The Hidden Cost of Financial Derivatives: Options Trading and the Cost of Debt*

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This version: January 14, 2017

ABSTRACT

We investigate the extent to which firms' cost of debt may be affected by the presence of an active options market for the stock. Our baseline results reveal a detrimental effect of options trading volume on bond yield spread and bond credit rating. Specifically, a one-standard deviation increase in options trading volume from its mean is associated with an increment of 10 basis points in bond at-issue yield spread. We discuss the potential underlying mechanisms that channel the effect and show that options appear to increase the risk of bondholders being expropriated by shareholders. In particular, options seem to stimulate strategic default decisions by shareholders. Finally, using several econometric specifications and instrumental variables analysis, we argue that the nature of the effect is causal.

KEYWORDS: cost of debt, options trading, expropriation risk, strategic default.

JEL Classification: G12, G23, G24, G31, G33

*All errors are ours. Authors are listed in alphabetical order.

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1 Introduction

Despite the exponential growth of total equity option volume traded on US, from 676 million contracts in 2000 to over 3,727 million contracts in 2015 [1], there is still considerable disagreement about the real effects of these instruments on the underlying firms. On the one hand, options can act as a managerial discipline mechanism increasing stock price informativeness, thus better reflecting fundamentals. In a seminal paper, Holmström and Tirole (1993) explore the active role of price informativeness in disciplining managers and incentivize them to engage in value-increasing activities which ultimately benefit shareholders. On the opposite side, we argue that an active options market exacerbates the classic conflict of interest between shareholder and debtholder by providing shareholders with a powerful instrument to expropriate debtholders. These conflicting channels of influence rise an interesting empirical question as to how bondholders, an important group of claimholders in the capital structure, view an active option market. In this paper we ask this open empirical question. Specifically, we study whether the volume of equity options written on the underlying asset rise or reduce firms cost of debt.

Our starting point is the recognition that active options markets alter incentives for market participants to gather private information and trading on such information makes stock prices more efficient (e.g., Cao, 1999; Chakravarty, Gulen, and Mayhew, 2004; Pan and Poteshman, 2006). However, the benefit from options markets goes beyond the presence of an options market on the firms stock and should be related to whether the market for the listed options has sufficient volume, because informed traders' incentives to trade are higher in high-volume markets (Pagano, 1989; Admati and Pfleiderer, 1988). Taken together, these works provide strong support for the conjecture that informational efficiency may be greater in the presence of high-volume options markets. Because prices play an active role (i.e., managers learn from prices) when managerial decisions are made (Dow and Gorton, 1997; Faure-Grimaud and Gromb, 2004; Chen, Goldstein, and Jiang, 2007), this should then provide an effective disciplining mechanism which leads to a reduction of the classical moral hazard problem between management and shareholders. However, policies that benefit shareholders will not necessarily be harmless for bondholders (Cremers, Nair, and Wei, 2007).

A more pessimistic view of the effect of options, from a bondholder perspective, is that active options markets can exacerbate the expropriation of bondholder wealth, which is an especial relevant concern in the event of financial distress. Since stronger shareholder

[1] Data from Options Clearing Corporation: http://www.optionsclearing.com/

control also better aligns management to shareholders, bondholder concerns of expropriation might be heightened as well (Jensen and Meckling, 1976). Shareholders may default for solvency reasons, as well for strategic reasons (Favara, Schroth, and Valta, 2012). Thus, as a firm becomes seriously distressed, increasing shareholder control can affect managerial decisions in a way that, not only augments the shareholder expected payoff in the event of default, but also contributes to anticipate the timing of default (Feldhütter, Hotchkiss, and Karakaş, 2016). Complementary to the indirect channel stated before, shareholders can also improve their expected payoff in the event of default, favoring strategic default, by directly leveraging on options features.

Combining all of these considerations, it is apparent that the net impact of options markets on the cost of debt is theoretically unclear and is ultimately an empirical issue. To answer this question, we assemble a rich and original dataset containing information on bond issues, firm-specific characteristics and options trading data. To approximate the total quarterly dollar options volume, we use the approach proposed by Roll, Schwartz, and Subrahmanyam (2009). We run panel data regressions on a sample of 4,330 bond issues by 808 different publicly traded U.S. firms during the period 1996 to 2014.

Our baseline test reveals a detrimental effect of options trading volume on a firm's cost of debt. In particular, a more liquid option market is related to higher yield spreads over treasuries and lower bond credit ratings. These results are robust to using alternative sub-samples, alternative measures of the cost of debt, the inclusion of a wide range of control variables and several econometric models. While these findings are consistent with the detrimental effect of options markets on the cost of debt, augmenting the conflict of interest between shareholder and bondholders, we have concerns that our results could be bias if investors that operate through option markets chose to trade on companies facing a more uncertain short-term future and, hence, costlier debt financing. For instance, options are a good instrument for trading on information about future equity volatility, which allows investors with information about stock price volatility to benefit from them (Ni, Pan, and Poteshman, 2008). To account for such selection issues, we extend our baseline specification by estimating two-stage least squares (2SLS) models using moneyness and open interest as instrumental variables (Roll, Schwartz, and Subrahmanyam, 2009; Blanco and Wehrheim, 2016). Overall, our identification strategies suggest that the detrimental association between options trading and the cost of debt is not simply driven by self-selection. Furthermore, we show how the harmful effect of option trading over the cost of debt remains economically and statistically significant considering time series yield spreads instead of bond issues. Results are also robust to the inclusion of

bond fixed effects.

We extend these baseline results in order to address potential concerns about our findings. First, we investigate whether the impact of options trading on the cost of debt depends on the level of firm distress. Results suggest that the detrimental effect of options volume on the cost of debt is worse when firm's are closer to experiment financial distress. Second, we aim to assess how the type of shareholder influence our results. Consistent with our main story, we find that the detrimental effect amplifies when the portion of dedicated owners, which have higher incentives to be informed about firm fundamentals and to influence managerial decisions, is higher. Finally, we explore a direct mechanism through which options may impact the cost of debt. We focus on two firm-specific proxies of shareholders' incentives for strategic default: the firm's liquidation costs and shareholders' bargaining power in renegotiation (Favara, Schroth, and Valta, 2012). The results show that the effect of options trading strengthens along with shareholders' incentives for strategic default. We find that the detrimental effect over the cost of debt is exacerbated when liquidation costs decrease and shareholders' bargaining power increases.

Our paper makes two contributions to the literature. The first lies in the understanding of the real effects of financial derivatives on the firm's real economy. In this vein, Roll, Schwartz, and Subrahmanyam (2009) show that options trading is positively associated with firm value and price informativeness, Blanco and Wehrheim (2016) find a positive association between options trading volume and firm innovation and Naiker, Navissi, and Truong (2013) show how a high-volume options markets reduce the cost of equity.

Second, we contribute to the understanding of the determinants of the cost of debt. While there is a vast literature studying the determinants of corporate bond spreads, to the best of our knowledge, an analysis of the relationship between options trading and the cost of debt has not previously been undertaken. Empirical studies have examined, for instance, the effect of liquidity (Odders-White and Ready, 2006), competition (Valta, 2012), government ownership (Borisova, Fotak, Holland, and Megginson, 2015), open market for corporate control (Qiu and Yu, 2009), political rights (Qi, Roth, and Wald, 2010) or strategic ownership (Aslan and Kumar, 2012).

The remainder of the paper is organized as follows. Section 2 describes the sample, the measurement of variables and descriptive statistics. In Section 3, we present our main results. In Section 4, we discuss the underlying mechanism through which options trading may affect the cost of debt. Section 5 concludes the paper.

2 Data and methodology

We compile information on bond issues, firm-specific characteristics and options trading data from a variety of sources. Detailed definition of all variables and their sources is provided in Appendix A. We start by extracting bond-level data from Thomson Reuters SDC Platinum Global New Issues Database. Our main focus is on new issues, rather than secondary market quotes, as they provide direct and more accurate measures for the cost of debt (e.g., Datta, Iskandar-Datta, and Patel, 1999; Elton, Gruber, Agrawal, and Mann, 2001; Maxwell and Stephens, 2003; Qi, Roth, and Wald, 2010; Francis, Hasan, John, and Waisman, 2010). We limit our sample to U.S. companies and issues of fixed-rate corporate bonds defined in U.S. dollars in the period 1996-2014 [2]. In addition to our measures for the cost of debt (bond rating and yield spread), we retrieve from SDC Global New Issues data regarding bond *maturity* and *principal* amount, and we build two dummy variables that indicate whether the bond is *callable*[3] and *public*. These variables have been successfully used before as determinants of the cost of debt [4].

We measure firm cost of debt using bond yield spread and bond rating. Both metrics are of standard use in the literature and provide direct values for the real cost incured by firms to access debt financing via bond markets. Our first measure for the cost of debt is the bond yield spread at the time of bond issue. Following Cremers, Nair, and Wei (2007) and Qiu and Yu (2009) we calculate the yield spread as the difference between the bond's yield to maturity and the Treasury bond yield with the same maturity. We collect constant maturity Treasury yields from the Federal Reserve H-15 Release for the 6-month, one-year, three-year, five-year, seven-year, 10-year, 20-year and 30-year maturities. In the few cases where there is not a maturity-equivalent Treasury bond, we use linear interpolation between the two closest maturities to calculate the yield of the risk-free bond [5].

Alternatively, we use bond rating to capture the perceived risk of the bond. To measure it, we rely on the Standard and Poor's rating reported by SDC [6]. We convert

[2]Options Metrics data coverage starts on 1996.

[3]There are no putable bonds in the sample once we apply all filters.

[4]See, among others, Qiu and Yu (2009),Qi, Roth, and Wald (2010), Francis, Hasan, John, and Waisman (2010) or Borisova, Fotak, Holland, and Megginson (2015).

[5]There are more complex methods in order to interpolate a piece wise term structure. No reason however suggests this can pose a problem. Most of our bonds either match a maturity-equivalent treasury or have maturities within one year from an existing Treasury.

[6]Whereas other agencies such Moody's also provide with individual bond rating, Standard and Poor's is standard in recent literature (Qiu and Yu, 2009; Qi, Roth, and Wald, 2010; Borisova, Fotak, Holland, and Megginson, 2015).

the traditional bond rating by S&P to a numerical scale where lower values correspond to poorer ratings [7] and vice-versa.

For data on options trading activity, we use Option Metrics. This database contains information on daily put and call contracts traded for each individual stock along with bid and ask closing prices from 1996 onwards. To define our measure of options volume we follow Roll, Schwartz, and Subrahmanyam (2009). We first multiply the total trade in each option by the end-of-day quote midpoint for that option. Next, we aggregate this number quarterly across all trading days and all options on the listed stock. We construct this variable, which we call *Options Volume*, for the quarter prior to that of the bond issuance [8].

Existing empirical research on structural credit risk modeling and market microstructure finds a significant role of firm specific characteristics in determining the cost of debt (Collin-Dufresne, Goldstein, and Martin, 2001; Campbell and Taksler, 2003; Odders-White and Ready, 2006; Avramov, Jostova, and Philipov, 2007; Ericsson, Jacobs, Oviedo, et al., 2009; Qiu and Yu, 2009). To control for these effects, we gather firm-specific data from CRSP-Compustat Merged (CCM) on the quarter prior to the bond issuance. Specifically, we collect data to construct the following variables: *Size* (as the log of total assets), return on assets or *ROA* (net income over total assets), *Leverage* (total debt divided by total assets), growth opportunities as proxied by *Tobin's Q* (sum of the market capitalization of a firm's common equity, liquidation value of its preferred shares and the book value of debt, divided by book value of assets), relative *Bid-ask spread*, and *Firm risk* (as proxied by the standard deviation of quarterly firm's cash-flow during previous year [9]). We drop firms that have missing observations for the quarter of interest in any of these variables and require them to be reporting to the CRSP database for at least two years, to mitigate back-filling bias. We also remove from our sample firms not quoted in the three major American markets (AMEX, NYSE or NASDAQ). Lastly, we exclude financial firms (SIC codes 6000-6999)[10], as their leverage may be influenced by their par-

[7] The complete numerical scale is as follows: 1-CCC-, 2-CCC, 3-CCC+, 4-B-, 5-B, 6-B+, 7-BB-, 8-BB, 9-BB+, 10-BBB-, 11-BBB, 12-BBB+, 13-A-, 14-A, 15-A+, 16-AA-, 17-AA, 18-AA+, 19-AAA-, 20-AAA, 21-AAA+.

[8] We set the value of *Options Volume* equal to zero when the firm is not quoted in the options market. Although firms not listed in options market can have a special idiosyncrasy and should be treated with caution (Mayhew and Mihov, 2004) only two observations in our final sample have options volume equal to zero. The results remain completely unchanged when excluding them.

[9] For robustness we also use stock return volatility instead of that of the cash-flows with unchanged results.

[10] We drop 222 financial firms. Results remain economically and statistically significant when we include these firms.

ticular idiosyncrasy and their debt-like liabilities are not strictly comparable to those of non-financial firms (Rajan and Zingales, 1995). In line with existing literature, all variables are winsorized at the 1st and 99th percentiles to ensure our results are not driven by outliers.

Because, after all filters, our datasets do not perfectly overlap, we loose some observations when merging data from these three sources together. Our final sample comprises 4,330 bond issues in the period 1996-2014 for 808 different firms [11]. Table 1 provides information on the number of issues per year as well as the number of issuers.

[Insert Table 1 around here]

2.1 Summary statistics

Table 2 reports the summary statistics for the main variables used in this study. The average issue in our sample has a spread over treasuries around 215 basis points (bps) with a median of 157 bps, which is consistent with similar recent studies [12] in the literature (e.g., Borisova, Fotak, Holland, and Megginson, 2015). With respect to bond rating, the average (median) according to our numerical scale is 11.54 (12.00), which corresponds to a Standard and Poor's rating between BBB and BBB+ (BBB+). The average firm has a quarterly options trading volume of $165 million (median $ 22.46 million). This substantial number responds to the dramatic exponential growth in the use of derivatives in recent years [13]. For other variables, firms in our sample have a mean (median) size of 33.48 (13.58) $ billion with an average Tobin's Q of 1.80 (median 1.57). The average bond in our sample has a principal equal 558 $ million and maturity around 12 years. Lastly, 99.5% of our bonds are public and less than 5% include a callable option. All these statistics fall within the standards in the literature. Due to high skewness that may jeopardize our results, we use the natural logarithm of some of

[11] We aggregate bond issues at the 6-digit-CUSIP level, which is the identifier provided by SDC Platinum.

[12] Obviously, in existing studies with a sample ending before 2007 the average yield spread is much lower (around 120 bps.). The average yield spread of our sample pre-2007 is 130 bps.

[13] Our number is considerably larger than the one reported by previous articles using this variable. Nonetheless, these studies (e.g., Roll, Schwartz, and Subrahmanyam, 2009; Blanco and Wehrheim, 2016) focus on a time-periods ending before 2005. The sample statistics prior to that date fall within those of the literature.

the variables for the analysis. Specifically, we calculate the natural logarithm of yield spread, options volume, total assets, firm risk, bid-ask spread and (one plus) maturity.

[Insert Table 2 around here]

2.2 Specification

In our baseline specification we analyze the effect of options trading volume on the firm cost of debt by performing the following ordinary least squares regressions (OLS) where i indexes bond issue and t indexes time:

$$Y_i = \alpha + \beta Ln(OptionVolume) + \gamma Z_i + \delta_t + \lambda_i + \epsilon \quad (1)$$

The dependent variable, Y_i, measures the cost of debt of a firm under the two metrics previously discussed. Thus, one kind of econometric model in our analysis will take the natural logarithm of the at-issue bond yield spread, *Ln(Yield Spread)*, as the dependent variable; whereas another will use the bond *S&P Rating* [14]. *Ln(Option Volume)* is the natural logarithm of the previously discussed options trading volume variable. The vector Z_i contains a set of bond and firm level controls [15]. We control for firm size (log total assets), growth opportunities (Tobin's Q), profitability (ROA), leverage, firm risk, illiquidity (bid-ask spread), bond maturity and callable option and a dummy for public bond. A complete definition of these variables is on Appendix A. In line with existing research, we expect that firm's size, growth potential and profitability impacts positively (by reducing) the cost of debt. On the other hand, leverage and firm risk (cash-flow volatility) will increase the return demanded by bondholders, contrary to the firm's interest. Similarly, bonds including a callable option or having longer maturities reflect, in principle, higher perceived risk. The control variable on stock market liquidity (or illiquidity) is of special relevance for this analysis. First, as exchanges are more prone

[14] We are aware of the potential problems of using OLS regression with a count variable such S&P Rating. To mitigate concerns regarding this issue we fit a Poisson model for S&P Rating, and we repeat the analysis with a Negative Binomial model. Also, we transform the rating variable to the natural log of one plus the rating in a traditional OLS regression. All these tests confirm our initial results.

[15] In subsequent analyses in the robustness section we add different extra controls in both of these dimensions that leave our initial results unchanged.

to quote options from firms with high stock trading volume (Mayhew and Mihov, 2004). But, more importantly, due to the asymmetric information embedded in stock market liquidity measures [16]. In particular, Odders-White and Ready (2006) find a negative relationship between a firm's credit rating and equity market liquidity. Moreover, common microstructure measures of adverse-selection such the relative bid-ask spread can be used to predict future changes in ratings. Following this rationale, we expect the relationship between stock liquidity and debt cost to be negative. We treat stock liquidity with caution by first using the relative bid-ask spread (used more prominently in the recent literature) as a proxy, and then repeating the analysis with the Amihud (2002) measure [17].

Despite our focus is on bond issues (and hence a pooled OLS model) rather than time-series (panel) data, there exist some time-varying features not related to bond or firm characteristics that can influence our analysis in an undesirable way. For example, the economic conditions surrounding a crisis (e.g. dotcom bubble, recent financial crisis) can increase debt financing cost in a manner unrelated to firm or bond fundamentals. Similarly, the exponential growth of derivatives markets in recent years [18] calls for a close control of time effects. For these reasons we include in our regression model the term δ_t, which accounts for year dummies. In a similar fashion, following past studies in the literature, λ_i controls for industry dummies (at the 2-digit SIC code level[19]). Lastly, we report robust standard errors clustered at the firm level, which is the most accurate and conservative approach (Petersen, 2009).

3 Empirical results

We begin the analysis with the results from regression specification in Equation 1, which we display in Table 3. In column 1 of Table 3 we start with an specification with only firm-level controls and time and industry dummies for the natural logarithm of bond

[16] See, among others, Roll (1984), Glosten and Harris (1988), Stoll (1989), Hasbrouck (1991), Easley, Kiefer, O'hara, and Paperman (1996) or Huang and Stoll (1997) for the seminal work on the issue.

[17] In fact, using of the Amihud (2002) measure yields larger economic significance of the effect related to Options volume. Given that it is most commonly used to capture the adverse selection component, we are conservative and stick to the traditional relative bid-ask spread in the main procedure. Results from using the Amihud (2002) measure are reported on Table B8 in Appendix B.

[18] The growth is specially surprising in equity options markets, whose volume change from 200 million contracts in 1996 to almost 4,000 million in 2015 (see Options Clearing Corporation).

[19] Table B1 in the robustness section show that results are robust to the inclusion of 4-digit SIC dummies.

yield spread as dependent variable. The same specification for our second dependent variable, S&P Rating, is reported in Column 3. We extend this analysis to include bond-level controls in Columns 2 and 4 of Table 3. Column 5 reports the results of a Poisson regression for S&P Rating.

The coefficient for Ln(Option Volume) is of high statistical significance (p-value $<$ 0.01) across all specifications in Table 3. Our baseline test reveals a detrimental effect of options trading volume on a firm's cost of debt. In particular, a more liquid option market is related to a higher yield spread over treasuries and a lower credit rating. In sum, increasing options trading volume is associated with costlier debt financing, after controlling for firm and bond characteristics, as well as for industry and time effects. The economic magnitude of the effect is strong. For example, taking the coefficient of 0.037 specified in Column 2, a one-standard deviation increase in options volume from its mean of \$165.01 millions is associated with a raise in the *Yield Spread* of nearly 10 bps.

Control variables in Table 3 have expected estimated coefficients for yield spread and credit rating. While firm size, growth opportunities, profitability and liquidity relate negatively with the cost of debt, leverage, firm risk and the existence of a callable option on the bond are positively associated with the cost of debt financing. One special case is maturity, which is related with an increasing yield spread but also a higher (better) credit rating. The relation between spreads and time to maturity is not surprising and attends to a reduced uncertainty regarding coupon and par value payments as the bond's maturity date approaches. The case of credit rating can be explained by a tendency from larger, financially stable, companies to issue debt with longer maturities propitiating agencies to evaluate these issues with better ratings.

[Insert Table 3 around here]

3.1 Endogeneity of options trading

In this section, we address concerns related to endogeneity. Option markets are a particularly beneficial trading venue for informed traders where trading and short-selling costs are minimum. Moreover, they show special usefulness in situations of high uncertainty. Given these particular features, it is a fair argument to think that our results can be explained by reverse-causality. For example, investors that operate through option markets may bias their trades towards those companies facing a more turbulent short-term

future and, hence, costlier debt financing. We deal with endogenous effects by using an instrumental variable (IV) approach and two-stage least squares (2SLS) regression. IV regression will not only help assess the causal direction of the relationship between options volume and cost of debt, but also mitigate the possible measurement error in the independent variable of interest.

A good instrument for our setting is a variable that is highly correlated with options trading (which we test via the first stage of the 2SLS procedure) but uncorrelated with our measures for the cost of debt except through other independent (control) variables (i.e., the exclusion restriction holds). Roll, Schwartz, and Subrahmanyam (2009) introduce two variables that serve as good instruments for our framework: (i) open interest in the stock's listed options; and (ii) moneyness (i.e., average absolute difference between the stock's market price and the option's strike price). We devote this section to the analysis of open interest as an instrument and show in Appendix B that results are similar when, first, using moneyness as an instrument and then both instruments together [20].

Open interest consists on the number of open options contracts in each day in a listed stock. As Roll, Schwartz, and Subrahmanyam (2009) argue, this measure should not be inherently related to firm value as it includes the sumation of both call and put contracts [21]. Extending this argument, open interest should not be associated either with higher or lower bond yield spreads or credit ratings in any mechanical way. To construct the variable open interest, we average open interest (provided by Option Metrics) across all options on a stock throughout the calendar quarter. The correlation between open interest and options volume in our whole sample is 0.4305, suggesting that indeed open interest bears a relation with options trading volume. As in the case of options volume, we measure open interest on the quarter prior to bond issuance and use the natural log of this variable, *Ln(Open Interest)*, for the 2SLS analysis.

We display the results from the 2SLS procedure on Table 4. Column 1 comprises results for the first stage of the 2SLS analysis where we regress options volume, *Ln(Option Volume)*, on the set of independent variables from Equation 1 plus open interest, *Ln(Open Interest)*, and a full set of time and industry dummies. The positive

[20] Previous literature including Roll, Schwartz, and Subrahmanyam (2009) and Blanco and Wehrheim (2016) use moneyness as their preferred instrument. However, we noted that from 2007 onwards the correlation of moneyness with options volume starts decreasing, probably related to the increased uncertainty related to the financial crisis. Although our results hold when using moneyness in the 2SLS, we stick to open interest in the main analysis as its correlation with options trading is strong through the whole sample period.

[21] High or low levels of call or put interest could be associated with higher or lower firm values, but not the sum of the two.

and highly significant coefficient of 0.91 for open interest provides additional evidence of the strong relationship between this variable and option volume. Columns 2 and 3 in Table 4 report the second stage from the 2SLS on our two measures for the cost of debt. The coefficients on the instrumented options volume variable for bond yield spread and bond rating of 0.075 and -0.383 respectively are strongly significant (p-value < 0.01) advocating for a causal effect of options trading on the cost of debt. These coefficients are slightly larger in magnitude that the ones reported via OLS (0.037 and -0.207 respectively). However, discrepancies between OLS and 2SLS coefficients are common and arise due to various motives primarily related to mitigation of errors-in-variables biases [22]. Since the analysis with other instrument (moneyness) reveal similar qualitative results [23], this divergence is unlikely to jeopardize the validity of our results but, rather, provide more accurate estimates that strengthen them.

[Insert Table 4 around here]

In summary, results from the 2SLS analysis are consistent with the notion of a significant causality running from more active option markets to a firm's cost of debt financing. Moreover, mitigating the bias due to the possible endogenous link between options and debt costs amplifies the main effect.

3.2 Bond fixed effects and time series analysis

Once we have established that our results are not driven by reverse-causality, we move on to analyze the robustness of our results in other dimensions. Despite our regression models include a full set of firm and bond characteristics with large explanatory power, time and industry dummies, and the considerably large r-squared statistics we report (e.g. ranging from 0.668 to 0.754 in Table 3), some concerns remain regarding biases related to omitted variables and time-series effects. We tackle this issue as most studies in the corporate finance literature, by using time and bond fixed effects in the regression specification.

[22] Beaver, McAnally, and Stinson (1997) and Irwin and Terviö (2002) provide a comprehensive analysis of the relevant econometric issues related to this process.

[23] For the sake of space, we report the estimates for the IV analysis with moneyness as an instrument in Appendix B. Table B2 provides the results from the analysis using moneyness as an instrument, whereas Table B3 displays results from using both instruments in the 2SLS.

This approach allows to control for every possible unobservable, time-invariant bond and time characteristic that may influence the results.

In order to perform such analysis, however, the at-issue data employed for the baseline procedure serves of no use, as we need panel data that include time-bond observations. To this end, we retrieve from Thomson Reuters Eikon (Datastream) bond-quarter information on bonds matching our initial criteria (i.e. bonds with fixed coupons, issued by US corporations). After applying usual filters and merging this data with the CRSP-Compustat variables described in Section 2 and defined in Appendix A, we are left with 2,028 bond-quarter observations with non-missing yield to maturity for 292 bonds. We follow previous methodology to calculate the variable *Yield spread* (i.e. bond yield to maturity in excess of a maturity-matched treasury bond) for each bond and quarter. Because the Thomson Reuters Eikon database only offers time-series data for active bonds, our sample covers the period 2002-2015. Table 5 provides with the main summary statistics, that confirm that indeed our time-series sample includes similar firms, on average, than our main sample. For example, the average firm in our main sample has total assets equal \$33 billion vs. \$39 billion in the time-series sample; Tobin's Q of 1.8 vs. 2.2 in the time-series sample; or Leverage equal 0.27 in the main sample vs. 0.35. On the other hand, the summary statistics for our variable of options volume are radically different. This issue however is far from posing a problem, as this divergence attends to a significant number of quarter observations coming from firms with no options trading [24].

[Insert Table 5 around here]

Extending our core analysis to this data sample has a dual benefit. First, in terms of mitigating concerns related to omitted variables. Second, it allows us to investigate whether the main effect of options trading on yield spreads occurs beyond the time of bond issue. With this purpose, we use the following econometric model, which is similar to that of Equation 1:

$$Spread_{i,t} = \alpha_{i,t} + \beta Ln(OptionVolume)_{i,t} + \gamma X_{i,t} + \delta_t + \lambda_i + \epsilon \tag{2}$$

[24] As before, we set options volume to zero when a firm has no options trading. Because of the time-series nature of this particular dataset, the number of observations with positive options volume is lower. Specifically, 1,003 out of 2,028 observations have positive (greater than zero) options trading volume.

where t indexes time and i indexes a specific bond. $Spread_{i,t}$ is the bond yield spread over the maturity-equivalent treasury at the end of quarter t. $Ln(OptionVolume)_{i,t}$ measures option trading volume on quarter t. We include time and bond fixed effects with the variables δ_t and λ_i respectively. Lastly, the vector X contains a set of time-varying controls used before including size, tobin's Q, return on assets, leverage, firm risk, bid-ask spread and bond time to maturity [25].

Results from Equation 2 are shown on Table 6. Columns 1 and 2 display the results of the regression model without bond-fixed effects, which we include in Columns 3 and 4. Additionally, Columns 2 and 4 extend the analysis by adding clustering of the standard errors at the bond level, the most demanding specification. Coefficients in Table 6 range from 0,112 to 0.098 and high significance across all four columns, with p-values lower than 5% even in the most constrained specification. These results provide further evidence regarding the nature of our main effect. First, the detrimental effect of active options markets on a firm's cost of debt is not limited to the time of the issue but, rather, seem to occur dynamically. Second, and more important, time-invariant omitted variables related to bond characteristics are not the drivers of the effect.

[Insert Table 6 around here]

Because time-invariant characteristics are not the only source of omitted variable bias, we perform a battery of extra robustness tests in the next section, which range from the in depth exploration of the monotonicity of the effect, to the inclusion of extra controls.

3.3 Additional robustness tests

We begin our robustness tests by investigating the monotonicity of options trading. That is, we are interested in unveiling whether the effect occurs monotonically, or, on the other hand, is limited to extreme values of options volume. To this intent, we include in our main regression specification (from Eq. 1) two extra features, reported in Table B4 in Appendix B. First, we add an squared term for *Ln(Option Volume)*, which is displayed in Columns 1 and 3 of Table B4 for bond yield spread and credit rating respectively.

[25] Obviously we exclude any bond-level invariant characteristic as we already account for that by using bond fixed-effects. We include time to maturity of a bond as control as it is well-recognized that yields tend to decrease as maturity approaches.

Secondly, we use the interaction of our main variable, *Ln(Option volume)*, with a dummy variable, *High Options Volume*, that takes value one if a firm's options volume is above the median for that year and zero otherwise. These results are reported in Columns 2 and 4. Coefficients for *Ln(Options Volume)* in Columns 1-4 of Table B4 remain of high statistical significance (p-value < 0.01) after accounting for the effect of extreme values of options trading, supporting monotonicity.

To provide additional insights, we also conduct a bootstrapped quantile regression for 200 replications. Results reported in Table B5 in Appendix B correspond to the estimation for the median (50th percentile). Coefficients and significance remain similar and robust when using 75th, 80th or 90th percentiles. Overall, these results are consistent with the notion of a monotonic effect of options trading on the firm's cost of debt.

Next, we consider possible time-varying omitted variables. Specifically, we augment the main econometric specification with the principal amount of the bond issue and the level of institutional ownership of the firm as controls. Firms demanding a larger principal amount may be those in a more fragile situation and urgent need of financing, which would explain why debt-holders demand a higher return for their money. On the other hand, Cremers, Nair, and Wei (2007) find a positive association between shareholder control and yield spreads. Because institutions are the group more prone to exert active shareholder control, we include total institutional ownership from the Thomson Reuters 13F filing [26] to rule out the possibility that our results are driven by correlations between active option markets and a firm's level of institutional ownership. Table B6 in Appendix B contains the results from both additions. The coefficient of *Ln(Option Volume)* remains highly statistically significant (p-value<0.01) with a small decrease in magnitude (0.032 from 0.037 for yield spread and -0.192 from -0.207 for bond rating) as a result of the inclusion of both control variables. These results shed evidence on option markets having an impact of its own over the cost of debt of a company, rather than being a secondary effect from preexisting findings.

Lastly, in order to test the robustness of the effect on bond rating and given the special construction of this variable, we perform two tests. First, we run the baseline OLS model on a transformed variable equal to the natural log of one plus bond rating, *Ln(1+Rating)*. Second, we fit a negative binomial model to the specification in Eq. 1. Results for both tests are reported in Table B7 in Appendix B, and confirm the validity of our initial results.

[26] As noted in Bushee (1998), not all institutions are interested in active governance. We explore this issue in the mechanisms section.

4 Possible mechanisms

Our evidence thus far is consistent with a detrimental effect of options trading volume on the firm's cost of debt, even after accounting for potential endogeneity concerns and performing a rich set of additional robustness tests. In this section, we turn to the last part of our analysis and discuss potential underlying mechanisms through which this may occur. It is of course challenging to provide definite proof, and hence our tests are only suggestive.

First, our main story argue that the harmful effect of options must be greater in the case of highly distress firms. This is because, default forces a change in control by which creditors become new owners through distribution of stock in a restructuring. Consistently, we expect the effect of options to worsen as the credit quality deteriorates, because the probability that control will shift to bondholders increases and, therefore, so does the likelihood of bondholder's expropriation by shareholders.

Second, we investigate how firm's cost of debt varies with options volume and specific shareholders characteristics. As we argue that the detrimental effect is ultimately related to the exacerbation of the classical conflict of interest between shareholders and bondholders, we expect this effect to depend on the predominant shareholder type and their incentives to influence managerial decisions (Cremers, Nair, and Wei, 2007).

Finally, we focus on two firm-specific proxies of shareholders' incentives for strategic default: the firm's liquidation costs and shareholders' bargaining power in renegotiation (Favara, Schroth, and Valta, 2012). We expect that the effect of options trading strengthens along with shareholders' incentives for strategic default. That is, the options' detrimental effect over the cost of debt should be exacerbated when liquidation costs decrease and shareholders' bargaining power increases.

4.1 Firm-level distress

We start investigating the effect of options trading on expropriation risk by considering two different measures of firm distress. First, we use the well-known Kaplan and Zingales (1997) index (K-Z Index) as a measure of financial constrains. Second, we construct a dummy variable to indicate whether a specific firm issues a Junk Bond.

We define the K-Z Index as in the synthetic specification from Lamont, Polk, and Saaá-Requejo (2001) and defined in Appendix A. A higher value for the K-Z Index indicates a firm relies stronger on external financing and, ultimately, has larger financial

constrains. Table 7 presents the results from first including the K-Z index as a control in our baseline regressions and then interacting it with Ln(Option Volume) for our two measures of firms cost of debt. The results from the interaction terms in Columns 2 and 4 in Table 7 reveal a significant larger perverse effect of options trading when firms are highly financially constrained.

[Insert Table 7 around here]

Next, we construct a dummy variable, *Junk bond*, that equals one if the bond's credit rating is below B-, which is the level from which Standard and Poor's considers the creditor to be 'currently vulnerable', and zero otherwise. Results from interacting this variable with options volume are reported in Table 8. Again, results point to a amplification of the detrimental effect of options when firms (bonds) are closer to default.

[Insert Table 8 around here]

Overall, these results are in line with our main story that the effect of option markets on a firm's cost of debt is channeled through the conflicting interests between shareholders and debtholders.

4.2 Options, institutional ownership and the cost of debt

In order to provide additional insights with respect to the role of option markets in the bondholder-shareholder conflict, we explore the interaction of *Ln(Option volume)* with variables accounting for the ownership level of institutions with different commitment to governance (control) practices. In particular we make use of the Bushee (1998) institutional investors classification [27]. In this classification, institutional investors fall within three different types, according to variables like past performance, portfolio turnover or diversification. *Dedicated* owners are those with low portfolio turnover and concentrated stakes and, hence, the ones more prone to exert shareholder control. *Transient* institutions are those with high turnover and diversified portfolios, which tend to exhibit

[27] We are grateful to Brian Bushee for kindly providing with these data in his website: http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html

momentum returns. *Quasi-index* investors use indexing or buy-and-hold strategies that produce low portfolio concentration and high diversification and are, therefore, the group less likely to perform active control.

Bearing this classification in mind, in line with our prior of active option markets exacerbating the agency cost of debt we expect the malicious effect of options trading to amplify in cases where shareholders are more likely to engage in active governance practices (Cremers, Nair, and Wei, 2007). Tables 9 and 10 show the results of interacting, in our baseline specification, *Ln(Option volume)* with the percentage of ownership in hands of *Dedicated* and *Quasi-index* owners, respectively [28].

[Insert Table 9 around here]

The coefficient for the interaction term of options and ownership by dedicated investors in Column 2 (4) of Table 9 is positive (negative) and significant at the 10% (5%) level for the regression over yield spread (bond rating). On the other hand the coefficient for the interaction of options and ownership by quasi-indexers in Column 2 (4) of Table 10 is negative (positive) and significant at the 5% level for the dependent variable yield spread (bond rating). These results are consistent with the detrimental effect of options augmenting in cases where shareholders have more control and, as a consequence, the risk of unfavorable renegotiation/expropriation for bondholders increases.

[Insert Table 10 around here]

4.3 Options trading and strategic default

Lastly, we consider the specific case of active option markets exacerbating shareholders' incentives to default strategically. This particular channel is of special interest as options facilitate taking a short position in a stock, allowing shareholders to gather extra profits from forcing firm default. To explore this possibility, we use two measures that proxy for the likelihood of strategic default (Garlappi, Shu, and Yan, 2008; Favara, Schroth, and Valta, 2012): liquidation costs and shareholders bargaining power.

[28] For the sake of space we show the results of the interaction with *Transient* owners, the less interesting group for our analysis, in Table B9 in Appendix B.

We measure liquidation costs by using the intangibles measure introduced in Berger, Ofek, and Swary (1996) and displayed in Equation 3. A higher value of intangible assets should make liquidation costlier (as these assets are lost in the event of default) and, hence, strategic default by shareholders less likely.

$$Intangibles = 1-(Cash+0.715\times Receivables+0.547\times Inventories+0.535\times PPE)/Assets \quad (3)$$

We report the interaction of *Ln(Option volume)* and *Intangibles* in Table 11. The coefficients of -0.070 in Column 2 for yield spread and of 0.634 in Column 4 for bond rating are statistically significant at the 10% and 1% levels, consistent with the idea of options trading activity being specially harmful for bondholders when liquidation costs are low.

[Insert Table 11 around here]

Next, we consider the case of shareholders bargaining power. As in previous studies, we define bargaining power as the ratio between total shares held by insiders (which we obtain from Worldscope) over total shares outstanding. We name this variable *Insiders Ownership*, and display the results from its interaction with options volume in Table 12.

[Insert Table 12 around here]

Interaction coefficient for yield spread as a dependent variable in Column 2 of Table 12 is positive and significant at the 5% level. For the case of bond rating, the coefficient from the interaction between insiders ownership and options volume in Column 4 is negative, although not statistically significant. These results confirm the worsening of the relationship between options and cost of debt when shareholders have high bargaining power.

Taken together, results suggest that the impact of options trading activity on a firm's cost of debt occurs via the exacerbation of the debtholder-shareholder conflict specially in situations where creditors bear high expropriation risk. In particular, outcomes from interaction terms analysis are consistent with options trading volume incentivizing shareholders to default strategically.

5 Conclusion

In this paper, we novelly investigate the extent to which an active option market relates to firm's cost of debt financing. The increasing importance of options markets in today's financial world contrasts the relatively low number of papers studying the effects of such growth in real variables. Whereas previous research finds that the positive informational enhancement flowing from high volume option markets translates into greater firm value (Roll, Schwartz, and Subrahmanyam, 2009), higher innovation quality (Blanco and Wehrheim, 2016) or a lower cost of equity capital (Naiker, Navissi, and Truong, 2013), our results show a perverse effect of these instruments for a group of high relevance within the structure of a company, debtholders.

Using a sample of 4,330 bond issues by 808 US companies in the period 1996-2014, we find that a one-standard deviation increase in options trading volume from its mean is associated with a raise in the bond at-issue yield spread of nearly 10 basis points. We test the robustness of our results in several ways. First, we consider two different measures of firm cost of debt (bond yield spread and bond rating by Standard & Poor's) and different econometric specifications (pooled OLS, clustering of the standard errors, time and industry fixed effects, Poisson and negative binomial regressions, quantile regressions, as well as different definitions and addition of control variables). Second, we investigate whether the effect also takes place in a time-series framework with bond fixed effects to mitigate concerns related to omitted variable biases. Third, we deal with endogeneity by implementing an instrumental variable regression via a two-staged least squares (2SLS). We use two instruments (open interest and moneyness) that have been successfully used before in similar settings (Roll et al., 2009; Blanco and Wehrheim, 2016). Our results are robust to the implementation of all these tests, which allows us to argue for an indeed causal effect of options trading volume on the firms' cost of debt.

We then explore the specific paths by which this effect is channeled. Results from several interaction terms analyses suggest that the impact of option markets occurs via the exacerbation of the traditional debtholder-shareholder conflict. The effect of options volume is more pronounced in situations where expropriation risk for bondholders is higher. Lastly, results are consistent with the notion of options trading activity encouraging strategic default decisions by dominant shareholders, revealing a hidden cost of financial derivatives for a firm's debtholders.

Tables and figures

Table 1: Number of Bond Issues per Year

Year	Number of Issues	Number of Firms
1996	77	53
1997	144	85
1998	188	111
1999	101	71
2000	118	76
2001	170	102
2002	131	65
2003	101	66
2004	31	26
2005	87	56
2006	159	101
2007	229	117
2008	253	125
2009	349	213
2010	400	253
2011	384	212
2012	470	257
2013	441	224
2014	497	259
Total	4330	

Table 2: Summary statistics

	Mean	StdDev	25%	Median	75%	Observation
Yield Spread (bps)	215.582	170.244	96.000	157.300	280.800	4330
S&P Rating	11.545	3.322	10.000	12.000	14.000	4330
Option Volume ($ Millions)	165.016	414.441	3.450	22.465	111.857	4330
Open Interest	1006.922	1728.727	117.367	382.986	1164.368	4328
Moneyness	0.283	0.138	0.200	0.256	0.323	4328
Total Assets ($ Billions)	33.488	59.883	5.062	13.586	33.883	4330
Tobin's Q	1.804	0.792	1.231	1.573	2.151	4330
ROA	0.015	0.015	0.006	0.014	0.023	4330
Leverage	0.273	0.156	0.161	0.251	0.355	4330
Bid-Ask Spread	0.003	0.006	0.000	0.001	0.003	4330
Firm risk	0.073	0.099	0.022	0.041	0.079	4330
Callable Dummy	0.045	0.207	0.000	0.000	0.000	4330
Public Bond Dummy	0.995	0.071	1.000	1.000	1.000	4330
Maturity (in years)	11.353	8.296	5.353	10.014	10.077	4330
Principal Amount ($ Millions)	558.060	457.799	250.000	450.000	700.000	4330

Notes: This table presents the summary statistics for the variables used in this study. Definition of all variables is provided in Appendix A. The sample period is 1996-2014.

Table 3: Options Volume and Cost of Debt

	Ln(Yield Spread)		S&P Rating		
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	Poisson (5)
Ln(Option Volume)	0.038***	0.037***	-0.224***	-0.207***	-0.017***
	(0.010)	(0.010)	(0.046)	(0.044)	(0.004)
Ln(Total Assets)	-0.288***	-0.280***	1.530***	1.457***	0.122***
	(0.017)	(0.017)	(0.089)	(0.089)	(0.008)
Tobin's Q	-0.310***	-0.296***	1.359***	1.318***	0.095***
	(0.024)	(0.023)	(0.104)	(0.101)	(0.009)
ROA	-4.868***	-5.313***	24.192***	23.608***	2.320***
	(0.893)	(0.896)	(3.837)	(3.802)	(0.358)
Leverage	0.913***	0.833***	-6.018***	-5.678***	-0.569***
	(0.105)	(0.101)	(0.431)	(0.429)	(0.044)
Ln(Firm risk)	0.033***	0.035***	-0.076	-0.068	-0.009**
	(0.013)	(0.012)	(0.047)	(0.047)	(0.004)
Ln(Bid-Ask Spread)	0.137***	0.148***	-0.231**	-0.240**	-0.033***
	(0.029)	(0.030)	(0.098)	(0.097)	(0.010)
Public Bond Dummy		-0.220		0.689	0.066
		(0.179)		(0.588)	(0.046)
Callable Dummy		0.311***		-1.873***	-0.275***
		(0.042)		(0.208)	(0.026)
Ln(Maturity)		0.230***		0.188***	0.019***
		(0.021)		(0.050)	(0.004)
Observations	4330	4330	4330	4330	4330
R^2	0.668	0.706	0.741	0.754	

Notes: This table presents OLS and Poisson regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 4: Options Volume and Cost of Debt: Open Interest as Instrument

	First stage	Second stage	
	Ln(Option Volume)	Ln(Yield Spread)	S&P Rating
	(1)	(2)	(3)
Ln(Open Interest)	0.910***		
	(0.040)		
Ln(Option Volume) (instrumented)		0.075***	-0.383***
		(0.015)	(0.064)
Ln(Total Assets)	0.565***	-0.335***	1.707***
	(0.050)	(0.023)	(0.103)
Tobin's Q	0.544***	-0.328***	1.462***
	(0.060)	(0.026)	(0.110)
ROA	3.640*	-5.490***	24.642***
	(2.142)	(0.890)	(3.736)
Leverage	-0.750***	0.863***	-5.820***
	(0.240)	(0.098)	(0.418)
Ln(Firm risk)	0.082***	0.026**	-0.023
	(0.030)	(0.011)	(0.044)
Ln(Bid-Ask Spread)	-0.221***	0.149***	-0.243**
	(0.072)	(0.031)	(0.102)
Public Bond Dummy	-0.005	-0.201	0.601
	(0.362)	(0.195)	(0.663)
Callable Dummy	0.129	0.292***	-1.777***
	(0.116)	(0.039)	(0.191)
Ln(Maturity)	-0.034	0.231***	0.184***
	(0.028)	(0.021)	(0.050)
Observations	4328	4328	4328
R^2	0.860		

Notes: This table presents 2SLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables with average quarterly open interest (Open interest) as instrumental variable. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 5: Summary statistics Time-series sample

	Mean	StdDev	25%	Median	75%	Observation
Yield spread	57.267	497.285	-147.465	111.003	236.604	2028
Option Volume ($ Millions)	30.910	195.222	0.000	0.000	0.329	2028
Total Assets ($ Billions)	39.974	50.324	8.180	23.484	47.392	2028
Tobinś Q	2.202	2.356	0.976	1.213	2.200	2028
ROA	-0.007	0.040	-0.012	0.004	0.009	2028
Leverage	0.355	0.165	0.260	0.323	0.405	2028
Bid-ask spread	0.001	0.001	0.000	0.001	0.001	2028
Firm risk	0.118	0.209	0.024	0.043	0.110	2028
Maturity	8.657	7.922	4.000	5.000	8.000	2028

Notes: This table presents the summary statistics for the variables used in the time-series analysis. Definition of all variables is provided in Appendix A and Section 3.2. Observations with positive options volume 1,003. The sample period is 2002-2015.

Table 6: Options Volume and Cost of Debt: Time-Series Analysis

	Yield spread			
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.112***	0.112**	0.098***	0.098**
	(0.038)	(0.047)	(0.037)	(0.049)
Ln(Total assets)	-0.375**	-0.375	-4.080***	-4.080***
	(0.184)	(0.341)	(0.425)	(1.014)
Tobin's Q	-1.352***	-1.352***	-2.013***	-2.013***
	(0.074)	(0.153)	(0.099)	(0.249)
ROA	-13.520***	-13.520***	-10.266***	-10.266**
	(2.356)	(4.511)	(2.414)	(4.622)
Leverage	6.733***	6.733***	7.621***	7.621***
	(0.873)	(1.696)	(1.100)	(1.962)
Ln(Firm risk)	-0.482***	-0.482***	-0.506***	-0.506***
	(0.088)	(0.181)	(0.090)	(0.168)
Ln(Bid-Ask spread)	3.245***	3.245***	3.304***	3.304***
	(0.180)	(0.713)	(0.192)	(0.832)
Ln(Maturity)	-0.224	-0.224	-1.570***	-1.570**
	(0.346)	(0.421)	(0.536)	(0.709)
Bond Fixed Effect	No	No	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Clustered S.E.	No	Bond level	No	Bond level
Observations	2028	2028	2028	2028
R^2	0.458	0.458	0.843	0.843

Notes: This table presents OLS panel regression estimates of firms' measures for bond yield spread over Treasuries on options trading volume (Option Volume) and a set of control variables. Variables are constructed quarterly. Detailed definition for all variables is provided in Appendix A and Section 3.2. Robust standard errors are in parenthesis. All regressions include a full set of time dummies whereas columns 3 and 4 include bond fixed effects. Observations with positive options volume 1,003. The sample period is 2002-2015. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 7: Options and Financial Distress: K-Z Index

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.039***	0.041***	-0.228***	-0.249***
	(0.011)	(0.011)	(0.046)	(0.046)
K-Z Index	0.000	-0.000	-0.011**	-0.004
	(0.001)	(0.001)	(0.006)	(0.007)
Ln(Option Volume) × K-Z Index		0.001**		-0.005***
		(0.000)		(0.002)
Ln(Total Assets)	-0.281***	-0.277***	1.468***	1.432***
	(0.018)	(0.018)	(0.092)	(0.090)
Tobin's Q	-0.316***	-0.315***	1.408***	1.401***
	(0.025)	(0.025)	(0.110)	(0.112)
ROA	-4.866***	-4.588***	18.697***	16.453***
	(0.920)	(0.901)	(3.709)	(3.465)
Leverage	0.849***	0.849***	-5.797***	-5.792***
	(0.110)	(0.110)	(0.477)	(0.475)
Ln(Firm risk)	0.034***	0.037***	-0.044	-0.068
	(0.013)	(0.013)	(0.049)	(0.046)
Ln(Bid-Ask Spread)	0.141***	0.144***	-0.218**	-0.244**
	(0.032)	(0.032)	(0.103)	(0.103)
Public Bond Dummy	-0.223	-0.224	0.758	0.770*
	(0.173)	(0.163)	(0.539)	(0.465)
Callable Dummy	0.310***	0.314***	-1.862***	-1.897***
	(0.043)	(0.042)	(0.233)	(0.228)
Ln(Maturity)	0.224***	0.226***	0.190***	0.181***
	(0.022)	(0.022)	(0.052)	(0.051)
Observations	3782	3782	3782	3782
R^2	0.702	0.704	0.759	0.763

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables, as well as the interaction of options volume with the K-Z Index (Kaplan and Zingales, 1997) as a measure of financial constrains. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 8: Options and Financial Distress: Junk Bonds

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.036***	0.035***	-0.201***	-0.195***
	(0.010)	(0.010)	(0.044)	(0.044)
Junk-bond Dummy	0.238***	0.155	-2.930***	-2.413***
	(0.092)	(0.103)	(0.425)	(0.487)
Ln(Option Volume) × Junk-bond Dummy		0.048*		-0.298**
		(0.026)		(0.133)
Ln(Total Assets)	-0.279***	-0.278***	1.443***	1.436***
	(0.017)	(0.017)	(0.088)	(0.088)
Tobin's Q	-0.297***	-0.297***	1.334***	1.331***
	(0.023)	(0.023)	(0.100)	(0.100)
ROA	-5.159***	-5.124***	21.720***	21.499***
	(0.891)	(0.891)	(3.709)	(3.702)
Leverage	0.809***	0.811***	-5.381***	-5.398***
	(0.102)	(0.102)	(0.432)	(0.432)
Ln(Firm risk)	0.034***	0.034***	-0.055	-0.055
	(0.012)	(0.012)	(0.047)	(0.047)
Ln(Bid-Ask Spread)	0.146***	0.147***	-0.217**	-0.220**
	(0.030)	(0.030)	(0.095)	(0.095)
Public Bond Dummy	-0.219	-0.220	0.679	0.685
	(0.177)	(0.177)	(0.571)	(0.568)
Callable Dummy	0.313***	0.312***	-1.906***	-1.902***
	(0.041)	(0.041)	(0.205)	(0.205)
Ln(Maturity)	0.231***	0.231***	0.176***	0.175***
	(0.021)	(0.021)	(0.050)	(0.049)
Observations	4330	4330	4330	4330
R^2	0.706	0.707	0.760	0.760

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables, as well as the interaction of options volume with a dummy variable of Junk Bond (credit rating below B-). Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 9: Options Volume and Cost of Debt: Dedicated Owners

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.035***	0.029***	-0.197***	-0.165***
	(0.011)	(0.011)	(0.045)	(0.045)
Own. Dedicated	0.072	-0.136	0.005	1.170
	(0.231)	(0.235)	(0.935)	(0.909)
Ln(Option Volume) × Own. Dedicated		0.137*		-0.768**
		(0.073)		(0.304)
Intitutional Ownership	0.108	0.107	-1.137***	-1.130***
	(0.082)	(0.083)	(0.340)	(0.339)
Ln(Total Assets)	-0.275***	-0.274***	1.372***	1.365***
	(0.019)	(0.019)	(0.092)	(0.091)
Tobin's Q	-0.300***	-0.302***	1.253***	1.263***
	(0.025)	(0.025)	(0.109)	(0.108)
ROA	-5.833***	-5.742***	24.990***	24.476***
	(0.870)	(0.860)	(3.927)	(3.866)
Leverage	0.867***	0.877***	-5.882***	-5.936***
	(0.106)	(0.106)	(0.437)	(0.436)
Ln(Firm risk)	0.035***	0.035***	-0.099**	-0.100**
	(0.013)	(0.013)	(0.049)	(0.049)
Ln(Bid-Ask Spread)	0.141***	0.141***	-0.232**	-0.232**
	(0.033)	(0.033)	(0.101)	(0.101)
Public Bond Dummy	-0.554***	-0.559***	1.243**	1.271**
	(0.052)	(0.051)	(0.518)	(0.493)
Callable Dummy	0.319***	0.314***	-1.842***	-1.813***
	(0.045)	(0.045)	(0.209)	(0.209)
Ln(Maturity)	0.210***	0.211***	0.185***	0.180***
	(0.023)	(0.023)	(0.053)	(0.053)
Observations	3649	3649	3649	3649
R^2	0.712	0.713	0.760	0.762

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables, as well as the interaction of options volume with ownership by Dedicated institutions as defined in Bushee (1998). Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 10: Options Volume and Cost of Debt: Quasi-Index Owners

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.029***	0.064***	-0.165***	-0.311***
	(0.011)	(0.020)	(0.045)	(0.085)
Own. Quasi-Index	-0.685***	-0.523***	3.973***	3.293***
	(0.186)	(0.196)	(0.781)	(0.834)
Ln(Option Volume) × Own. Quasi-Index		-0.077**		0.325**
		(0.032)		(0.144)
Intitutional Ownership	0.583***	0.593***	-3.860***	-3.901***
	(0.147)	(0.145)	(0.629)	(0.624)
Ln(Total Assets)	-0.258***	-0.259***	1.274***	1.277***
	(0.019)	(0.019)	(0.091)	(0.092)
Tobin's Q	-0.287***	-0.290***	1.178***	1.191***
	(0.025)	(0.025)	(0.108)	(0.106)
ROA	-6.002***	-5.949***	25.992***	25.773***
	(0.868)	(0.879)	(3.892)	(3.893)
Leverage	0.825***	0.825***	-5.628***	-5.627***
	(0.104)	(0.103)	(0.425)	(0.422)
Ln(Firm risk)	0.033**	0.034***	-0.087*	-0.091*
	(0.013)	(0.013)	(0.048)	(0.048)
Ln(Bid-Ask Spread)	0.138***	0.135***	-0.215**	-0.200**
	(0.033)	(0.032)	(0.100)	(0.099)
Public Bond Dummy	-0.546***	-0.564***	1.202*	1.278*
	(0.059)	(0.063)	(0.641)	(0.668)
Callable Dummy	0.315***	0.302***	-1.827***	-1.770***
	(0.043)	(0.043)	(0.197)	(0.203)
Ln(Maturity)	0.209***	0.210***	0.189***	0.186***
	(0.023)	(0.023)	(0.052)	(0.052)
Observations	3649	3649	3649	3649
R^2	0.715	0.717	0.766	0.768

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables, as well as the interaction of options volume with ownership by Quasi-index institutions as defined in Bushee (1998). Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 11: Options and Strategic Default: Liquidation costs

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.037***	0.084***	-0.210***	-0.632***
	(0.010)	(0.026)	(0.044)	(0.162)
Intangibles	0.430**	0.632***	-2.312***	-4.136***
	(0.171)	(0.200)	(0.783)	(0.928)
Ln(Option Volume) × Intangibles		-0.070*		0.634***
		(0.038)		(0.234)
Ln(Total Assets)	-0.282***	-0.279***	1.471***	1.444***
	(0.018)	(0.018)	(0.090)	(0.088)
Tobin's Q	-0.295***	-0.294***	1.318***	1.314***
	(0.024)	(0.024)	(0.100)	(0.101)
ROA	-5.450***	-5.364***	24.156***	23.377***
	(0.923)	(0.921)	(3.837)	(3.710)
Leverage	0.881***	0.868***	-5.946***	-5.826***
	(0.106)	(0.107)	(0.433)	(0.426)
Ln(Firm risk)	0.034***	0.036***	-0.064	-0.078*
	(0.012)	(0.012)	(0.046)	(0.044)
Ln(Bid-Ask Spread)	0.149***	0.152***	-0.226**	-0.257***
	(0.030)	(0.031)	(0.096)	(0.097)
Public Bond Dummy	-0.205	-0.198	0.630	0.571
	(0.180)	(0.178)	(0.596)	(0.570)
Callable Dummy	0.329***	0.331***	-1.906***	-1.926***
	(0.045)	(0.045)	(0.220)	(0.218)
Ln(Maturity)	0.232***	0.233***	0.167***	0.159***
	(0.021)	(0.021)	(0.049)	(0.048)
Observations	4228	4228	4228	4228
R^2	0.705	0.706	0.754	0.756

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables, as well as the interaction of options volume with Liquidation costs proxied by intangible assets as in Favara, Schroth, and Valta (2012). Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table 12: Options and Strategic Default: Insiders Ownership

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.030**	0.025**	-0.176***	-0.168***
	(0.012)	(0.012)	(0.050)	(0.053)
Inside Own.	0.333***	0.197*	-0.949**	-0.713
	(0.088)	(0.106)	(0.369)	(0.470)
Ln(Option Volume) × Inside Own.		0.069**		-0.119
		(0.031)		(0.164)
Institutional Ownership	0.110*	0.118*	-0.939***	-0.952***
	(0.063)	(0.063)	(0.276)	(0.275)
Ln(Total Assets)	-0.265***	-0.265***	1.329***	1.330***
	(0.020)	(0.019)	(0.096)	(0.096)
Tobin's Q	-0.315***	-0.318***	1.308***	1.312***
	(0.025)	(0.025)	(0.109)	(0.109)
ROA	-6.347***	-6.271***	26.193***	26.061***
	(0.938)	(0.939)	(3.959)	(3.964)
Leverage	0.883***	0.893***	-5.930***	-5.947***
	(0.113)	(0.113)	(0.428)	(0.429)
Ln(Firm risk)	0.036**	0.036**	-0.089*	-0.089*
	(0.014)	(0.014)	(0.048)	(0.048)
Ln(Bid-Ask Spread)	0.098***	0.098***	-0.111	-0.112
	(0.037)	(0.037)	(0.102)	(0.102)
Public Bond Dummy	-0.566***	-0.560***	1.278***	1.267***
	(0.051)	(0.052)	(0.475)	(0.477)
Callable Dummy	0.308***	0.303***	-1.866***	-1.857***
	(0.042)	(0.041)	(0.211)	(0.213)
Ln(Maturity)	0.210***	0.209***	0.176***	0.177***
	(0.024)	(0.024)	(0.055)	(0.056)
Observations	3852	3852	3852	3852
R^2	0.705	0.705	0.760	0.760

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables, as well as the interaction of options volume with Insiders ownership as a measure of shareholders' bargaining power (Favara, Schroth, and Valta, 2012). Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

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Appendix A Variable definition

A.1. Bond variables

Variable	Definition
Yield spread (in basis points)	Difference in the bond yield to maturity at-issue (reported by SDC Global New Issues) and the yield of a Treasury bond (collected from the Federal Reserve H-15 Release) with the same maturity. In cases where there is no maturity-equivalent Treasury, we use linear interpolation to calculate the yield of the risk-free bond.
Ln(Yield spread)	Natural logarithm of Yield spread.
S&P Rating	Bond rating by the agency Standard and Poor's (as reported by SDC Global New Issues). We transform the ordinal variable to a numerical scale in the following way: 1-CCC-, 2-CCC, 3-CCC+, 4-B-, 5-B, 6-B+, 7-BB-, 8-BB, 9-BB+, 10-BBB-, 11-BBB, 12-BBB+, 13-A-, 14-A, 15-A+, 16-AA-, 17-AA, 18-AA+, 19-AAA-, 20-AAA, 21-AAA+.
Public Bond Dummy	Dummy variable equal 1 if the bond is public (as reported by SDC Global New Issues) and zero otherwise.
Callable Dummy	Dummy variable equal 1 if the bond is callable (as reported by SDC Global New Issues) and zero otherwise.
Maturity (in years)	Time to maturity (in years) as reported by SDC Global New Issues.
Principal	Principal amount of the issue (in $ Millions) as reported by SDC Global New Issues.
Junk Bond Dummy	Dummy variable that equals one if the bond is rated below B- by Standard and Poor's and zero otherwise.

A.2. Option variables

Variable	Definition
Options Volume (Millions)	Total daily trade in each option multiplied by end-of-day quote midpoint for that option. This number is then aggregated across all options for a single stock on all trading days for a given quarter. Following Roll, Schwartz, and Subrahmanyam (2009). Source: Option Metrics.
Ln(Option Volume)	Natural logarithm of Options Volume.
Open Interest	Quarterly average of the daily Open interest (number of put and call contracts that remain open in a stock) provided by Option Metrics.
Ln(Open Interest)	Natural logarithm of Open Interest.
Moneyness	Quarterly average of the daily absolute deviation of the exercise price of each traded option from the closing price of the underlying stock. Following Roll, Schwartz, and Subrahmanyam (2009). Source: Option Metrics and CRSP-Compustat.
Ln(Moneyness)	Natural logarithm of Moneyness.
High Option Volume	Dummy variable that equals one if the firm's value for Options Volume is above the median for that year and zero otherwise.

A.3. Firm variables

Variable	Definition
Ln(Total Assets)	Natural logarithm of quarterly total assets for a firm reported by CRSP-Compustat.
Tobin's Q	Sum of the market capitalization of a firm's common equity (stock price times shares outstanding at the end of the quarter), liquidation value of its preferred shares and the book value of debt, divided by book value of assets. Calculated for each quarter based on CRSP-Compustat items. (Tobin's Q = (prccq×cshoq + atq - ceqq - txdb)/atq)).
ROA	Return on Assets. Net income over total assets (quarterly). Source: CRSP-Compustat.
Leverage	Total debt over total assets (quarterly). Source: CRSP-Compustat.
Firm risk	Standard deviation of quarterly cash-flow from operations (income before extraordinary items plus depreciation and amortization, normalized by total assets) over the previous year. Source: CRSP-Compustat.
Ln(Firm risk)	Natural logarithm of Firm risk.
Bid-Ask Spread	Average of the daily relative bid-ask spread for a stock and quarter. Relative Bid-Ask Spread = 100×(Ask - Bid)/(0.5×(Ask + Bid)). Source: CRSP-Compustat.
Ln(Bid-Ask Spread)	Natural logarithm of Bid-Ask Spread.
Institutional Ownership	Total shares held by institutional investors from the Thomson Reuters 13F quarterly filing over total shares outstanding from CRSP.
Ownership Dedicated/ Transient/ Quasi-Index	Total shares held by Dedicated/ Transient/ Quasi-Index institutional investors from the Bushee (1998) classification and Thomson Reuters 13F filing over total shares outstanding from CRSP.
Ln(Amihud)	Natural logarithm of the Amihud (2002) illiquidity measure calculated as the ratio between absolute stock return and turnover from CRSP over a trading quarter.
Insiders Ownership	Total shares held by insiders from Worldscope over total shares outstanding.
K-Z Index	Kaplan and Zingales (1997) Index for financial constrains build under the Lamont, Polk, and Saaá-Requejo (2001) specification: $KZ = -1.001 \times Cash - flow_t/PPE_{t-1} + 0.282 \times Q_t + 3.139 \times Debt_t/Capital_t - 39.367 \times Dividends_t/PPE_{t-1} - 1.314 \times Cash_t/PPE_{t-1}$. Data from Compustat.
Intangibles	Measured as in Berger, Ofek, and Swary (1996): $Intangibles = 1 - (Cash + 0.715 \times Receivables + 0.547 \times Inventories + 0.535 \times PPE)/Assets$. Data from Compustat.

Appendix B Additional tables

Table B1: Options Volume and Cost of Debt: SIC4 Dummies

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.033***	0.030***	-0.208***	-0.190***
	(0.010)	(0.010)	(0.042)	(0.041)
Ln(Total Assets)	-0.313***	-0.303***	1.645***	1.573***
	(0.017)	(0.017)	(0.089)	(0.088)
Tobin's Q	-0.282***	-0.275***	1.069***	1.042***
	(0.025)	(0.025)	(0.113)	(0.112)
ROA	-4.109***	-4.460***	21.672***	21.057***
	(0.781)	(0.792)	(3.498)	(3.486)
Leverage	0.793***	0.753***	-5.382***	-5.220***
	(0.091)	(0.092)	(0.450)	(0.453)
Ln(Firm risk)	0.027**	0.032***	-0.058	-0.061
	(0.013)	(0.012)	(0.045)	(0.045)
Ln(Bid-Ask Spread)	0.130***	0.140***	-0.245***	-0.251***
	(0.025)	(0.028)	(0.085)	(0.084)
Public Bond Dummy		-0.312**		0.822
		(0.147)		(0.794)
Callable Dummy		0.234***		-1.464***
		(0.043)		(0.200)
Ln(Maturity)		0.227***		0.139***
		(0.020)		(0.042)
Observations	4330	4330	4330	4330
R^2	0.724	0.756	0.810	0.817

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of four-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B2: Options Volume and Cost of Debt: Moneyness as Instrument

	First stage	Second stage	
	Ln(Option Volume)	Ln(Yield Spread)	S&P Rating
	(1)	(2)	(3)
Ln(Moneyness)	1.157***		
	(0.109)		
Ln(Option Volume)		0.333***	-1.334***
		(0.043)	(0.164)
Ln(Total Assets)	1.377***	-0.697***	3.045***
	(0.036)	(0.062)	(0.251)
Tobin's Q	0.871***	-0.551***	2.285***
	(0.057)	(0.049)	(0.183)
ROA	5.713***	-6.054***	26.725***
	(2.180)	(1.098)	(4.453)
Leverage	-0.914***	1.055***	-6.530***
	(0.305)	(0.133)	(0.532)
Ln(Firm risk)	0.167***	-0.027	0.173***
	(0.037)	(0.017)	(0.067)
Ln(Bid-Ask Spread)	-0.150*	0.155***	-0.267*
	(0.086)	(0.043)	(0.148)
Public Bond Dummy	-0.293	-0.076	0.142
	(0.490)	(0.321)	(1.128)
Callable Dummy	0.298*	0.200***	-1.436***
	(0.157)	(0.056)	(0.229)
Ln(Maturity)	-0.008	0.236***	0.165***
	(0.031)	(0.025)	(0.062)
Observations	4328	4328	4328
R^2	0.775		

Notes: This table presents 2SLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables with average absolute moneyness (Moneyness) as instrumental variable. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B3: Options Volume and Cost of Debt: Both Instruments

	First stage	Second stage	
	Ln(Option Volume)	Ln(Yield Spread)	S&P Rating
	(1)	(2)	(3)
Ln(Open Interest)	0.872***		
	(0.041)		
Ln(Moneyness)	0.360***		
	(0.095)		
Ln(Option Volume)		0.090***	-0.438***
		(0.015)	(0.063)
Ln(Total Assets)	0.591***	-0.355***	1.784***
	(0.050)	(0.023)	(0.104)
Tobin's Q	0.559***	-0.341***	1.510***
	(0.059)	(0.026)	(0.110)
ROA	4.676**	-5.522***	24.762***
	(2.131)	(0.892)	(3.744)
Leverage	-0.802***	0.874***	-5.860***
	(0.241)	(0.098)	(0.419)
Ln(Firm risk)	0.075**	0.023**	-0.012
	(0.030)	(0.011)	(0.044)
Ln(Bid-Ask Spread)	-0.252***	0.149***	-0.245**
	(0.076)	(0.031)	(0.104)
Public Bond Dummy	0.034	-0.193	0.574
	(0.360)	(0.202)	(0.688)
Callable Dummy	0.119	0.287***	-1.758***
	(0.115)	(0.039)	(0.189)
Ln(Maturity)	-0.030	0.231***	0.183***
	(0.027)	(0.022)	(0.050)
Observations	4328	4328	4328
R^2	0.861		

Notes: This table presents 2SLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables with average quarterly open interest (Open interest) and average absolute moneyness (Moneyness) as instrumental variables. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B4: Options Volume and Cost of Debt: Monotonicity

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.042***	0.044***	-0.265***	-0.231***
	(0.013)	(0.012)	(0.059)	(0.054)
Ln(Option Volume) × Ln(Option Volume)	-0.001		0.014	
	(0.002)		(0.009)	
High Options Volume		-0.017		-0.211
		(0.058)		(0.296)
Ln(Option Volume) × High Options Volume		-0.006		0.072
		(0.015)		(0.075)
Ln(Total Assets)	-0.278***	-0.278***	1.424***	1.439***
	(0.018)	(0.018)	(0.086)	(0.087)
Tobin's Q	-0.295***	-0.294***	1.302***	1.309***
	(0.023)	(0.023)	(0.101)	(0.102)
ROA	-5.283***	-5.312***	23.246***	23.418***
	(0.902)	(0.897)	(3.725)	(3.739)
Leverage	0.828***	0.828***	-5.622***	-5.645***
	(0.100)	(0.100)	(0.420)	(0.424)
Ln(Firm risk)	0.036***	0.035***	-0.075*	-0.071
	(0.012)	(0.012)	(0.046)	(0.046)
Ln(Bid-Ask Spread)	0.150***	0.150***	-0.257***	-0.249**
	(0.030)	(0.030)	(0.097)	(0.097)
Public Bond Dummy	-0.215	-0.216	0.631	0.652
	(0.177)	(0.176)	(0.566)	(0.573)
Callable Dummy	0.310***	0.308***	-1.864***	-1.868***
	(0.041)	(0.042)	(0.207)	(0.207)
Ln(Maturity)	0.230***	0.231***	0.190***	0.188***
	(0.022)	(0.021)	(0.050)	(0.050)
Observations	4330	4330	4330	4330
R^2	0.706	0.706	0.754	0.754

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume), its squared term, a dummy variable for high options volume (*High Options Volume*), its interaction with options volume, and a set of control variables. *High Options Volume* equals one if options volume for firm is above the median in a given year and zero otherwise. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B5: Options Volume and Cost of Debt: Quantile Regression

	Ln(Yield Spread)	S&P Rating
	(1)	(2)
Ln(Option Volume)	0.038***	-0.166***
	(0.008)	(0.034)
Ln(Total Assets)	-0.269***	1.390***
	(0.014)	(0.068)
Tobin's Q	-0.278***	1.400***
	(0.020)	(0.084)
ROA	-5.987***	25.052***
	(0.789)	(3.978)
Leverage	0.767***	-5.471***
	(0.079)	(0.368)
Ln(Firm risk)	0.044***	-0.052
	(0.010)	(0.042)
Ln(Bid-Ask Spread)	0.173***	-0.189**
	(0.018)	(0.083)
Public Bond Dummy	-0.365***	0.964**
	(0.102)	(0.468)
Callable Dummy	0.339***	-2.014***
	(0.037)	(0.211)
Ln(Maturity)	0.214***	0.130***
	(0.014)	(0.050)
Observations	4330	4330

Notes: This table presents regression results of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables from a bootstrapped quantile regression at the median (50th percentile) with 200 replications. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B6: Options Volume and Cost of Debt: Extra Controls

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.033***	0.032***	-0.200***	-0.192***
	(0.010)	(0.010)	(0.044)	(0.045)
Ln(Total Assets)	-0.321***	-0.316***	1.530***	1.444***
	(0.017)	(0.018)	(0.090)	(0.094)
Tobin's Q	-0.300***	-0.305***	1.326***	1.262***
	(0.022)	(0.023)	(0.101)	(0.108)
ROA	-5.455***	-5.723***	23.865***	24.807***
	(0.845)	(0.834)	(3.790)	(3.903)
Leverage	0.824***	0.865***	-5.662***	-5.875***
	(0.094)	(0.100)	(0.420)	(0.429)
Ln(Firm risk)	0.028**	0.030**	-0.056	-0.091*
	(0.012)	(0.013)	(0.046)	(0.049)
Ln(Bid-Ask Spread)	0.144***	0.138***	-0.233**	-0.226**
	(0.029)	(0.033)	(0.097)	(0.101)
Public Bond Dummy	-0.301	-0.554***	0.837	1.244**
	(0.195)	(0.061)	(0.620)	(0.558)
Callable Dummy	0.291***	0.308***	-1.838***	-1.825***
	(0.040)	(0.044)	(0.202)	(0.208)
Ln(Maturity)	0.221***	0.200***	0.204***	0.203***
	(0.021)	(0.022)	(0.050)	(0.052)
Principal	0.245***	0.247***	-0.444***	-0.427***
	(0.029)	(0.031)	(0.122)	(0.126)
Intitutional Ownership		0.102		-1.116***
		(0.074)		(0.327)
Observations	4330	3649	4330	3649
R^2	0.718	0.724	0.756	0.762

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables that additionally include bond principal amount (*Principal*) and total *Intitutional Ownership*. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B7: Options Volume and Cost of Debt: Alternative Distributions

	Ln(1+Rating)		S&P Rating	
	OLS		Negative Binomial	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	-0.019***	-0.018***	-0.019***	-0.017***
	(0.005)	(0.004)	(0.004)	(0.004)
Ln(Total Assets)	0.131***	0.123***	0.130***	0.122***
	(0.008)	(0.008)	(0.008)	(0.008)
Tobin's Q	0.101***	0.096***	0.099***	0.095***
	(0.010)	(0.009)	(0.009)	(0.009)
ROA	2.541***	2.476***	2.400***	2.320***
	(0.383)	(0.379)	(0.369)	(0.358)
Leverage	-0.611***	-0.574***	-0.607***	-0.569***
	(0.046)	(0.045)	(0.046)	(0.044)
Ln(Firm risk)	-0.014***	-0.013***	-0.010**	-0.009**
	(0.005)	(0.004)	(0.004)	(0.004)
Ln(Bid-Ask Spread)	-0.037***	-0.038***	-0.033***	-0.033***
	(0.011)	(0.011)	(0.011)	(0.010)
Public Bond Dummy		0.053		0.066
		(0.056)		(0.046)
Callable Dummy		-0.206***		-0.275***
		(0.024)		(0.026)
Ln(Maturity)		0.023***		0.019***
		(0.004)		(0.004)
Observations	4330	4330	4330	4330

Notes: This table presents OLS and Negative Binomial regression estimates of firms' measures for different transformation of the bond rating measure on options trading volume (Option Volume) and a set of control variables. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B8: Options Volume and Cost of Debt: Amihud Illiquidity

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.049***	0.048***	-0.251***	-0.232***
	(0.012)	(0.011)	(0.048)	(0.046)
Ln(Total Assets)	-0.258***	-0.249***	1.447***	1.359***
	(0.023)	(0.023)	(0.096)	(0.095)
Tobin's Q	-0.298***	-0.284***	1.330***	1.284***
	(0.028)	(0.027)	(0.112)	(0.109)
ROA	-5.150***	-5.553***	24.825***	24.074***
	(0.911)	(0.909)	(3.924)	(3.892)
Leverage	0.951***	0.876***	-6.102***	-5.768***
	(0.107)	(0.104)	(0.420)	(0.418)
Ln(Firm risk)	0.041***	0.043***	-0.099**	-0.094**
	(0.013)	(0.013)	(0.048)	(0.047)
Ln(Amihud Illiq)	0.075***	0.079***	-0.151**	-0.162**
	(0.024)	(0.024)	(0.070)	(0.068)
Public Bond Dummy		-0.221		0.675
		(0.191)		(0.601)
Callable Dummy		0.318***		-1.929***
		(0.041)		(0.201)
Ln(Maturity)		0.220***		0.202***
		(0.022)		(0.050)
Observations	4185	4185	4185	4185
R^2	0.666	0.701	0.742	0.756

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables including the Amihud (2002) as a measure of liquidity. Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.

Table B9: Options Volume and Cost of Debt: Transient Owners

	Ln(Yield Spread)		S&P Rating	
	(1)	(2)	(3)	(4)
Ln(Option Volume)	0.028***	0.034**	-0.151***	-0.130**
	(0.011)	(0.014)	(0.044)	(0.059)
Own. Transient	0.904***	0.971***	-5.748***	-5.511***
	(0.187)	(0.193)	(0.841)	(0.894)
Ln(Option Volume) × Own. Transient		-0.040		-0.140
		(0.051)		(0.241)
Intitutional Ownership	-0.084	-0.078	0.122	0.142
	(0.092)	(0.092)	(0.386)	(0.389)
Ln(Total Assets)	-0.252***	-0.254***	1.226***	1.218***
	(0.019)	(0.020)	(0.091)	(0.092)
Tobin's Q	-0.287***	-0.287***	1.167***	1.166***
	(0.024)	(0.024)	(0.107)	(0.107)
ROA	-5.990***	-6.031***	26.015***	25.868***
	(0.865)	(0.864)	(3.862)	(3.818)
Leverage	0.839***	0.840***	-5.690***	-5.686***
	(0.105)	(0.104)	(0.423)	(0.423)
Ln(Firm risk)	0.033**	0.033**	-0.086*	-0.087*
	(0.013)	(0.013)	(0.049)	(0.048)
Ln(Bid-Ask Spread)	0.140***	0.140***	-0.225**	-0.224**
	(0.033)	(0.033)	(0.101)	(0.101)
Public Bond Dummy	-0.534***	-0.543***	1.119*	1.086
	(0.061)	(0.062)	(0.678)	(0.684)
Callable Dummy	0.298***	0.295***	-1.717***	-1.726***
	(0.043)	(0.044)	(0.191)	(0.189)
Ln(Maturity)	0.209***	0.209***	0.190***	0.191***
	(0.023)	(0.023)	(0.052)	(0.052)
Observations	3649	3649	3649	3649
R^2	0.716	0.716	0.768	0.768

Notes: This table presents OLS regression estimates of firms' measures for the cost of debt (bond yield spread and bond rating) on options trading volume (Option Volume) and a set of control variables, as well as the interaction of options volume with ownership by Transient institutions as defined in Bushee (1998). Detailed definition for all variables is provided in Appendix A. Robust standard errors are clustered at the firm level (in parenthesis). All regressions include a full set of two-digit SIC code dummies and time dummies. The sample period is 1996-2014. ***, ** and * denote significance at the 1%, 5% and 10%, respectively.