.012	0.030	0.000	0.000	0.037
Distance to Default	0.298	0.588	-0.047	0.230	0.865
Panel C: Firms' Characteristics - Mandatory IR derivative users (458 firm-years)					
IR derivatives intensity (IRPC)	0.188	0.175	0.039	0.143	0.374
Total assets ($m)	1354.050	1814.568	93.870	632.956	3780.478
Q ratio	1.595	1.207	0.847	1.260	2.357
Leverage (Debt to Equity)	2.065	5.611	0.128	0.750	3.827
Tangibility	0.298	0.223	0.062	0.258	0.668
CAPEX/Assets	0.055	0.054	0.010	0.037	0.121
Advertisement/Assets	0.009	0.028	0.000	0.000	0.030
R&D/Assets	0.009	0.026	0.000	0.000	0.027
Distance to Default	0.183	0.430	-0.115	0.153	0.795

Table 3: Comparison of IR Derivative Mandatory and Voluntary Users, and Nonusers

This table compares mean and median of IR derivatives, Q ratio (log) and firm characteristic of mandatory IR derivatives users, voluntary IR derivatives users, and nonusers. IR Derivatives intensity is the net notional amount of IR derivatives divided by total assets. Total assets represent the book value (BV) of assets. Q ratio is defined as (market value at fiscal year-end + BV of assets –BV of Equities)/BV total assets. Debt to Equity is long term debt to market value. Return on Assets is net income divided by total assets. CAPEX is capital expenditures. Advertisement and R&D are advertisement and research and development expenses, respectively. Tangibility is net properties, plant and equipment divided by total assets. Sales growth is changes of sales from two years before divided by total assets. Distance to Default is KMV-Merton measure explained in Appendix. *, ** and *** represents 10%, 5% and 1% significant level of the *t*-test and Wilcoxon rank-sum *Z*-test for the mean and median comparisons, respectively.

Panel A: Comparison of the mean of parameters between mandatory IR hedgers, voluntary IR Hedgers, and Nonhedgers						
	Mandatory Hedgers (1)	Voluntary Hedgers (2)	Nonhedgers (3)	Diff.: (1)-(2)	Diff.: (1)-(3)	Diff.: (2)-(3)
Observations	458	1164	2259			
Mean of:						
IR derivatives intensity	0.188	0.116	0.000	0.073***	n.a.	n.a.
Log of Q ratio	0.325	0.296	0.352	0.030	-0.027	-0.057***
Log of total assets	6.374	7.060	6.247	-0.686***	0.127*	0.813***
Debt to Equity	2.065	1.343	1.206	0.722***	0.859***	0.137
Return on assets	0.003	0.024	0.010	-0.021***	-0.007	0.014***
Tangibility	0.298	0.355	0.311	-0.057***	-0.013	0.044***
CAPEX/Assets	0.055	0.060	0.060	-0.005	-0.005	0.000
Advertisement/Assets	0.009	0.012	0.012	-0.002	-0.003	-0.001
R&D/Assets	0.009	0.012	0.016	-0.003*	-0.007***	-0.004***
Distance to Default	0.183	0.298	0.271	-0.115***	-0.088***	0.027
Panel B: Comparison of the median of the parameters between mandatory IR hedgers, voluntary IR Hedgers, and Nonhedgers						
Median of:						
IR derivatives intensity	0.143	0.080	0.000	0.063***	n.a.	n.a.
Log of Q ratio	0.231	0.241	0.278	-0.009	-0.047	-0.037**
Log of total assets	6.450	7.037	6.250	-0.587***	0.200**	0.787***
Debt to Equity	0.750	0.554	0.362	0.196***	0.388***	0.192***
Return on assets	0.023	0.033	0.033	-0.011***	-0.010***	0.000
Tangibility	0.258	0.300	0.240	-0.042***	0.018	0.06***
CAPEX/Assets	0.037	0.044	0.038	-0.007**	0.000	0.006***
Distance to Default	0.153	0.230	0.194	-0.077***	-0.041***	0.036*

Table 4: Mandatory and Voluntary Use of IR derivatives and Firm Value

The dependent variable is the log of Q ratio defined as (market value at fiscal year-end + BV of assets – BV of Equities)/BV of total assets. Column (1) and (2) exhibit the results of the impact of IR derivatives on firm value in a sample of mandatory IR derivative users and nonusers. Column (3) and (4) exhibit the results of the impact of voluntary use of IR derivatives on firm value in a sample of voluntary IR derivative users and nonusers. In column (1) and (3) results are obtained from industry fixed-effect (equations (1)). Column (2) and (4) report the estimates via pooled OLS without industry fixed-effect. IR Derivatives is the net notional amount of IR derivatives divided by total assets. Total assets represent the book value (BV) of assets. Debt to Equity is long term debt to market value. Return on Assets is net income divided by total assets. CAPEX is capital expenditures. Advertisement and R&D are advertisement and research and development expenses, respectively. Tangibility is net properties, plant and equipment divided by total assets. Sales growth is changes of sales from two years before divided by total assets. Dividend dummy is 1 if firm-year pays dividend and 0 otherwise. Geographical dummy is 1 if firm-year has operation abroad and 0 otherwise. Global industry Q is the Q ratio of a hypothetical firm whose asset and equity is the aggregate amount of all firms' assets and equities with the same 2-Digit SIC code of firm-year in COMPUSTAT universe. Distance to Default is KMV-Merton measure explained in Appendix. Standard errors robust to heteroskedasticity and serial correlation (clustered at industry level in models (1) and (3), and at firm level in models (2) and (4)) are reported in parenthesis. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

	Mandatory versus Nonusers		Voluntary versus Nonusers	
	(1)	(2)	(3)	(4)
IR Derivatives	0.418***	0.428***	0.042	-0.031
	(0.083)	(0.114)	(0.109)	(0.113)
Log of assets	0.022**	0.028***	0.005	0.013
	(0.009)	(0.010)	(0.009)	(0.010)
ROA	0.569***	0.530***	0.837***	0.795***
	(0.189)	(0.153)	(0.147)	(0.132)
Tangibility	-0.155**	-0.244***	-0.144	-0.196***
	(0.077)	(0.068)	(0.086)	(0.065)
CAPEX	1.468***	1.734***	1.232***	1.487***
	(0.386)	(0.245)	(0.352)	(0.222)
R&D	3.376***	3.495***	3.271***	3.385***
	(0.295)	(0.451)	(0.405)	(0.412)
Advertisement	0.712**	0.393	0.533*	0.325
	(0.350)	(0.475)	(0.268)	(0.379)
Debt to Equity	0.001	0.001	0.000	-0.001
	(0.005)	(0.005)	(0.005)	(0.004)
Dividend dummy	0.058**	0.044	0.048**	0.022
	(0.023)	(0.031)	(0.024)	(0.027)
Geographical Dummy	-0.023	-0.046*	-0.001	-0.020
	(0.027)	(0.028)	(0.021)	(0.025)
Distance to Default	0.097*	0.110*	0.070**	0.077**
	(0.052)	(0.059)	(0.029)	(0.031)
Sales Growth	0.013	0.009	0.014	0.011
	(0.020)	(0.016)	(0.018)	(0.014)
Global industry Q		0.215***		0.199***
		(0.043)		(0.039)
Industry fixed-effect	Yes	No	Yes	No
Time effect (Years)	Yes	Yes	Yes	Yes
Observations	2717	2717	3423	3423
Adjusted R^2	0.195	0.220	0.180	0.225

Table 5: IRPCs and Value Implication of IR derivatives

The dependent variable is log of Q ratio defined as (market value at fiscal year-end + BV of assets – BV of Equities)/BV of total assets. In column (1) results are obtained from industry fixed-effect model (equation (2)) on a sample of voluntary and mandatory IR derivative users. Column (2) reports the estimates for the same sample via pooled OLS without industry fixed-effect. IR Derivatives are the net notional amount of IR derivatives divided by total assets. IRPC dummy is 1 if the IR derivative is mandated by creditors and 0 otherwise. Total assets represent the book value (BV) of assets. Debt to Equity is long-term debt to market value. Return on Assets is net income divided by total assets. CAPEX is capital expenditures. Advertisement and R&D are advertisement and research and development expenses, respectively. Tangibility is net properties, plant and equipment divided by total assets. Sales growth is changes of sales from two years before divided by total assets. Dividend dummy is 1 if firm-year pays dividend and 0 otherwise. Geographical dummy is 1 if firm-year has operation abroad and 0 otherwise. Global industry Q is the Q ratio of a hypothetical firm whose asset and equity is the aggregate amount of all firms' assets and equities with the same 2-Digit SIC code of firm-year in COMPUSTAT universe. Distance to Default is KMV-Merton measure explained in Appendix. Standard errors robust to heteroskedasticity and serial correlation (clustered at industry level in models (1), and at firm level in models (2)) are reported in parenthesis. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

	(1)	(2)
IR Derivatives	0.104	0.108
	(0.075)	(0.076)
IRPC dummy	-0.055	-0.037
	(0.036)	(0.044)
IRPC dummy × IR Derivatives	0.515***	0.555***
	(0.126)	(0.132)
Log of assets	0.002	0.017
	(0.010)	(0.012)
Return on Assets	0.459	0.470
	(0.346)	(0.348)
Tangibility	-0.094	-0.168**
	(0.144)	(0.075)
CAPEX/Assets	1.444***	1.556***
	(0.490)	(0.290)
R&D/Assets	3.405***	3.687***
	(1.149)	(0.974)
Advertisement/Assets	0.861**	0.398
	(0.350)	(0.350)
Debt to Equity	-0.008	-0.009*
	(0.006)	(0.005)
Dividend dummy	0.011	-0.009
	(0.032)	(0.031)
Geographical Dummy	-0.019	-0.034
	(0.025)	(0.032)
Distance to Default	0.078*	0.082
	(0.047)	(0.050)
Sales Growth	0.042*	0.042*
	(0.023)	(0.025)
Global industry Q		0.200***
		(0.049)
Industry fixed-effect	Yes	No
Time effect	Yes	Yes
Observations	1622	1622
Adjusted R^2	0.212	0.241

Table 6: Instrumental Variable Approach and the Impact of Mandatory Use of IR derivatives on Firm Value

The dependent variable is log of Q ratio defined as (market value at fiscal year-end + BV of assets – BV of Equities)/BV of total assets. The results in Column (1) and (2) are estimated via 2SLS model for instrumental variable estimations for industry fixed-effect and pooled OLS, respectively in a sample of mandatory IR derivative users and nonusers. First stage *F*-test, PK and Hansen J for under- and over-identification tests for measurement relevance of instrument in IV tests are presented in the table. IR Derivatives is the net notional amount of IR derivatives divided by total assets. Total assets represent the book value (BV) of assets. Debt to Equity is long term debt to market value. Return on Assets is net income divided by total assets. CAPEX is capital expenditures. Advertisement and R&D are advertisement and research and development expenses, respectively. Tangibility is net properties, plant and equipment divided by total assets. Sales growth is changes of sales from two years before divided by total assets. Dividend dummy is 1 if firm-year pays dividend and 0 otherwise. Geographical dummy is 1 if firm-year has operation abroad and 0 otherwise. Global industry Q is the Q ratio of a hypothetical firm whose asset and equity is the aggregate amount of all firms' assets and equities with the same 2-Digit SIC code of firm-year in COMPUSTAT universe. Distance to Default is KMV-Merton measure explained in Appendix. Standard errors robust to heteroskedasticity and serial correlation (clustered at industry level in models (1), and at firm level in models (2)) are reported in parenthesis. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

	(1)	(2)
IR Derivatives	2.276**	2.401**
	(0.904)	(1.067)
Log of assets	0.032***	0.030***
	(0.011)	(0.011)
Return on Assets	0.570***	0.549***
	(0.175)	(0.136)
Tangibility	-0.074	-0.203***
	(0.106)	(0.078)
CAPEX/Assets	1.485***	1.762***
	(0.355)	(0.249)
R&D/Assets	3.594***	3.805***
	(0.189)	(0.486)
Advertisement/Assets	0.909***	0.567
	(0.337)	(0.512)
Debt to Equity	-0.001	-0.001
	(0.006)	(0.006)
Dividend dummy	0.058**	0.054*
	(0.024)	(0.032)
Geographical Dummy	-0.010	-0.020
	(0.036)	(0.033)
Distance to Default	0.100**	0.112*
	(0.051)	(0.059)
Sales Growth	0.008	0.007
	(0.018)	(0.015)
Global industry Q		0.258***
		(0.054)
Industry fixed-effect	Yes	No
Time effect (Years)	Yes	Yes
Observations	2717	2717
Adjusted R^2 (Uncentered)	0.019	0.388
First stage *F*-test	8.02	11.08
PK Under-identification (*p*-value)	2.83%	0.00%
Hansen J over-identification	0.000	0.000

Table 7: Propensity Score Matched-Sample Test of Firm Value between Mandatory Users of IR derivatives and Nonusers, and Mandatory and Voluntary Users

Panel A and B present the comparison of Q ratios between mandatory IR derivative users and Nonusers, and Mandatory IR derivative users and voluntary users subgroups, respectively. Treatment effect is the mandatory use of IR derivatives. Control firms are the matched firm-years after propensity score matching procedure explained in the text. The number of observations for treated and control variables in each test are reported separately as supported firm-years. Log of assets, Long-term Debt/Market value, KMV-Merton Distance to Default, Return on assets (net income divided by total assets) , year dummies, and Global industry Q as well as R&D and Advertisement expenses, and Capital expenditures all scaled by total assets are used in matching. In addition, EBIT/(Long-term debt) and IR derivatives (net notional amount of IR derivatives divided by total assets) is used in Panel A and B tests, respectively. For each treated firm-year, the non-treated firms whose propensity score is equal to or 0.01 different from that of treated at maximum (caliper) is used as controlled firm. After matching for each subgroup test, the difference between the Q ratios of treated and the propensity-score-weighted average of the Q ratio of the controlled firm-years is tested and the *p*-value of the *t*-test is reported.

	Panel A: Mandatory vs. Nonusers Treatment: Mandatory Control: Nonusers Supported: Treated = 455, Control = 2259		Panel B: Mandatory vs. Voluntary Treatment: Mandatory Control: Voluntary Supported : Treated = 450, Control = 1164	
	Before Matching	After Matching	Before Matching	After Matching
Q ratio (Treated)	1.595	1.591	1.595	1.596
Q ratio (Control)	1.611	1.439	1.473	1.401
Difference	-0.016	**0.153**	0.122	**0.194**
p-value	38.02%	**1.71%**	2.47%	**0.55%**
Minimum bias	4.28%	0.09%	5.71%	0.10%
Maximum bias	29.63%	4.17%	46.91%	10.11%

Figure 1: Control Variable Biases before and after Propensity Score Matching

This figure presents control variable biases before and after propensity score matching between Mandatory IR derivative users and Nonusers (1.A), and Mandatory IR derivative users and voluntary users (1.B). Treatment effect is the mandatory use of IR derivatives in both tests. Control firms are the matched firm-years after propensity matching procedure explained in the text. Log of assets, Long-term Debt/Market value, KMV-Merton Distance to Default, Return on assets (net income divided by total assets), year dummies, and Global industry Q as well as R&D and Advertisement expenses, and Capital expenditures all scaled by total assets are used in matching. , EBIT/(Long-term debt) is included in the first test and IR derivatives (net notional amount of IR derivatives divided by total assets) is included in the second test. For each treated firm-year, the non-treated firms whose propensity score is equal to or 0.01 different from that of treated at maximum (caliper) is used as controlled firm. The bias of each variable is calculated based on Equation (6) and presented (non-absolute value) for each test separately.

Figure 1.A.: Mandatory vs. Nonusers
Treatment: Mandatory
Control: Nonusers
Number of supported firm-years:
Treated = 455 firm-years, Control = 2259 firm-years

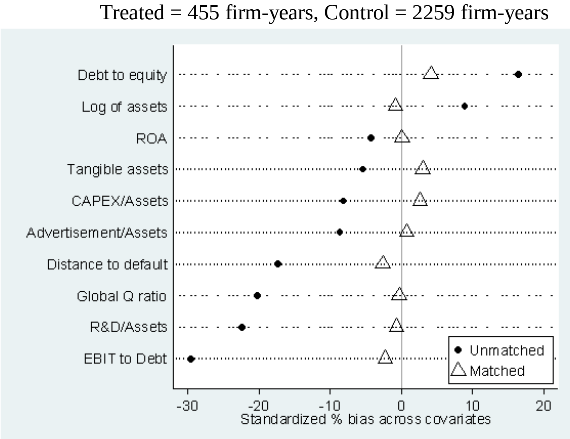

Figure 1.B.: Mandatory vs. Voluntary
Treatment: Mandatory
Control: Voluntary
Number of supported firm-years:
Treated = 450 firm-years, Control = 1164 firm-years

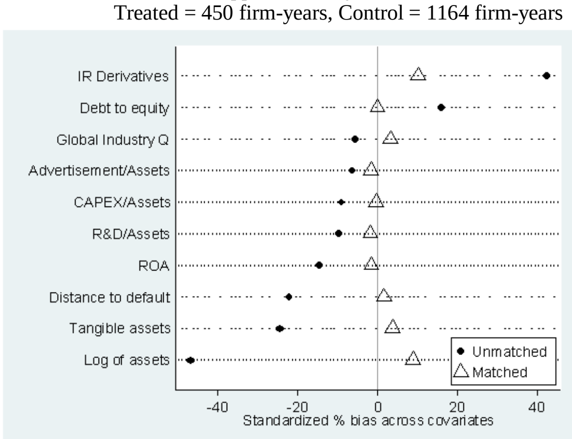

Table 8: Mandatory and Voluntary use of IR derivatives, Credit Agreement Covenants and Firm Value

The dependent variable is log of Q ratio defined as (market value at fiscal year-end + BV of assets – BV of Equities)/BV of total assets. In column (1) results are obtained from industry fixed-effect (equation (1)) with dummy variables for 19 covenants listed in Appendix and their interaction with IRPC. Covenants Dummies are 1 if the subject covenant is effective for the credit agreement of the sample firm-year and 0 otherwise. Column (2) reports the estimates via pooled OLS without industry fixed-effect with the same covenant dummies and interaction terms. Sample firm-years are mandatory IR derivative users and Nonusers. For the space saving, only significant coefficients of the interaction terms with IRPC are reported for both models. IR Derivatives is the net notional amount of IR derivatives divided by total assets. Total assets represent the book value (BV) of assets. Debt to Equity is long-term debt to market value. Return on Assets is net income divided by total assets. CAPEX is capital expenditures. Advertisement and R&D are advertisement and research and development expenses, respectively. Tangibility is net properties, plant and equipment divided by total assets. Sales growth is changes of sales from two years before divided by total assets. Dividend dummy is 1 if firm-year pays dividend and 0 otherwise. Geographical dummy is 1 if firm-year has operation abroad and 0 otherwise. Global industry Q is the Q ratio of a hypothetical firm whose asset and equity is the aggregate amount of all firms' assets and equities with the same 2-Digit SIC code of firm-year in COMPUSTAT universe. Distance to Default is KMV-Merton measure explained in Appendix. Standard errors robust to heteroskedasticity and serial correlation (clustered at industry level in models (1), and at firm level in models (2)) are reported in parenthesis. *, ** and *** represent 10%, 5% and 1% significant level, respectively.

	(1)	(2)
IR Derivatives	0.524**	0.479**
	(0.245)	(0.226)
Log of assets	0.012	0.017
	(0.010)	(0.012)
Return on Assets	0.532***	0.503***
	(0.185)	(0.164)
Tangibility	-0.121	-0.193***
	(0.079)	(0.072)
CAPEX/Assets	1.252***	1.525***
	(0.389)	(0.260)
R&D/Assets	3.309***	3.536***
	(0.368)	(0.478)
Advertisement/Assets	0.837**	0.566
	(0.343)	(0.466)
Debt to Equity	0.002	0.003
	(0.005)	(0.005)
Dividend dummy	0.061**	0.054
	(0.026)	(0.033)
Geographical Dummy	-0.021	-0.039
	(0.027)	(0.028)
Distance to Default	0.099	0.112*
	(0.062)	(0.067)
Sales Growth	0.011	0.009
	(0.020)	(0.017)
Global industry Q		0.212***
		(0.043)

Table 8 - *Continued*

	(1)	(2)
Other liquidity Covenant	0.265***	0.254***
	(0.083)	(0.097)
Quick ratio Covenant	0.181**	0.138*
	(0.071)	(0.080)
Senior Debt to Cash flow Covenant	-0.086**	-0.091**
	(0.037)	(0.040)
IRPC × Other liquidity Covenant	-1.899	-2.333**
	(1.143)	(1.146)
IRPC × Quick ratio Covenant	-1.815**	-1.193
	(0.755)	(0.930)
IRPC × Senior Debt to Cash flow Covenant	0.891***	0.588*
	(0.304)	(0.327)
Industry fixed-effect	Yes	No
Time Effect (Years)	Yes	Yes
Observations	2524	2524
Adjusted R^2	0.242	0.271