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Options Trading and Corporate Debt Structure

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Abstract

Option trading activity can enhance informational efficiency of underlying securities by helping to complete markets and by stimulating information production that leads to informed trades. Recent empirical studies find evidence suggesting that enhanced informational efficiency from options trading translates into higher firm values by allowing for a more efficient allocation of firm resources. In this paper, we develop and test the hypothesis that, in addition to a more efficient allocation of firm resources, options trading also enhances firm value through a financing channel, by promoting a debt structure that relies more on public debt and less on more costly bank financing. Consistent with both an information channel (where increased informational efficiency reduces the demand for the superior ability of banks to access and process private information) and a governance channel (where enhanced informational efficiency reduces the demand for bank lender governance) we find that bank loan issuance and the ratio of bank loans to total debt are negatively related to option listing and options trading volume.

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1. Introduction

Options trading activity can enhance informational efficiency of underlying securities by helping to complete markets and by stimulating information production that leads to informed trades. Recent empirical studies find evidence suggesting that enhanced informational efficiency from options trading translates into higher firm values by allowing for a more efficient allocation of firm resources. For example, consistent with the idea that options trading contributes to information production that managers use to make better investment decisions, Roll, Schwartz, and Subrahmanyam (2009) find that investment sensitivity to stock price increases with options trading volume as does firm value.[2] In this paper, we develop and test the hypothesis that, in addition to a more efficient allocation of firm resources, options trading also enhances firm value, through a financing channel, by promoting a lower cost debt structure; i.e., a combination of public and private debt that serves to increase firm value.

The starting point for our analysis is the recognition that bank debt is more expensive than public debt and that firms willingly pay the cost differential when they expect to sufficiently benefit from the unique advantages that borrowing from banks offer.[3] A large theoretical and empirical literature provides a variety of explanations of the costs and benefits of bank loans versus public debt.[4] One broadly held view arising from this literature is that banks are "special" in their ability to access and process private information about borrowing firms. Thus, more opaque firms with greater information asymmetry, that have difficulty issuing bonds publicly, will borrow from banks because of their superior information processing ability. We hypothesize that the increased informational efficiency associated with options trading reduces information asymmetry thereby enhancing the ability of firms to issue debt publicly and reducing firm demand for the superior information processing that bank loans offer.

In addition to the information channel, we also investigate a second, *governance*, channel through which options trading activity may also affect debt structure choices. The basis for this

[2] Consistent with an improved allocation of resources, Blanco and Wehrheim (2017) report that firms with more options trading activity generate more patents and patent citations per dollar invested in research and development.
[3] Schwert (2019) provides evidence that banks, after accounting for seniority, earn an economically large premium relative to the market price of credit risk as measured by bond spreads from the same firm on the same debt. This finding is viewed as direct evidence of the willingness of firms to pay for the unique qualities of bank loans.
[4] See, for example, Diamond (1984, 1991), Fama (1985), James (1987), Berlin and Loeys (1988), Rajan (1992), Chemmanur and Fulghieri (1994), Houston and James (1996) and Park (2000).

investigation is that banks, because of their more concentrated ownership of debt claims and greater facility with renegotiating debt contracts, are better positioned than public debtholders to provide creditor governance. Thus, firms that can benefit from increased creditor governance will choose to borrow from banks rather than issue debt publicly. Our empirical strategy for investigating the governance channel is based on theory and evidence suggesting that the increased informational efficiency associated with options trading enhances the effectiveness of alternative governance mechanisms thereby reducing the demand for creditor governance associated with bank borrowing.[5] In effect, we test for whether there is substitution out of bank governance when options trading increases governance pressure from alternative mechanisms.[6]

The empirical research on debt structure is largely based on cross-sectional analysis of the determinants of firms' *mix* of debt claims as measured by the ratio of bank (and/or public) debt to total firm debt.[7] We follow the cross-sectional approach and supplement our findings using the incremental approach, pioneered by Denis and Mihov (2003) that analyzes the determinants of the source of *new* debt issues, i.e., the choice between bank loans and public debt issues.[8]

We begin by providing baseline evidence that options trading volume reduces firm reliance on costly bank financing. Our dependent variable in this analysis is the ratio of bank loans to total debt and our key test variable is the level of options dollar trading volume. Using standard controls from the debt structure literature, we find that firms with higher options trading volumes have debt structures that rely significantly less on bank borrowing. Specifically, a one standard deviation increase in the options trading volume is associated with a 4.66% decrease in the ratio of bank loans to total debt.

Well-known endogeneity concerns make it difficult to determine whether there is a causal

[5] See Ferreira, Ferreira, and Raposo (2011) and Garcia (2017) for evidence showing that increased price efficiency enhances governance pressure from alternative governance mechanisms.

[6] The substitution hypothesis we consider is based on the idea that firm managers can be exposed to "too much" governance (Hermalin and Weisbach, 2012). Consistent with a "substitution of governance mechanisms" hypothesis, Avedian, Cronqvist, and Weidenmier (2015) show that firms substitute away from independent board governance in response to the added external governance pressure arising from the creation of the Securities and Exchange Commission. More closely related to our study, Bharath and Hertzel (2018) show that firms substitute out of bank governance following an exogenous shock (import tariff reduction) that increased governance pressure from the product market.

[7] See, for example, Houston and James (1996), Johnson (1997), Krishnaswami, Spindt, and Subramaniam (1999).

[8] Multinomial logit estimates in Denis and Mihov (2003) show that the primary determinant of debt source is a firm's credit quality with high credit quality firms issuing public debt and lower credit quality firms issuing bank debt. They also present evidence that the level of asymmetric information and project quality explain debt source.

link going from options trading activity to debt choice. We use an instrumental variable approach to address concerns with endogeneity, following Roll et al. (2009). Using options open interest and moneyness as instrumental variables in a 2SLS analysis, we confirm that options trading causes firms to shift from bank debt to public debt.

To complement our analysis of the relation between the mix of debt claims and options trading volume, we examine *changes* in debt structure in the years surrounding the year of option listing. Using a propensity score matching framework, we find that the ratio of bank debt to total debt declines significantly over the three years following option listing as compared with matched firms without listed options. Highlighting the importance of options trading *volume* in enhancing price efficiency, we find that the reduction in bank debt in the years following option listing is larger and more significant for firms with listed options that are more heavily traded.[9] In addition, consistent with the reduction in bank debt to total debt *ratios*, we also find a significant reduction in the number and dollar amount of bank loans to total debt *issues* in the years following option listing. Taken collectively, our results are consistent with the view that the enhanced information environment associated with options trading benefits firms by making public debt issuance less costly and by reducing the demand for the unique qualities that more-costly bank loan financing offers.

We investigate the cross-sectional nature of our sample to further characterize the effect of changes in options trading volume on firm debt choice and to bolster support for the validity of our conclusions and tests that control for endogeneity concerns. Our first set of tests focuses on firms that are expected to have more severe information asymmetry problems (as proxied by firm size and the ratio of property, plant, and equipment to total assets (PPE)) and firms with non-investment grade credit ratings. Consistent with the prediction that the enhanced informational environment associated with options trading is more beneficial for firms with more severe information problems and firms with lower credit ratings, we find that the relation between options trading volume and the ratio of bank debt to total debt is significantly more negative for smaller firms, firms with lower levels of PPE, and firms with non-investment grade credit ratings. This evidence suggests that the reduced reliance on more costly bank financing we document for the

[9] This finding is consistent with the argument and evidence in Roll et al. (2009) that "the valuation benefit from options to a firm should depend on options trading activity, over and beyond the presence of an options market on the firm's stock."

full sample is driven in large part by firms that are expected to benefit most from the enhanced information environment associated with options trading activity.

In a related analysis, we examine the effects of an external decrease in informational efficiency associated with an exogenous drop in the number of financial analysts following a firm. We use the closure and merger of brokerage firms as natural experiments. Previous literature finds that a drop in the number of financial analyst causes firms to switch from public debt financing to bank loans (Li, Lin, and Zhan (2018)). If options trading indeed provides informational efficiency, we would expect there to be a buffer for firms with higher options trading volumes. in such exogenous shock. Consistent with the argument, we find that a drop in the number of analysts has a significant positive effect on the use of bank debt for firms with low options trading volumes (including firms with no options listed). However, we find no significant effect on debt structure for firms with higher options trading volumes. These findings highlight the information efficiency benefits of options trading and suggest that these can substitute, in part, for financial analysts in enhancing the information environment within which firms operate.

We also find cross-sectional evidence that options trading affects debt structure through a governance channel. Previous research finds evidence that managers of firms operating in competitive industries face intense product market governance pressure. To the extent that the improved information environment associated with options trading enhances the efficiency of alternative governance mechanisms, we expect a more significant negative relation between options trading volume and the use of bank debt for firms in operating in competitive industries. Our findings are consistent with this expectation.

We also test for a governance channel effect by examining the relation between options trading volume and the strictness of bank loan covenants. We use the covenant strictness measure from Murfin (2012) which approximates the probability that the bank will obtain contingent control through a covenant violation. In effect, tighter restrictions are used to keep borrowers on a "shorter leash" thereby imposing greater governance pressure on the firm. Consistent with a governance mechanism substitution effect, we find that covenant strictness decreases with increases in options trading volume. That is, governance pressure from banks is reduced as governance pressure from alternative governance mechanisms increases.

Our paper contributes to several strands of literature. First, our central finding that options trading allows for a lower cost debt structure contributes to the literature examining whether financial markets affect corporate decision-making or are simply a sideshow with no real economic consequences. Previous studies have largely focused on the asset side of the balance sheet showing that increases in firm value associated with options trading activity reflect improvements in firm resource allocation and investment. Our study is the first to focus on the liability side of the balance sheet by showing that options markets have real economic consequences by fostering an enhanced information environment that increases firm value by allowing for a lower cost financing structure.

Second, our study contributes to the literature on the debt structure of public firms and, in particular, the choice between bank loans and public debt issuance. Our finding that firms shift away from costlier bank loan financing to public debt issuance when options trading enhances the information environment, provides new evidence on the importance of asymmetric information in explaining debt structure. Furthermore, we show that the effect on debt structure comes through two channels. First, the reduction in information asymmetry eases information problems associated with issuing public debt and reduces the demand for the information processing services associated more expensive bank borrowing. Second, the enhanced information environment reduces the cost of alternative governance mechanisms resulting in a substitution away from more-costly bank monitoring. Previous evidence on the importance of ex post governance in explaining debt choice is limited to Bharath and Hertzel, 2018. To our knowledge, ours is the first study to consider how exogenous shifts in a firm's information environment affects governance structure through the choice between bank loans and public debt.

The remainder of the paper is organized as follows: Section 2 describes the data and the construction of our variables. Section 3 presents the main empirical results on the relation between options trading and debt structure. Section 4 extends the basic tests by considering the cross-sectional nature of our sample. Section 5 concludes.

2. Data and Variables

To investigate the effect of options trading on debt structure and the source of new debt issues, we begin by assembling a large sample of existing debt claims, new bank loans, and public

debt issues for U.S. public companies over the period 2003-2016.[10] We obtain detailed debt structure data from S&P Capital IQ. In our analysis, we consider two measures of debt structure: (i) the percentage of bank debt (the sum of revolving credit and term loans) to total debt and (ii) the percentage of public debt (the sum of senior and subordinated bonds and notes) to total debt.[11] We exclude observations where the sum of these two ratios adds up to more than one to avoid potential data errors. We obtain bank loan issuance data from DealScan, and public bond issuance data from Thomson Reuters SDC Platinum.

Daily options trading data is from OptionMetrics. Following Roll et al. (2009), we calculate the annual dollar trading volume for each stock in our sample. To begin, for each option, we use the midpoint of the daily closing bid and ask price as the trading price and multiply this price by the trading volume for that day. Then, for each stock, we sum up the daily dollar trading volume for all listed options over the year to obtain the stock-year level options trading volume. We also obtain measures of moneyness and open interest from OptionMetrics.

Financial and accounting data is from Compustat. We control for firm characteristics that have been documented to affect a firm's choice of debt. Firm size is measured as the logarithm of total book assets. Firm leverage is the amount of long-term debt and debt in current liabilities scaled by total assets. Market-to-book ratio is defined as market value scaled by book value and measures growth opportunities and also potential asset substitution risk. ROA, operating income before depreciation scaled by total assets, captures firm profitability. We also include PPE, the amount of property, plant, and equipment scaled by total assets, to represent the tangibility of the firms' assets. We also control for long-term credit rating in our analysis. More detailed definitions can be found in Appendix A.

Table 1 presents the distribution of unique firms with non-missing debt structure and control variables across the years of our sample period. The table shows the distribution according to whether a firm has listed options or not. While the number of unique public firms has declined over the sample period, the number of firms with traded options has increased. For example, in 2002, around 40% of our sample firms had traded options. The percentage increased to more than

[10] Following previous literature, our sample period begins in 2003, when the coverage of Capital IQ became more comprehensive (Colla et al. (2013), Li, Lin, and Zhan (2018)).
[11] Other debt and capital leases are excluded, as it is not clear whether these belong to private or public debt.

70% in 2015. The evidence is consistent with the fact that the options market has become larger and more liquid in recent years. (Muravyev and Pearson (2016)).

Table 2 provides summary statistics (calculated over all firms and years) for debt structure, control variables, and options trading volume. Panel A covers the full set of firms while Panel B covers the subset of firms that have positive options trading volume.[12] For the full sample, as shown in Panel A, the mean (median) value of the bank-to-total debt percentage is 42.7% (30.6%). Panel B shows that the mean (median) value of this percentage is much smaller, 35.6% (17.9%), for the subsample of firms with positive options volume. The results for public debt mirror this finding showing greater usage of public debt for firms with positive options volume. Such preliminary evidence is consistent with the hypothesis that options trading reduces the demand for bank financing, on average, for firms with options listed, the annual options dollar trading volume is 1.25 million USD. The median, however, is only 0.071 million USD. Such evidence shows that options trading volume is highly skewed. In our baseline analysis, we therefore take the natural logarithm of total dollar trading volume (Ldvol) to study the relation between options trading and a firm's debt structure. As in Roll et al. (2009), firms with traded options tend to be larger and more profitable than firms without options.

Before turning to our regression analysis, Figure 1 provides a graphical depiction of the relation between debt structure and options trading volume. The figure shows the results of sorting firms with listed options into deciles by options trading volume and then plotting the average bank debt (public debt) percentage for each decile. Consistent with our argument that firms with more options trading volume have less need for relatively more expensive bank debt, we find that bank debt (public debt) financing decreases (increases) monotonically with options trading volume. From firms with lowest options trading volume (decile 1) to firms with the highest options trading volume (decile 10), bank debt financing decreases from 52.14% to 13.17% and public debt financing increases from 30.02% to 65.57%. These differences are both economically meaningful.

The univariate results from Figure 1, however, can be contaminated by other firm fundamental differences. Table 3 presents the correlations among the variables from Table 2 for both the full sample and the subsample of firms with listed options. Again, the results provide

[12] For the full set of firms we define options trading volume to be zero for firms with no options listed. All continuous variables are winsorized at the 1st and 99th percentiles to remove the effect of outliers.

preliminary evidence consistent with our hypothesis that greater option trading activity reduces firm reliance on costly bank financing. The correlation between the bank-to-total debt ratio and options volume is negative for both samples: -0.07 for the full sample and -0.18 for the subsample with listed options. The results for public debt mirror this finding showing a positive correlation between the usage of public debt and options trading volume. The other correlations in the table highlight the need to use control variables in our regression analysis. In particular, the usage of bank debt is highly negatively correlated with firm size and credit rating.

3. Empirical evidence

3.1 Baseline results

To explore the empirical relation between options trading and debt structure, we first run OLS regressions for the subsample of firms with positive options trading using the following specification:

$$y_{i,t} = \alpha + \beta_1 * Ldvol_{i,t-1} + \delta' X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where $y_{i,t}$ is debt structure (as measured by bank debt percentage and public debt percentage) for firm *i* in year *t*, $Ldvol_{i,t-1}$ is the natural logarithm of the options dollar trading volume for firm *i* in year *t-1*; and $X_{i,t-1}$ is a vector containing a set of control variables, industry- and year- fixed effects. All standard errors are robust and clustered at the firm level.

Columns (1) and (2) of Table 4 present our baseline results. The impact of options trading volume on corporate debt structure is statistically and economically significant. A one standard deviation increase in options trading volume (2.715) is associated with a decrease of 4.66% in bank loan financing and an increase of 2.90% in corporate bond financing. In addition to the baseline regressions, we also consider several alternative specifications. Columns (3) and (4) present the marginal effects from Tobit regressions, which address the concern that a certain number of firms have zero bank debt or zero public debt. Columns (5) and (6) report regression results with firm fixed effects. Again, the results support our argument that firms with more

actively traded options have more public debt and less bank debt because of an enhanced information efficiency. In columns (7) and (8), we also include the firms without positive options trading volume and define the trading volume to be zero. Again, we obtain consistent results.

Coefficients of other control variables are mostly consistent with the literature. For example, larger company size and higher tangibility reduce the use of bank loan financing while increase the use of public debt because of less information asymmetry. Besides, firms with better credit ratings use more public bond and less bank debt as a result of lower default risk.

In appendix Table B1, we replace *Ldvol* with a ranking variable *Dvol Rank*. We rank firms into 100 groups according to the dollar trading volume of options every year, then assign the group rank *Dvol Rank* to each firm. We re-estimate the effect of *Dvol Rank* on debt structure. The consistent results lend support to our aforementioned evidence and confirm the linearity.

3.2 Instrumental variable approach

Although the baseline results are consistent with the hypothesis that options trading affects a firm's debt choices, potential concerns with endogeneity bias make it difficult to identify a causal link going from options trading volume to debt structure. One possibility is that options trading and debt choice may both be affected by omitted factors that are not observable. To address such concerns, we follow Roll et al. (2009) and employ an instrumental variable (IV) approach using moneyness and open interest of listed options as instrumental variables. Moneyness is the average absolute difference between the stock's market price and the option's strike price. Open interest is the average open interest across all options on a stock throughout the calendar year.

For satisfying the relevance condition, it is evident that open interest is positively associated with options trading volume. In terms of the relation between moneyness and options trading volume, Roll et al. (2009) provide several arguments from the perspectives of agents and traders. The agents would speculate on volatility by avoiding deep in-the-money and out-of-the-money options. The informed traders are more likely to be attracted by out-of-the-money options, while uninformed traders are more interested in in-the-money options. Thus, while moneyness is related to trading volume, the direction of the relation is an empirical question. For the exclusion condition, it is unlikely that moneyness and open interest of options could directly affect the debt

structure of the firms. As the exchanges periodically list new options that are at-the-money, moneyness has no direct link with a firm's debt choice. Open interests contain both call and put options, it is less clear how the sum of these options can have direct impact on debt choice. Consequently, neither of these instrumental variables has a direct association with firms' debt structures without the channel from options trading volume.

In Table 5, we present a two-stage least square (2SLS) estimate of the baseline regression in Table 4. The second stage results, presented in columns (1) and (2) for bank debt and public debt, respectively, are consistent with our previous results showing that options trading volume reduces the use of bank debt and increases the use of public debt. Column (3) reports the first stage result which shows that options trading volume is positively associated with open interest while negatively associated with moneyness. We also present the results for the relevance test, the weak instrument test, and the overidentification test. There is no evidence that our instrumental variables are invalid.

The results from the IV approach formally establish the causal effect on firms' debt structure from options trading activities. With actively traded options, firms benefit from a better information environment which allows them to switch from relatively more expensive bank debt to less expensive public debt. In appendix Table B2, we further conduct robustness test using entropy balancing approach and obtain consistent results.

3.3 Evidence from issuance decisions

In this section we provide complimentary evidence for our baseline findings by examining how options trading activity affects the choice between bank borrowing and public debt as the source of *new* debt financing. Intuitively, if options trading improves the information environment, firms will be better positioned to issue debt publicly and their demand for the information and governance benefits from borrowing from banks will be reduced. Thus, a shift in debt structure ratios will reflect incremental decisions regarding the source of new debt issues.

To examine issuance decisions, we collect bank loan and public bond issuance data for our sample firms. We obtain bank loan issuance data from DealScan and public bond issuance data from Thomson Reuters SDC Platinum. Next, we merge the debt issuance data with the debt

structure data and control variables used in our earlier analysis to obtain a sample of 8,160 firm-year observations. Summary statistics (reported in Table B3) show that 77.2% (22.8%) of new debt issues over the sample period are bank loans (public debt issues).

Table 6 provides a multivariate analysis of the effect of options trading volume on the choice between bank loans and public debt issues in sourcing new debt financing. Specifically, column (1) shows estimates of the following linear probability model:

$$z_{i,t} = \alpha + \beta_1 * Ldvol_{i,t-1} + \delta' X_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

where $z_{i,t}$ is a binary variable equal to one if firm *i* issues a bank loan, and equal to zero if firm *i* issues a public bond in year *t*. $Ldvol_{i,t-1}$ is the natural logarithm of the options dollar trading volume in year *t-1*; and $X_{i,t-1}$ is a vector containing a set of control variables and industry and year fixed effects. All standard errors are robust and clustered at the firm level.

The coefficient of options trading volume is significantly negative at the 1% level, implying that firms with active options trading choose to decrease their reliance on bank loan financing. We further demonstrate the robustness of our findings by replacing the binary variable in Equation (2) with a percentage measure calculated as the dollar amount of bank loan issuances in a year scaled by the dollar amount of all debt issuances in that year. The results are reported in column (2). The negative coefficient of options trading volume is consistent with the result in linear probability model shown in column (1). Specifically one standard deviation increase in options trading volume (2.655, according to Table B3) is associated with a reduction of 2.10% of bank loan issuance as new source of debt financing.

3.4 Evidence from option listing

To complement our analysis of the relation between debt structure (as measured by the mix of debt claims) and options trading activity, we examine changes in debt structure in the years

surrounding the initiation of options trading.[13] Our hypothesis predicts a shift from bank debt to public debt when options trading is initiated, with a more significant shift for firms with greater options trading activity. We firstly use a propensity score matching approach to compare firms with newly initiated options trading (i.e., treated firms) with similar, matched, firms without listed options (i.e., control firms). Then we follow Hu (2018) to study the effects of options listing using a quasi-natural experiment approach.

Panel A in Table 7 presents the average changes in bank debt ratios in a 7-year window around option listing.[14] Given the lumpy nature of debt issuances and retirements, we expect that changes in debt structure to be gradual over time. Using propensity matching approach, we match the treated and control firms by debt structure, size, leverage, market-to-book ratio, and ROA. [15]

The panel shows that over the three years before option listing, there are no significant differences in bank debt ratios between treated firms and control firms. In the option listing year, treated firms start to diverge from the control firms with a difference in bank debt ratios of -6.66%, significant at the 1% level. The decline continues over the following three years and the difference with the control firms continues with similar magnitude and statistical significance. An opposite pattern can be found in Panel A of Appendix Table B4 for public debt ratios. We visualize the changes in debt structure around option listing year in Figure 2.[16]

Although PSM can mitigate the difference between firms with and without options listing, it still can be hindered by unobservable variables which can affect listing decisions of firms. To further address the endogeneity issue, we employ a quasi-natural experiment on option listing used by Hu (2018). To list options, the SEC requires firms to have a minimum stock price of $3.00. If two firms have negligible difference regarding firms' characteristics, one marginally meets listing

[13] We define the initiation of options trading for a firm (sometimes referred to in the text "as option listing") as the first year that there is positive options trading volume.

[14] As the changes in public debt ratios mirror those of the bank debt ratios, we present the results for the public debt ratios in Appendix Table B1 for brevity.

[15] To match on debt structure, we rank firms each year according to their bank debt and public debt ratios, respectively. The ranks are then assigned to firms and we match the firms according to the rank, following Naiker, Navissi, and Truong (2013).

[16] We plot bank debt ratios and public debt ratios for the years around option listing for (i) all treated firms, (ii) treated firms after deleting the quintile of firms with the lowest options trading volume over the following three years, and (iii) control firms without listed options. Consistent with the argument that improvements in informational efficiency associated with options trading should be greater as options trading volume increases, we find that changes in debt structure around option listing are larger for firms with more actively traded options. The results for public debt ratios mirror these findings, further illustrating the effect of options trading volume on debt structure.

requirements but the other marginally fails to meet, then the listing decision is more likely to be random for these margin firms. Therefore, we exploit the randomness around the minimum stock price ($3.00) to investigate the causal effect of option listing on debt structure. To define treated group (firms with options listing), we only include firms that have stock price above the mandated minimum price by less than two dollars at the end of the last month prior to listing date and have information in CRSP for at least 252 trading days before listing. In total, 67 unique firms are identified as treated firms. For the control group, we first select all non-listing firms that have price below the minimum mandated price by less than two dollars. The non-listing firm is then further matched to a listing firm based on the closest propensity score at the same time. Following Hu (2018), we employ a logit regression below to estimate the probability of listing as the propensity score.

$$\begin{aligned} Listing_t = {} & \beta_0 + \beta_1 Size_{t-1} + \beta_2 Volume_{t-1,t-12} + \beta_3 Volume_{t-1} + \beta_4 Volume_{t-12} + \beta_5 STD_{t-1,t-12} \\ & + \beta_6 STD_{t-1} + \beta_7 STD_{t-12} + \beta_8 Spread_{t-1,t-12} + \beta_9 Spread_{t-1} + \beta_{10} Spread_{t-12} \\ & + \omega Industry + \theta Year + \varepsilon_t \end{aligned}$$

where Listing is a binary variable equal one for listing firm-month observation and zero otherwise. $Size_{t-1}$ is the natural logarithm of the market capitalization at the end of month t-1. Volume is the log average daily stock trading volume. STD is the log standard deviation of daily stock return. Spread is a percentage measure calculated as $\frac{2\times(ask-bid)}{ask+bid}$ at the market close. We include values of Volume, STD, and Spread in the last month (t-1), the past year (t-1, t-12), and 12 months ago (t-12), respectively.

Panel B compares the bank debt ratios among listing firms and control firms within this small margin. Before options are listed, there is no significant difference in bank debt ratios between listing firms and control firms. In the listing year, listing firms start to diverge from control firms with a difference in bank debt ratio of -15.48% but the difference is not statistically significant. The decline in bank debt ratio of listing firms continues and the difference with control firms keeps enlarging in the following year. As a result, listing firms have lower bank debt ratio by 20.18% with a t-statistic of -2.06 compared to control firms. The quasi-natural experiment

supports the negative relation between option listing and bank debt ratio, and the treatment effect is consistent with our prior argument.

In another test, we show that after options listing, firms are more likely to issue bond rather than bank loans as the first source for debt financing. We focus on a subsample of firms with bank debt only (i.e., *Bank Debt*=100), which may not have the access to public bond market because of high information asymmetry. Options listing, however, enhances information efficiency and helps these firms to issue bond. Consequently, compared with similar firms without option listing, we expect the firms with options listing to "switch" to public debt financing as the first source for debt financing. We test the hypothesis and present the results in Table 8.

Firms with listed options during the sample period form the treated group. The rest of firms without listed options belong to control group.[17] In Panel A of Table 8, we find 42.70% of threated firms switch to public debt as the first source of debt financing. In contrast, 20.21% of control firms firstly issue public debt. In Panel B, we further run a linear probability regression that controls for firm-level characteristics. *Bond Issue,* the dependent variable, equals to one if a firm's first issue is public debt and equals to zero if a firm's first issue is bank loan. The results again confirm that options listing increases the probability of switching to public debt.

To summarize, we document an economically large shift from bank loan financing to public debt after a firm's options are listed. Such evidence lends further support to our argument that options trading enhances information transparency and alters a firm's debt choices.

4. Cross-sectional tests

In this section, we investigate the cross-sectional nature of our sample to further characterize the effect of options trading on firm debt choice and to bolster support for the validity of our conclusions. We consider cross-sectional characteristics that are expected to generate differing effects through both the information channel and the governance channel.

4.1 Information channel

[17] After screening, we have 1,251 control firms that have never listed options during the sample period and 441 treated firms that have listed options during the sample period.

If options trading indeed alters a firm's debt choice by enhancing the information environment, we would expect more significant effects for firms with greater information asymmetry and worse credit ratings. Results based on sample splits along these dimensions are presented in section 4.1.1. In section 4.1.2, we present a natural experiment that considers the effect of options trading on debt structure responses to an exogenous decrease in analyst coverage.

4.1.1 The effect of firm size, asset tangibility, and credit rating

To further explore the information channel, we use alternative measures to proxy for firm level of information asymmetry. We employ firm size, asset tangibility, and credit rating as measures of the information environment of firms. Our assumption in this analysis is that small firms and firms with lower level of tangible assets are more likely to suffer from asymmetric information problems in debt financing. Options trading could provide them much more assistance compared with firms with less information asymmetry. We thereby divide the sample into terciles based on firm size (PPE). Big Size (High PPE) group represents firms belonging to the top tercile, while Small Size (Low PPE) group represents firms belonging to the bottom tercile. We also classify firms into two groups based on their long-term credit rating. Investment group represents firms that have investment grade credit ratings. Otherwise, they belong to the non-investment grade group. Intuitively, firms with good credit ratings are more transparent than firms with bad ratings. According to our hypothesis that options trading mitigates information asymmetry, we should expect the impact of trading volume should be more pronounced for firms with more significant asymmetric information, i.e., small size group, low PPE group, and non-investment credit rating group. Panel A in Table 9 presents results consistent with our hypothesis — the first two columns show that the coefficient of options trading volume in the small size subsample (-2.568) is almost twice the size of the coefficient found for the big size subsample (-1.377). Additionally, the low PPE group has a coefficient of -2.168 significant at the 1% level, while high PPE group has an insignificant coefficient. The non-investment grade group has a coefficient of -2.079 significant at the 1% level, while the investment grade group has an insignificant coefficient.

To further verify the differences between subsamples indeed exist and are statistically significant, we use the permutation test to examine whether the differences are statistically significant or not. Bottom rows in Panel A demonstrate that differences in effect of options trading

among firm size, asset tangibility, and credit rating subsamples are significant at the 1% level, respectively. Results support that options trading reduces the reliance of bank debt for firms with greater information asymmetry substantially.

4.1.2 Natural experiment: Exogenous shock to information asymmetry

In this section, we examine how options trading volume differentially affects debt structure responses to an exogenous shock to information asymmetry. To identify a shock to information asymmetry, we exploit exogenous changes in analyst coverage due to brokerage closures and mergers. Financial analysts are one of the most important information providers to external investors and an exogenous reduction of financial analysts due to brokerage closures and mergers leads to an increase in information asymmetry (Hong and Kacperczk (2012); Kelly and Ljungqvist (2012)). Li, Lin, and Zhan (2018) document that an exogenous reduction in financial analysts causes firms to shift from public debt to bank debt. In the context of our paper, we would expect the effect of an exogenous reduction in financial analysts to be much weaker, or even absent, for firms with active options trading activities that serve to reduce information asymmetry. Correspondingly, firms with less help of options trading more significantly rely on bank debt after experiencing an exogenous drop in analyst coverage. Specifically, we run difference-in-difference regressions for firms with high options trading volume and low options trading volume. Following Li et al. (2018), we estimate the effect of financial analyst loss on debt structure using the following specification.

$$y_{i,t} = \alpha + \beta_1 * Treated * Post + \beta_2 * Treated + \beta_3 * Post + \delta' X_{i,t-1} + \varepsilon_{i,t} \qquad (3)$$

where $y_{i,t}$ is the debt structure variable of interest, i.e., either the bank debt ratio or the public debt ratio. *Treated* is a binary variable set equal to one if a firm experienced a drop in the number of financial analysts, and otherwise set equal to zero. *Post* is a binary variable set equal to one in the year after a firm lost a financial analyst, otherwise set equal to zero.

Consistent with our expectations, Panel B in Table 9 shows that the interaction term coefficients are statistically significant only among firms with low options trading volumes. This

finding suggests that following an exogenous decrease in analyst coverage, firms with low option trading volumes experience a significant increase in bank borrowing and a significant decrease in public debt. In contrast, an exogenous drop in financial analyst coverage has no significant effect on the debt structure of firms with high levels of options trading volume. Overall, the differential response to shocks to information asymmetry highlights the role of options trading in reducing information asymmetry and provide support for the hypothesis that options trading benefits firms by allowing for a lower cost debt structure.

4.2 Governance channel

Increased information efficiency created by more active options trading also has important implications for corporate governance. Previous literature has documented that with higher price efficiency, firms reduce the number of independent directors as a result of enhanced external and internal monitoring (Ferreira, Ferreira, and Raposo (2011)). In the same vein, we hypothesize that with a higher option trading volume, firms no longer desire the strong monitoring from banks, which motivates firms to shift away from bank debt to public debt. In this section, we provide supporting evidence by 1) examining the strength of loan covenants, 2) examining the effects of options trading in competitive versus non-competitive industries.

4.2.1 Bank loan covenant strictness

If options trading enhances the efficiency of alternative governance mechanisms, we would expect a substitution away from the creditor governance provided by banks. One way to identify a substitution effect is to examine how options trading activity affects the strictness of bank loan covenants. Covenants are the essential mechanism lending banks use to obtain control and impose effective monitoring. Therefore, to the extent that a more active options market increases pressure from alternative governance mechanisms, we expect bank loan contracts to have looser covenants. We use the covenant strictness measure from Murfin (2012) which approximates the probability that the bank will obtain contingent control through a covenant violation.[18] Consistent with a governance mechanism substitution effect, we find that covenant strictness decreases with increases in options trading volume. The results are presented in columns (1) and (2) of Table 10.

[18] We thank Justin Murfin for sharing the covenants strictness data.

In addition, we also show the robust effect of options trading on loan covenant strictness by examining an alternative strictness measure, PVIOL, proposed by Demerjian and Owens (2016). We obtain consistent results that options trading reduces the strictness of loan covenants. Taken together, our empirical finding of the change in covenant strictness supports the argument that options trading enhances the governance pressure from alternative governance mechanisms and reduces the need for governance from banks.

4.2.2 Product market governance: Competitive versus non-competitive industries

Previous research finds evidence that managers of firms operating in competitive industries face intense product market governance pressure. To the extent that the improved information environment associated with options trading enhances the efficiency of alternative governance mechanisms, we expect a more significant negative relation between options trading volume and the use of bank debt for firms in operating in competitive industries. This expectation is based on the idea that firm managers can be exposed to "too much" governance (Hermalin and Weisbach (2012)).

We explore the differential impact of options trading on debt structure for firms operating in competitive and concentrated environment. We tabulate the results and compare the different effects in Table 11. In first two columns, we measure competition using Herfindal-Hirschman index (HHI) at two-digit SIC industry level. A high HHI indicates low competition and a low HHI indicates high competition. Consistent with the argument that an increase in governance efficacy created by options trading, firms in competitive industries substitute. Such a shift is, in contrast, absent in concentrated industries. Column (1) and (2) show that the coefficient of options trading volume in the competitive industries (-2.629) is twice greater than the coefficient found for the concentrated industries (-0.8367). The difference in firms' debt structure response to options trading between competitive and concentrated industries is statistically significant. In columns (3) and (4), we partition the sample according to firm-level competitive threats, *Fluidity*. *Fluidity* measures similarity between a firm's products and the aggregate changes in the competitors' products and is constructed by comparing the similarity in product description in 10-K files (Hoberg, Phillips, and Prabhala (2014)). High Fluidity indicates more competitive threats from inter- and intra-industry competitors. We obtain consistent results that firms respond more to

options trading when competitive threats are high and present that differing effect of options trading cross high and low competitive subsamples is significant at the 1% level.

Such cross-sectional difference adds additional support to our argument that options trading reduces the demand for the superior governance of banks by increasing efficiency of alternative mechanisms and extends the literature on the substitutional relation between different governance mechanisms.

5. Conclusion

Options trading activity can enhance informational efficiency of underlying securities by helping to complete markets and by stimulating information production that leads to informed trades. Recent research finds evidence suggesting that enhanced informational efficiency from options trading leads to higher firm values by allowing for a more efficient allocation of firm resources. This paper provides evidence that, in addition to a more efficient allocation of firm resources, options trading also enhances firm value through a financing channel, by promoting a debt structure that relies more on public debt and less on costlier bank financing. Consistent with both an information channel (where increased informational efficiency facilitates public debt issuance and reduces the demand for the superior ability of banks to access and process private information) and a governance channel (where enhanced informational efficiency reduces the demand for bank lender governance), we find that bank loan issuance and the ratio of bank debt to total debt are negatively related to options trading activity. We interpret our findings as contributing to the debt structure literature that considers how a firms' information environment affects the choice between bank borrowing and public debt issuance. More broadly, our finding that options trading activity affects firm debt structure choices contributes to the literature that contends that trading in financial markets affects corporate decision-making and is more than simply a sideshow with no real economic consequences.

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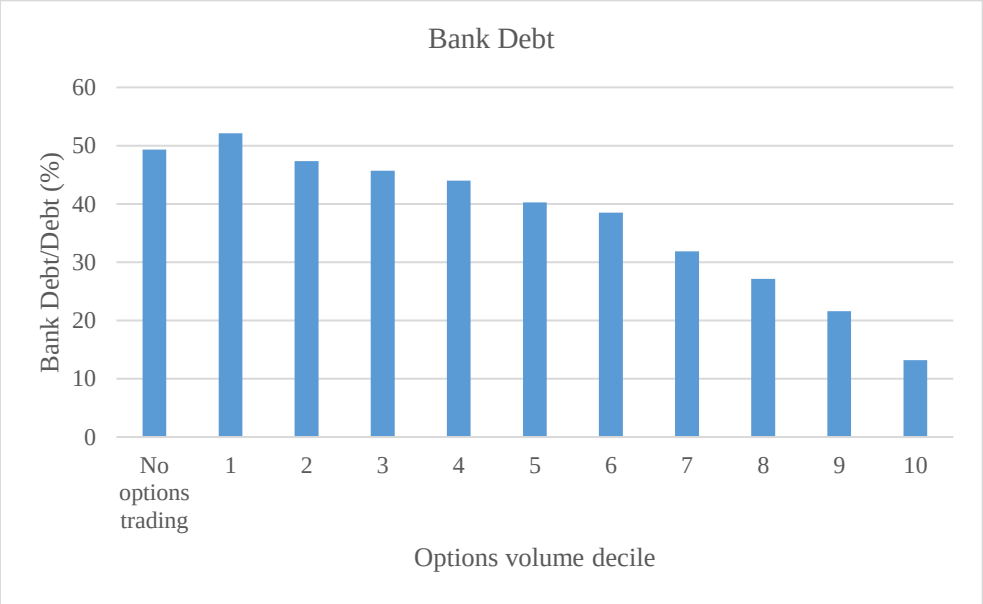
Figure 1: Debt Structure and Options Trading Volume

This figure presents bank debt and public debt ratios for firms sorted across option trading volume deciles. Firms with positive options trading volume during 2002–2015 are sorted each year into deciles by options trading volume. *Bank Debt* is the amount of bank debt scaled by the total amount of debt. *Public Debt* is the amount of public debt scaled by the total amount of debt. The mean value of *Bank Debt* and *Public Debt* over all sample years within each decile is depicted below. Firms without option trading are listed on the left.



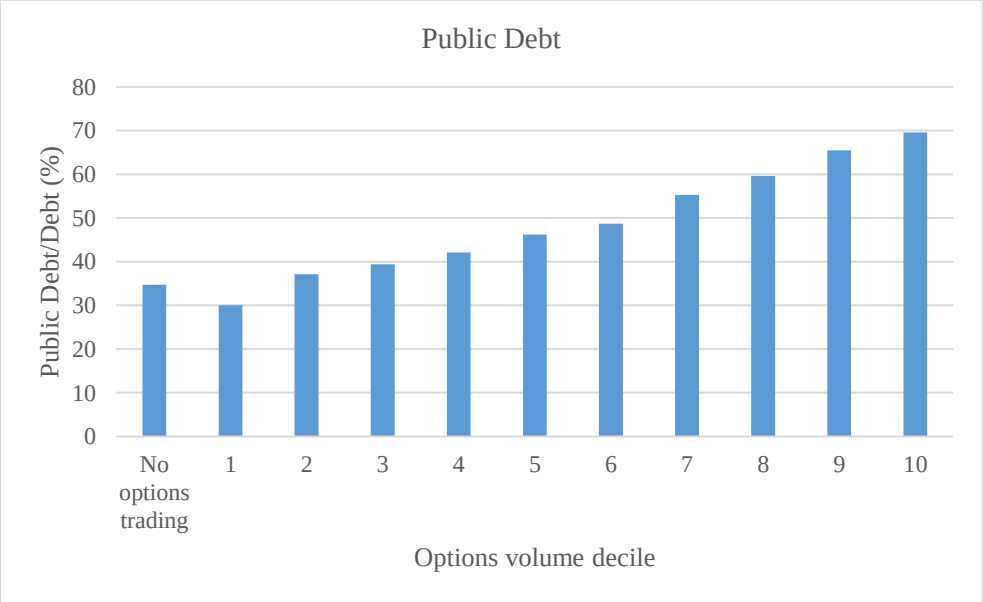
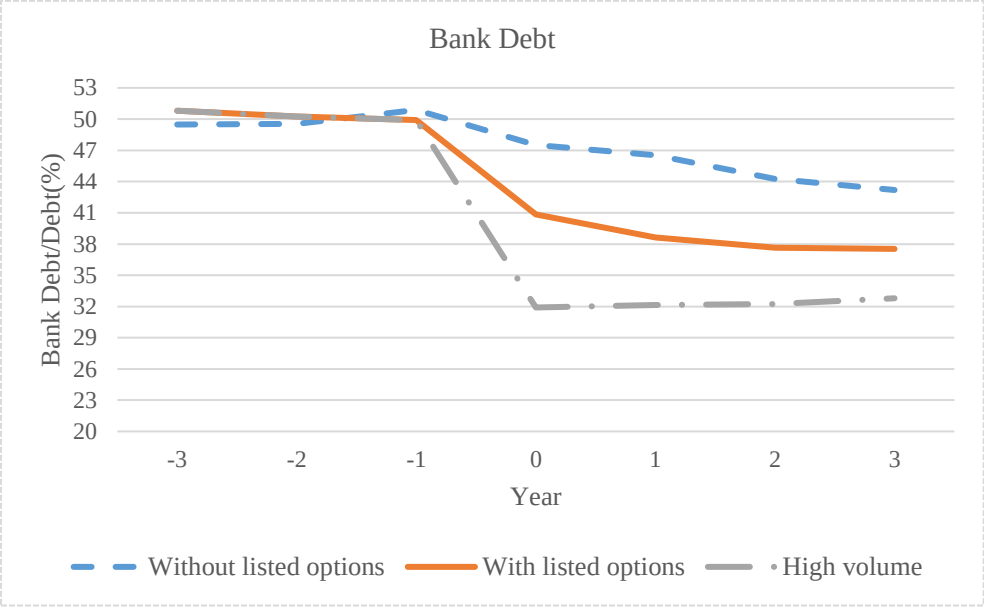


Figure 2: Changes in Debt Structure around Options Listing

This figure presents changes in debt structure around option listing as compared with matched firms without listed options. We first estimate an individual propensity score of having an option listing for all observations in the whole sample based on different mating criteria. Firms with listed options are then matched to firms without listed options based on the closeness of the propensity scores of having an option listing. We calculate three-year average trading volume after listing, sort firms into quintile base on average trading volume and exclude firms in the bottom quintile, i.e., low trading volume firms, which construct the High volume group. The top figure shows the dynamic of bank debt. While the bottom figure shows the dynamic of public debt. The sample period is from 2002 to 2015.



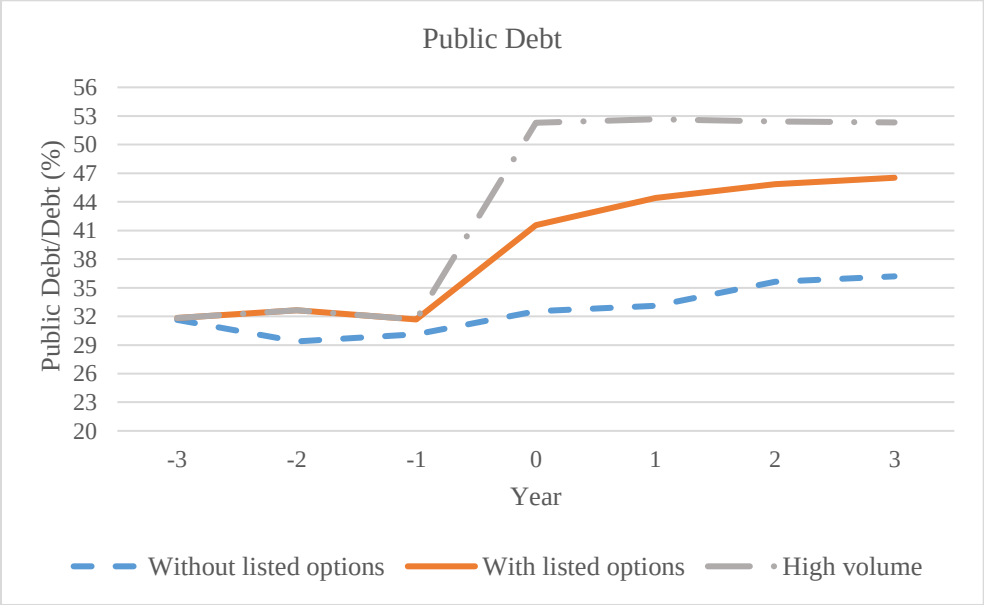


Table 1: Number of Firms with Non-Missing Data

This table contains the sample size of firms each year. Column (1) lists the total number of firms with available data for debt structure and the control variables. Column (2) lists the number of firms with listed options and column (3) lists the number of firms without listed options. Column (4) lists the percentage of all firms with listed options.

Year	All Firms	Firms With Listed Options	Firms Without Listed Options	Firms With Listed Options /All Firms
	(1)	(2)	(3)	(4)
2002	3,385	1,348	2,037	39.8%
2003	3,258	1,326	1,932	40.7%
2004	3,190	1,359	1,831	42.6%
2005	3,145	1,406	1,739	44.7%
2006	3,137	1,486	1,651	47.4%
2007	3,386	1,601	1,785	47.3%
2008	3,197	1,607	1,590	50.3%
2009	3,034	1,601	1,433	52.8%
2010	2,910	1,584	1,326	54.4%
2011	2,878	1,700	1,178	59.1%
2012	2,859	1,735	1,124	60.7%
2013	2,828	1,783	1,045	63.0%
2014	2,788	1,819	969	65.2%
2015	2,485	1,791	694	72.1%
Total	42,480	22,146	20,334	52.1%

Table 2: Summary Statistics

This table reports descriptive statistics for our debt structure, options trading, and control variables. We construct two variables in order to measure the debt structure of firms. *Bank Debt* is a percentage measure which is the amount of bank debt scaled by the total amount of debt. *Public Debt* is a percentage measure which is the amount of public debt scaled by the total amount of debt. *Dvol* is the dollar volume of options trading in millions. *Ldvol* is the natural log of dollar trading volume of options. Other variable definitions are shown in Appendix A. Panel A presents summary statistics for all firms. Panel B presents summary statistics for 3,652 unique firms with positive options trading volume. Firms with no data on options trading activity are assumed to have options volume equal to zero. The sample period is from 2002 to 2015. All variables are winsorized at the 1% and 99% level.

Panel A: All firms

Variables	Observation	Mean	S.D.	P25	Median	P75
Bank Debt	42,480	42.656	41.169	0.000	30.550	92.325
Public Debt	42,480	44.449	40.813	0.000	42.594	87.777
Dvol (in millions)	42,480	0.886	10.451	0.000	0.001	0.082
Ldvol	42,480	5.827	5.929	0.000	6.383	11.311
Size	42,480	5.939	2.675	4.318	6.200	7.755
Leverage	42,480	0.375	0.702	0.083	0.237	0.412
MtoB	42,480	3.907	12.380	1.115	1.481	2.278
ROA	42,480	-0.128	1.058	0.016	0.093	0.149
PPE	42,480	0.512	0.435	0.159	0.396	0.786
Rating	42,480	1.843	1.315	1.000	1.000	3.000

Panel B: Firms with positive options trading volume

Variables	Observations	Mean	S.D.	P25	Median	P75
Bank Debt	22,146	35.631	38.998	0.000	17.898	72.777
Public Debt	22,146	51.493	40.025	0.000	60.697	91.133
Dvol (in millions)	22,146	1.252	4.069	0.011	0.071	0.492
Ldvol	22,146	11.182	2.715	9.333	11.173	13.106
Size	22,146	7.507	1.735	6.340	7.458	8.635
Leverage	22,146	0.271	0.236	0.099	0.239	0.384
MtoB	22,146	1.949	1.631	1.164	1.516	2.168
ROA	22,146	0.091	0.193	0.066	0.113	0.166
PPE	22,146	0.497	0.403	0.168	0.390	0.763
Rating	22,146	2.361	1.475	1.000	1.000	4.000

Table 3: Correlation Matrix

This table reports the correlation matrix for our debt structure, options trading, and control variables. We construct two variables in order to measure the debt structure of firms. *Bank Debt* is a percentage measure which is the amount of bank debt scaled by the total amount of debt. *Public Debt* is a percentage measure which is the amount of public debt scaled by the total amount of debt. *Dvol* is the dollar volume of options trading in millions. *Ldvol* is the natural log of dollar trading volume of options. Other variable definitions are shown in Appendix A. Panel A presents the correlation matrix regarding all firms. Firms with no data on options trading activity are assumed to have options volume equal to zero. Panel B presents the correlation matrix regarding firms with listed options, which contains 3,652 unique firms with options trading volume. The sample period is from 2002 to 2015. All variables are winsorized at the 1% and 99% level.

Panel A: All firms

	Bank Debt	Public Debt	Dvol	Ldvol	Size	Leverage	MtoB	ROA	PPE	Rating
Bank Debt	1.00									
Public Debt	-0.76	1.00								
Dvol	-0.07	0.05	1.00							
Ldvol	-0.24	0.24	0.16	1.00						
Size	-0.22	0.25	0.13	0.67	1.00					
Leverage	-0.06	0.13	-0.02	-0.14	-0.34	1.00				
MtoB	-0.03	0.03	-0.01	-0.15	-0.46	0.62	1.00			
ROA	0.05	-0.04	0.02	0.21	0.52	-0.64	-0.80	1.00		
PPE	-0.02	0.08	-0.01	-0.03	0.01	0.10	-0.02	0.02	1.00	
Rating	-0.35	0.41	0.12	0.50	0.65	-0.04	-0.12	0.15	0.08	1.00

Panel B: Firms with positive options trading volume

	Bank Debt	Public Debt	Dvol	Ldvol	Size	Leverage	MtoB	ROA	PPE	Rating
Bank Debt	1.00									
Public Debt	-0.76	1.00								
Dvol	-0.18	0.13	1.00							
Ldvol	-0.30	0.29	0.53	1.00						
Size	-0.36	0.42	0.41	0.58	1.00					
Leverage	-0.07	0.21	-0.02	0.02	0.16	1.00				
MtoB	0.01	-0.09	0.06	0.12	-0.27	0.00	1.00			
ROA	0.02	0.03	0.08	0.12	0.30	-0.07	-0.27	1.00		
PPE	-0.04	0.12	0.00	0.01	0.06	0.18	-0.10	0.11	1.00	
Rating	-0.40	0.47	0.28	0.41	0.70	0.15	-0.15	0.17	0.13	1.00

Table 4: Baseline Results

This table presents baseline results regarding the impact of options trading on debt structure. The dependent variable, *Bank Debt*, is the amount of bank debt scaled by the total amount of debt. *Public Debt* is the amount of public debt scaled by the total amount of debt. Other variable definitions are shown in Appendix A. Columns (1) and (2) report OLS regressions with industry and year fixed effects. Columns (3) and (4) use Tobit regressions to address potential problems that a certain number of firms have zero private debt or zero public debt. Columns (5) and (6) report OLS regressions with firm and year fixed effects. In Columns (7) and (8), we include firms with no data on options trading activity and assume that they have options volume of zero. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Variables	Firms With Positive Options Trading Volume						All Firms	
	OLS		Tobit		OLS		OLS	
	Bank Debt	Public Debt	Bank Debt	Public Debt	Bank Debt	Public Debt	Bank Debt	Public Debt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ldvol	-1.717***	1.068***	-2.504***	1.114***	-0.703***	0.658***	-0.718***	0.522***
	(-7.38)	(4.66)	(-7.50)	(3.57)	(-3.41)	(3.51)	(-8.37)	(6.08)
Size	-3.766***	4.176***	-3.702***	6.662***	-2.201**	3.489***	-2.473***	2.253***
	(-7.03)	(7.86)	(-4.69)	(9.24)	(-2.13)	(3.29)	(-7.81)	(7.11)
Leverage	-2.003	26.384***	4.746	42.024***	-9.399***	26.457***	-3.002**	28.571***
	(-0.87)	(11.45)	(1.46)	(13.82)	(-3.75)	(8.90)	(-1.96)	(18.84)
MtoB	-0.518	-0.706*	-1.284	-1.341**	-0.164	-0.489*	-2.050***	0.654**
	(-1.08)	(-1.96)	(-1.53)	(-2.51)	(-0.59)	(-1.87)	(-7.56)	(2.52)
ROA	21.531***	-12.878***	29.644***	-17.055***	7.375***	-7.015***	34.451***	-25.868***
	(7.00)	(-4.78)	(5.48)	(-4.47)	(3.40)	(-2.79)	(17.37)	(-13.79)
PPE	-4.038**	4.024**	-2.262	5.996***	-0.497	-2.215	-3.762***	2.769**
	(-2.48)	(2.47)	(-1.06)	(2.82)	(-0.19)	(-0.88)	(-3.08)	(2.35)
Rating	-5.952***	7.176***	-7.269***	8.712***	-3.421***	4.615***	-8.007***	9.258***
	(-13.61)	(14.59)	(-11.82)	(13.81)	(-6.10)	(7.62)	(-21.76)	(23.11)
Industry FE	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No	Yes	Yes	No	No
Observations	22,146	22,146	22,146	22,146	21,588	21,588	42,479	42,479
Adjusted/ Pseudo R^2	0.246	0.312	0.029	0.048	0.657	0.702	0.204	0.250

Table 5: Instrumental Variable Regressions

This table shows the first and second stage results of instrumental variable (IV) regressions via the two-stage least squares (2SLS) approach. We use open interest and absolute moneyness as instrumental variables for option dollar trading volume. *Open Interest* is the average open interest across all options on a stock throughout the calendar year. *Moneyness* is the average absolute difference between the stock's market price and the option's strike price. Other variable definitions are shown in Appendix A. Columns (1) and (2) report second stage results and column (3) presents the first stage result. The bottom rows present tests regarding the first stage F test, the weak instrument test, and the over-identification test. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Variables	Second Stage		First Stage
	Bank Debt	Public Debt	Ldvol
	(1)	(2)	(3)
Predicted Ldvol	-2.198***	1.395***	
	(-8.51)	(5.49)	
Open Interest			1.080***
			(161.91)
Moneyness			-2.178***
			(-13.57)
Size	-3.197***	3.796***	0.116***
	(-5.74)	(6.92)	(9.88)
Leverage	-2.381	26.649***	-0.368***
	(-1.03)	(11.55)	(-7.89)
MtoB	-0.301	-0.853**	0.144***
	(-0.63)	(-2.36)	(13.77)
ROA	21.380***	-12.818***	0.894***
	(7.07)	(-4.79)	(13.41)
PPE	-4.169**	4.120**	-0.132***
	(-2.56)	(2.52)	(-4.05)
Rating	-5.971***	7.186***	-0.005
	(-13.65)	(14.59)	(-0.56)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	22,128	22,128	22,128
Adjusted R^2	0.248	0.313	0.916
First Stage F-Test			9641.79
			(0.000)
Anderson-Rubin Wald Test	65.42	25.4	
	(0.000)	(0.000)	
Hansen J Statistic	0.584	1.430	
	(0.445)	(0.232)	

Table 6: The Effect of Options Trading on the Source of New Debt Issues

This table presents evidence regarding the impact of options trading volume on the source of new debt issues. The dependent variable, *Bank Loan Issuance* is a binary variable that equals one if the firm issued Bank loan and equals zero if the firm issued a bond. We also compute *Dollar amount of bank loan issuance*, the percentage of the dollar amount of bank loan issuance scaled by the total dollar amount of debt issuance as dependent variable reported in column (2). We replicates the baseline regression in Table 4 using bank loans isssues and dollar amount of bank loan issues as dependent variables, respectively. Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2012. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust clustered at the firm level and t-statistics are reported in parentheses.

Variables	Linear Probability	OLS
	Bank Loan Issuance	Dollar amount of bank loan issuance %
	(1)	(2)
Ldvol	-0.007***	-0.791***
	(-2.83)	(-2.72)
Size	0.026***	1.247*
	(4.40)	(1.84)
Leverage	-0.033	-13.973***
	(-1.24)	(-3.69)
MtoB	-0.014**	-2.632***
	(-2.58)	(-3.88)
ROA	0.266***	50.533***
	(5.75)	(7.10)
PPE	0.015	0.464
	(0.96)	(0.23)
Rating	-0.028***	-4.418***
	(-6.24)	(-8.72)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	8,158	8,158
Adjusted/ Pseudo R^2	0.178	0.197

Table 7: Changes in Bank Loan Ratios around Options Listing

This table presents changes in bank loan ratio around option listing compared with matched firm without listed options. Panel A reports changes in bank debt among control and treated firms by matching size, leverage, market-to-book ratio, ROA, bank debt rank, and public debt rank in a seven-year window around listing. We first estimate an individual propensity score of having an option listing for all observations in the full sample. Firms with listed options are then matched to firms without listed options based on the closeness of the propensity scores of having an option listing. Panel B reports changes in bank debt among control and treated firms regarding a quasi-natural experiment on option listings following Hu (2018). *Control* represents matched firms without listed options, while *Treated* represents firms with listed options. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The t-statistics are reported in parentheses.

Panel A: Changes in bank debt around options listing

Year	Treated	Control	T-C	t-statistics
Listing Year-3	50.81	49.50	1.31	0.67
Listing Year-2	50.24	49.53	0.71	0.40
Listing Year-1	49.92	50.88	-0.96	-0.61
Listing Year	40.85	47.51	-6.66***	-6.65
Listing Year+1	38.63	46.52	-7.89***	-7.34
Listing Year+2	37.66	44.25	-6.59***	-5.77
Listing Year+3	37.53	43.19	-5.66***	-4.67

Panel B: A quasi-natural experiment on option listings

Variable	Treated	Control	Difference	t-statistics
	(1)	(2)	(3)	(4)
Listing year-1	61.52	69.44	-7.92	-0.92
Listing year	50.78	66.26	-15.48	-1.61
Listing year+1	49.78	69.96	-20.18**	-2.06

Table 8: First Debt Issue for Firms with Bank Debt Only

This table presents evidence regarding the impact of options listing on the source of first new debt issue among firms with bank debt only. The test sample consists of all firms with 100% bank debt. For firms with listed options during the sample period, those firms with 100% bank debt before option listing are remained. After screening, it leads to 1251 control firms that have never listed options during the sample period and 441 treated firms that have listed options during the sample period. Panel A presents the comparison between treated firms and control firms in terms of first debt issuing. In Panel B, dependent variable is *Bond Issue* equals one if a firm first debt issue was public debt. Otherwise it equals zero if a firm first debt issue was bank debt. *Options Listing* is a binary variable equal to one indicating firms with listed options otherwise equal to zero. Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2012. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust clustered at the firm level and t-statistics are reported in parentheses.

Panel A: Comparison regarding first debt issue between treated and control groups

	Total	# of firms first issuing public debt	# of firms first issuing bank debt	(2)+(3)	(2)/(4)
	(1)	(2)	(3)	(4)	(5)
Control	1251	39	154	193	20.21%
Treated	441	38	51	89	42.70%
Total	1692	77	205	282	

Panel B: Probability of first issuing public debt

Variables	(1) OLS	(2) OLS	(3) Probit
Options Listing	0.195***	0.155**	0.695***
	(3.09)	(2.16)	(2.80)
Size	-0.024	-0.031	-0.088
	(-1.39)	(-1.47)	(-1.04)
Leverage	-0.074	-0.079	-0.110
	(-0.46)	(-0.44)	(-0.16)
MtoB	0.051***	0.058**	0.195***
	(2.64)	(2.59)	(2.67)
ROA	-0.540***	-0.435***	-1.873***
	(-5.04)	(-3.03)	(-3.57)
PPE	0.061	0.017	0.297
	(1.01)	(0.18)	(1.22)
Constant	0.191**	0.916***	-1.065**
	(2.02)	(7.45)	(-2.47)
Observations	244	244	244
Industry FE	No	Yes	No
Adjusted /Pseudo R^2	0.244	0.221	0.228

Table 9: Subsample Evidence

Panel A of this table presents cross-sectional differences in the relation between bank debt ratios and options trading volume based on sorting firms into size and PPE terciles. Columns (1) and (2) report results for the Big and Small Size terciles; Columns (3) and (4) report results for the High and Low PPE terciles. Results sorted by whether firms have an investment grade credit rating are shown in columns (5) and (6). Panel B reports the results of DID regressions, examining the effect of an exogenous drop in financial analysts on firms' financing choice, conditional on the options trading volume before the shock. Our sample consists of 3,545 unique firm-years from 2002 to 2011 from 1,538 unique U.S. public firms, with 1,938 treated firm-years. Control firms are matched according to the Fama-French 48 industry classification, year, and Size, Q, and Analyst Coverage tercile. We sort firms into tercile based on options trading volume. *High Opt Vol* represents firms with high options trading volume belonging to the top tercile. *Low Opt Vol*. represents firms with low options trading volume belonging to the bottom tercile. *Treated* is a dummy equal to one, if the firm has experienced an exogenous drop in analyst coverage; and zero otherwise. *Post* is a dummy equal to one if the variable is observed one year after the shock, and zero if the variable is observed one year before the shock. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Panel A: Subsample comparisons

Variables	Bank Debt					
	Big Size	Small Size	High PPE	Low PPE	Investment	Non-Investment
	(1)	(2)	(3)	(4)	(5)	(6)
Ldvol	-1.377***	-2.568***	-0.466	-2.168***	0.417	-2.079***
	(-9.86)	(-7.57)	(-1.31)	(-6.18)	(1.12)	(-7.88)
Size			-5.848***	-3.504***	-5.969***	-4.573***
			(-7.25)	(-4.64)	(-7.33)	(-7.83)
Leverage	5.499***	-5.149	-1.902	-4.869	-13.599***	-6.492***
	(3.05)	(-1.59)	(-0.62)	(-1.41)	(-3.92)	(-2.61)
MtoB	-1.910***	0.117	-1.974**	-0.811*	-1.410	-0.006
	(-4.18)	(0.27)	(-2.55)	(-1.72)	(-1.61)	(-0.01)
ROA	3.736	16.840***	22.386***	21.036***	-13.052	23.651***
	(0.82)	(5.61)	(6.41)	(4.78)	(-1.48)	(7.42)
PPE	-5.701***	0.740			0.464	-6.292***
	(-5.86)	(0.26)			(0.22)	(-3.33)
Rating	-5.064***	-5.926***	-6.741***	-4.427***		
	(-16.85)	(-5.14)	(-9.31)	(-6.18)		
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,524	8,164	7,444	7,268	5,763	16,380
Adjusted R^2	0.256	0.115	0.325	0.232	0.215	0.138
Difference	-1.191***		-1.703***		-2.497***	
p-values	(0.000)		(0.000)		(0.000)	

Panel B: The effect of options trading on the relation between analyst coverage and debt structure

Variables	High Opt Vol Bank Debt	Low Opt Vol Bank Debt	High Opt Vol Public Debt	Low Opt Vol Public Debt
	(1)	(2)	(3)	(4)
Treated*Post	1.403	3.580*	-1.386	-3.509**
	(1.338)	(1.868)	(1.845)	(1.749)
Treat	-1.013	-1.647	-0.210	3.186
	(1.623)	(3.881)	(2.322)	(3.792)
Post	1.461	2.010	-1.367	-1.912
	(0.949)	(1.998)	(0.996)	(1.574)
Size	-5.592***	-6.416***	2.273	2.655**
	(1.076)	(0.887)	(1.511)	(1.308)
MtoB	-6.013***	-6.164***	0.637	-1.730
	(1.826)	(1.777)	(1.930)	(2.225)
ROA	106.981***	117.324***	-87.348***	-62.848***
	(18.770)	(11.703)	(25.527)	(16.995)
PPE	-6.030***	-6.188	4.036	8.975
	(1.837)	(4.756)	(2.498)	(5.509)
Rating	-3.488***	-4.206***	4.098***	7.538***
	(0.698)	(0.882)	(1.215)	(1.083)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	3,545	3,473	3,545	3,473
Adjusted R^2	0.189	0.152	0.134	0.230

Table 10: Options Trading Volume and Covenant Strictness

This table presents evidence on the impact of options trading volume on the strictness of bank loan covenants. *Strictness,* developed by Murfin (2012), approximates the probability that the lender will receive contingent control via a covenant violation. PVIOL, the covenant strictness measure constructed by Demerjian and Owens (2016), covers 15 types of capital-based and performance-based covenants and is available in Dealscan. *Loan Spread* is the all-in-spread drawn in the DealScan. *Log(Loan Maturity)* is the natural log of the loan maturity measured in months. *Log(Loan Size)* is the natural log of the loan facility amount. *CDS Trading* is a dummy variable that equals one if the firm has CDS trading on its debt at loan initiation and zero otherwise. Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2008. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust clustered at the firm level and t-statistics are reported in parentheses.

Variables	(1) Strictness	(2) Strictness	(3) PVIOL	(4) PVIOL
Ldvol	-0.835***	-0.800***	-0.867**	-0.953*
	(-3.11)	(-2.62)	(-2.01)	(-1.85)
Log(Loan Maturity)	1.158	1.229	-2.574*	-2.428*
	(1.52)	(1.61)	(-1.96)	(-1.91)
Log(Loan Size)	1.847***	0.940	2.064**	1.363
	(3.11)	(1.46)	(2.37)	(1.52)
Log(Loan Spread)	9.702***	8.973***	19.192***	17.088***
	(10.07)	(9.22)	(13.53)	(10.92)
Number Of Lenders	0.129	-0.649	-0.486	-0.758
	(0.18)	(-0.89)	(-0.41)	(-0.63)
Size		-0.142		1.168
		(-0.19)		(0.88)
Rating Flag		3.223**		-4.920*
		(2.35)		(-1.94)
Z Score		-0.740***		-1.792***
		(-4.17)		(-5.56)
CDS Trading		1.720		-0.184
		(1.24)		(-0.07)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Loan Purpose FE	Yes	Yes	Yes	Yes
Performance Pricing FE	Yes	Yes	Yes	Yes
Observations	2,180	2,071	4,050	3,805
Adjusted R^2	0.277	0.297	0.214	0.211

Table 11: The Effect of Product Market Competition

This table presents findings on the impact of product market competition on the relation between bank debt ratios and options trading volume. In columns (1) and (2), we sort firms into terciles based on the Herfindal-Hirschman index (HHI) at the two-digit SIC level. High HHI represents firms in the top tercile, while Low HHI represents firms in the bottom tercile. In columns (3) and (4), we sort firms into terciles based on fluidity scores from Hoberg-Phillips's website. High Fluidity represents firms in the top tercile, while Low Fluidity represents firms in the bottom tercile. Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Variables	Bank Debt			
	High HHI	Low HHI	High Fluidity	Low Fluidity
	(1)	(2)	(3)	(4)
Ldvol	-0.836**	-2.629***	-1.716***	-0.287
	(-2.13)	(-7.42)	(-5.01)	(-0.73)
Size	-4.641***	-3.362***	-3.648***	-4.938***
	(-5.15)	(-4.38)	(-4.95)	(-5.37)
Leverage	-3.087	-2.758	-9.998***	5.574
	(-0.72)	(-0.95)	(-3.88)	(1.36)
MtoB	-1.353**	-0.294	0.210	-1.857**
	(-2.17)	(-0.44)	(0.35)	(-2.45)
ROA	22.591***	16.880***	12.295***	26.350***
	(4.34)	(4.54)	(3.57)	(3.90)
PPE	-10.773***	-2.988	2.525	-11.443***
	(-3.92)	(-1.25)	(1.03)	(-4.34)
Rating	-6.611***	-4.054***	-4.099***	-8.429***
	(-8.26)	(-6.62)	(-6.32)	(-11.84)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observation	7,015	8,180	7,057	7,066
Adjusted R^2	0.244	0.232	0.227	0.301
Low-High	-1.793***		1.429***	
p-values	(0.000)		(0.000)	

Appendix A: Variable Definitions

Variable	Definitions
Bank Debt	A percentage measure equals the amount of bank debt scaled by the total amount of debt. Source: S&P Capital IQ
Public Debt	A percentage measure equals the amount of public debt scaled by the total amount of debt. Source: S&P Capital IQ
Dvol	Dollar trading volume of options in millions. Source: OptionMetrics
Ldvol	The logarithm of dollar trading volume of options. Source: OptionMetrics
Size	The logarithm of total assets. Source: Compustat
Leverage	The amount of long-term debt and debt in current liabilities scaled by total assets. Source: Compustat
MtoB	The market value scaled by book value. Source: Compustat
ROA	Operating income before depreciation scaled by total assets. Source: Compustat
PPE	The amount of property, plant, and equipment scaled by total assets. Source: Compustat
Rating	Long-term credit rating, where 1 for none rating, 2 for lowest rating, and 7 for the highest rating. Source: Compustat
Open Interest	Average open interest across all options on a stock throughout the calendar year. Source:
Moneyness	Average absolute difference between the stock's market price and the option's strike price. Source:
Strictness	A measure developed by Murfin (2012) approximates the probability that the lender will receive contingent control via a covenant violation.
PIVOL	The average strictness measure for all loan covenants constructed by Demerjian and Owens (2016).
Log(Loan Maturity)	The logarithm of the loan maturity measured in months. Source: DealScan
Log(Loan Size)	The logarithm of the loan facility amount. Source: DealScan
Log(Loan Spread)	The logarithm of all-in-spread drawn in the DealScan. Source: DealScan
Number Of Lenders	The number of lenders in a loan syndicate. For sole lender loans, this equals one. Source: DealScan
Rating Flag	A dummy that equals one if the borrower has an S&P credit rating for long-term debt issues and zero otherwise. Source: Compustat
Z Score	A measure developed by Altman's (1968) equals 3.3* EBIT/total assets + 0.999* sales/total assets + 1.4*retained earnings/total assets+ 1.2*(current assets – current liabilities)/total assets+0.6* market value of equity/total liabilities. Source: Compustat
CDS Trading	A dummy variable that equals one if CDS referencing the borrower's name are trading at the time of loan initiation and zero otherwise. Source: GFI Group
Loan Purpose	Dummy variables for loan purposes, including corporate purposes, debt repayment, working capital, takeover, etc. Source: DealScan
Performance Pricing	A dummy variable that equals one if the loan facility used performance pricing, otherwise equals zero. Source: DealScan

Appendix B: Additional Tables
Table B1: Robustness Tests

This table presents robust tests regarding the impact on the debt structure of options trading. We rank firms from one to one hundred each year based on dollar options trading volume, denoted as *Dvol Rank*. We replicate baseline regression in Table 4, replacing *Ldvol* with *Dvol Rank*. Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Variables	Bank Debt	Public Debt	Bank Debt	Public Debt
	(1)	(2)	(3)	(4)
Dvol Rank	-0.158***	0.103***	-0.068***	0.052***
	(-7.23)	(4.75)	(-3.41)	(2.84)
Size	-1.865	26.331***	-9.376***	26.399***
	(-0.81)	(11.45)	(-3.74)	(8.89)
Leverage	-0.530	-0.720**	-0.154	-0.466*
	(-1.11)	(-2.00)	(-0.56)	(-1.77)
MtoB	21.533***	-12.864***	7.399***	-6.961***
	(7.00)	(-4.78)	(3.42)	(-2.76)
ROA	-4.093**	4.072**	-0.573	-2.146
	(-2.51)	(2.50)	(-0.22)	(-0.85)
PPE	-5.935***	7.168***	-3.412***	4.612***
	(-13.56)	(14.57)	(-6.08)	(7.61)
Rating	-0.158***	0.103***	-0.068***	0.052***
Industry FE	Yes	Yes	No	No
Year FE	Yes	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes
Observations	22,146	22,146	21,588	21,588
Adjusted R^2	0.246	0.312	0.657	0.702

Table B2: Entropy Balancing Approach

This table presents entropy balancing results regarding the impact of options trading on debt structure. We test the robustness of our findings employing the multivariate matching approach, entropy balancing approach, proposed by Hainmueller (2012) to check. With the help of entropy balancing, we could identify weights in order to equalize the differences across firms with different level of options trading volume and provide reliable inference in terms of the relation between options trading and debt structure of firms. The dependent variable, *Bank Debt*, is the amount of bank debt scaled by the total amount of debt. *Public Debt* is the amount of public debt scaled by the total amount of debt. Other variable definitions are shown in Appendix A. *High Dvol* equals to one representing firms with high options trading volume above median (treated group), otherwise equals zero (control group). Columns (1) and (2) report OLS regressions including industry and year fixed effects with entropy balancing weights, while columns (3) and (4) report results witout entropy balancing weights as comparison. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Variables	(1)	(2)	(3)	(4)
	Entropy Balancing		Without Entropy Balancing	
	Bank Debt	Public Debt	Bank Debt	Public Debt
High Dvol	-6.104***	3.548**	-6.847***	4.949***
	(-4.94)	(2.46)	(-6.73)	(4.92)
Size	-4.870***	4.152***	-4.611***	4.579***
	(-7.73)	(5.44)	(-9.81)	(9.47)
Leverage	2.436	18.222***	-1.171	25.922***
	(0.48)	(3.62)	(-0.50)	(11.30)
MtoB	-1.527**	-0.226	-0.819*	-0.567
	(-2.16)	(-0.26)	(-1.68)	(-1.59)
ROA	15.248**	-4.240	21.706***	-12.948***
	(1.96)	(-0.49)	(6.83)	(-4.78)
PPE	-4.872**	4.722**	-3.988**	4.035**
	(-2.51)	(2.18)	(-2.44)	(2.47)
Rating	-5.375***	6.726***	-5.890***	7.139***
	(-10.16)	(10.56)	(-13.49)	(14.53)
Observations	22,146	22,146	22,146	22,146
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.270	0.297	0.244	0.312

Table B3: Summary statistics for debt issuance analysis

This table reports descriptive statistics for our debt issuance, options trading, and control variables. We construct two variables in order to measure the debt issuance of firms. *Bank Loan Issuance* is a binary variable that equals one if the firm issued Bank loan and equals zero if the firm issued a bond. We also compute *Dollar amount of bank loan issuance*, the percentage of the dollar amount of bank loan issuance scaled by the total dollar amount of debt issuance. *Dvol* is the dollar volume of options trading in millions. *Ldvol* is the natural log of dollar trading volume of options. Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2012 which contains 2,265 unique firms with options trading volume. All variables are winsorized at the 1% and 99% level.

Panel A: Summary statistics

Variables	Observations	Mean	S.D.	P25	Median	P75
Bank Loan Issue	8,160	0.772	0.420	1.000	1.000	1.000
Dollar amt. of bank loan issuance	8,160	67.483	42.234	21.716	100.000	100.000
Bank Debt	8,160	29.880	35.626	0.000	12.500	52.469
Public Debt	8,160	59.703	36.450	28.560	71.948	92.069
Dvol (in millions)	8,160	1.729	4.894	0.020	0.129	0.824
Ldvol	8,160	11.722	2.655	9.909	11.767	13.622
Size	8,160	8.057	1.647	6.934	7.967	9.182
Leverage	8,160	0.294	0.213	0.152	0.271	0.395
MtoB	8,160	1.760	1.091	1.142	1.449	1.987
ROA	8,160	0.115	0.131	0.079	0.119	0.168
PPE	8,160	0.538	0.407	0.193	0.456	0.833
Rating	8,160	2.895	1.502	1.000	3.000	4.000

Panel B: Correlation matrix

	Bank Loan Issue	Dollar amount of bank loan issuance	Bank Debt	Public Debt	Dvol	Ldvol	Size	Leverage	MtoB	ROA	PPE	Rating
Bank Loan Issue	1.00											
Dollar amt. of bank loan issuance	0.87	1.00										
Bank Debt	0.11	0.20	1.00									
Public Debt	-0.09	-0.17	-0.82	1.00								
Dvol	-0.02	-0.07	-0.18	0.10	1.00							
Ldvol	-0.04	-0.09	-0.29	0.23	0.57	1.00						
Size	-0.01	-0.11	-0.45	0.41	0.45	0.62	1.00					
Leverage	-0.05	-0.11	-0.06	0.13	-0.04	-0.04	0.07	1.00				
MtoB	-0.03	0.00	0.06	-0.12	0.07	0.12	-0.25	-0.03	1.00			
ROA	0.18	0.18	0.00	0.05	0.07	0.12	0.18	-0.04	0.06	1.00		
PPE	0.01	-0.01	-0.08	0.14	-0.03	-0.02	0.00	0.17	-0.08	0.14	1.00	
Rating	-0.03	-0.13	-0.49	0.47	0.27	0.41	0.70	0.06	-0.11	0.16	0.06	1.00

Table B4: Changes in Public Debt Ratios around Option Listing

This table presents changes in public debt ratio around option listing compared with matched firm without listed options. Panel A reports changes in bank debt among control and treated firms by matching size, leverage, market-to-book ratio, ROA, bank debt rank, and public debt rank in a seven-year window around listing. We first estimate an individual propensity score of having an option listing for all observations in the full sample. Firms with listed options are then matched to firms without listed options based on the closeness of the propensity scores of having an option listing. Panel B reports changes in bank debt among control and treated firms regarding a quasi-natural experiment on option listings following Hu (2018). *Control* represents matched firms without listed options, while *Treated* represents firms with listed options. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The t-statistics are reported in parentheses.

Panel A: Changes in Public Debt in the years around option listing

Year	Treated	Control	T-C	t-statistics
Listing Year-3	31.83	31.65	0.17	0.09
Listing Year-2	32.64	29.37	3.27	1.91
Listing Year-1	31.68	30.12	1.56	1.01
Listing Year	41.57	32.53	9.04***	8.94
Listing Year+1	44.40	33.09	11.31***	10.27
Listing Year+2	45.85	35.64	10.21***	8.57
Listing Year+3	46.53	36.19	10.34***	8.15

Panel B: A quasi-natural experiment on option listings

Variable	Listing Firms	Control Firms	Difference	T Statistics
	(1)	(2)	(3)	(4)
Listing year-1	27.49	24.80	2.69	0.74
Listing year	38.04	23.11	14.93	1.66
Listing year+1	37.98	23.00	14.98*	1.67

Table B5: Subsample Evidence for Public Debt

This table presents the impact on the debt structure of options trading in terms of the information channel. we sort firms into tercile based on firm's size (PPE). Big (High) represents firms belong to the top tercile, while Small (Low) represents firms belonging to the bottom tercile. We also sort firms based on whether firms have investment rating shown in columns (5) and (6). Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Variables	Public Debt					
	Big Size	Small Size	High PPE	Low PPE	Investment	Non-Investment
	(1)	(2)	(3)	(4)	(5)	(6)
Ldvol	0.354	2.076***	0.095	1.568***	-0.282	1.453***
	(0.91)	(6.68)	(0.26)	(4.04)	(-0.59)	(5.68)
Size			6.013***	2.448***	1.840	6.463***
			(7.32)	(2.90)	(1.64)	(11.41)
Leverage	-5.588	39.261***	20.227***	32.019***	16.665**	32.291***
	(-1.16)	(11.45)	(6.43)	(8.15)	(2.48)	(12.89)
MtoB	-2.467**	-1.454***	-0.131	-0.540	-2.356*	-1.002***
	(-2.04)	(-4.01)	(-0.17)	(-1.19)	(-1.96)	(-2.61)
ROA	13.700	-10.270***	-11.808***	-11.602***	26.369**	-16.634***
	(1.57)	(-3.69)	(-3.23)	(-2.82)	(2.27)	(-5.84)
PPE	3.268	-0.700			-3.295	7.372***
	(1.39)	(-0.28)			(-1.21)	(4.00)
Rating	5.548***	8.530***	6.881***	7.947***		
	(7.40)	(7.44)	(9.00)	(9.50)		
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,524	8,164	7,444	7,268	5,763	16,380
Adjusted R^2	0.255	0.197	0.355	0.284	0.151	0.222
Difference	1.721***		1.473***		1.735***	
p-values	(0.000)		(0.000)		(0.000)	

Table B6: The Effect of Product Market Competition for Public Debt

This table presents the impact on the debt structure of options trading in terms of competition channel. In columns (1) and (2), we sort firms into tercile based on Herfindal-Hirschman index (HHI) at two-digit SIC. High HHI represents firms belonging to the top tercile, while Low HHI represents firms belonging to the bottom tercile. In columns (3) and (4), we sort firms into tercile based on fluidity scores from Hoberg-Phillips's website. High Fluidity represents firms belonging to the top tercile, while Low Fluidity represents firms belonging to the bottom tercile. Other variable definitions are shown in Appendix A. The sample period is from 2002 to 2015. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are robust and clustered at the firm level and t-statistics are reported in parentheses.

Variables	Public Debt			
	High HHI	Low HHI	High Fluidity	Low Fluidity
	(1)	(2)	(3)	(4)
Ldvol	0.183	2.237***	1.603***	-0.597
	(0.46)	(6.64)	(4.53)	(-1.56)
Size	4.205***	3.384***	3.043***	6.123***
	(4.45)	(4.34)	(3.87)	(6.34)
Leverage	21.600***	28.425***	30.268***	18.490***
	(5.37)	(8.57)	(9.95)	(4.17)
MtoB	0.206	-1.001**	-0.936**	-0.304
	(0.32)	(-2.22)	(-2.05)	(-0.40)
ROA	-12.647***	-8.571**	-5.168	-10.078
	(-2.66)	(-2.49)	(-1.50)	(-1.62)
PPE	9.995***	2.891	-1.395	11.673***
	(3.53)	(1.24)	(-0.56)	(4.32)
Rating	7.402***	6.601***	6.747***	8.349***
	(8.55)	(8.97)	(8.72)	(10.63)
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observation	7,015	8,180	7,057	7,066
Adjusted R^2	0.282	0.335	0.296	0.336
Low-High	2.055***		-2.199***	
p-values	(0.000)		(0.000)	