How a Bond Issuance Affects Liquidity of Preexisting Bonds of the Firm

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Abstract

The extreme illiquidity of corporate bonds during the financial crisis of 2008, along with better availability of trading data, has encouraged a dramatic increase in research attempting to explain corporate bond liquidity. Many firms issue bonds when other previously issued bonds of the same firm are still outstanding. We analyze how the new issuance affects the liquidity of the preexisting bonds of the same firm. One might expect the liquidity of the preexisting bonds to improve since there is a greater quantity of very similar bonds outstanding. On the other hand, investment bankers aggressively market the new issuance which may diminish trading and liquidity of the preexisting bonds. We find the former effect to dominate.

1. Introduction

The liquidity premium of a corporate bond is a very important component of its total yield. In fact, recent studies such as Bao (2011) and Chen, Cui, He, and Milbradt (2018) have shown cases where the liquidity risk premia can be larger than default risk premia. Given the importance of bond market liquidity and the extreme illiquidity experienced during financial crises, many recent researchers have tried to develop improved models of corporate bond market liquidity. These studies often focus on how bond market liquidity during the crisis period of 2007-2009 differs from liquidity in non-crisis periods.

It is well known that regulators imposed important changes upon the market after the crisis. Understandably, many studies address how changes in the regulation of corporate bond market trading may affect the liquidity of the market. Adrian, Boyarchenko, and Shachar (2017) analyze bond dealer ability to intermediate trades by linking changes in liquidity of dealers to their transaction activity and balance sheet constraints. They find that institutions that face more regulations after the crisis reduce their volume of trade and have less ability to intermediate customer trades. Bessembinder, Jacobsen, Maxwell, and Venkatarman (2018) study trading cost and dealer behavior and find that average trade execution costs have not tended to increase from 2006 to 2016. At the same time dealer capital commitment and block trade frequency have decreased since the crisis; they suggest that corporate bond liquidity is evolving away from bank-affiliated dealers due to post-crisis regulations. With regard to how regulatory changes may have affected stressed bonds suffering a downgrade in credit quality, Bao,O'Hara, and Zhou (2018) find that the illiquidity of stressed bonds increased after the Volcker Rule. In contrast to this finding, Trebbi and Xioa (2019) find the corporate bond market has *not* become less liquid due to the Volcker Rule, the Dodd-Frank Act, and Basel III. Wang and Zhong (2019) maintain that the

impact of post-crisis regulations is puzzling and develop a model to explain the behavior of bid-ask spreads, dealer inventory, and the difficulty of executing large trades.

Other recent corporate bond liquidity research does not necessarily focus as much on the impact of regulation upon liquidity. Helwege, Huang, and Wang (2014), attempt to separate the credit spread component from the liquidity component by using bonds of the same firm trading on same day. They report significant improvement in explaining bond spreads but note that a significant portion of the spread remains unexplained. Schestag, Schuster, and Uhrig-Homburg (2016) do a very thorough analysis of alternative bond liquidity measures. They find that high-frequency intraday measures are very strongly correlated. Furthermore, they find that most lower –frequency proxies using daily data perform quite well. Goldstein and Hotckiss (2019) surprisingly find that cross-sectional estimates of trading costs do not increase as prior trading activity declines and suggest that dealers adjust behavior to address inventory risk of trading in risky, illiquid bonds. Dick-Nielsen and Rossi (2019) maintain that sudden exclusion of a bond from an index reveals no information about fundamental bond valuation and find that cost of immediate trading in such excluded bonds has dramatically increased after the 2008 crisis. [1]

The purpose of our research is to analyze how a firm's issuance of a bond affects the liquidity the preexisting outstanding bonds of the same firm. It is quite noteworthy that alternative theories suggest opposing effects. That is, the first theory suggests a hypothesis that the liquidity of preexisting bonds will increase upon issuance of new bonds. A second theory, in contrast, suggests that the liquidity of preexisting bonds will decrease because the new bonds may be aggressively marketed by investment bankers to the disadvantage of preexisting bonds. The

[1] Other recent corporate bond research has analyzed yield but has not necessarily focused as much upon liquidity at those listed above. Chung, Wang and Wu (2019) examine the pricing of volatility risk. We note that Cai,Han, Li, and Li (2019) examine the price impact of herding while Friewald and Nagler (2019) analyze systematic over- the-counter frictions and how they relate to the unexplained common factor in yield spread changes.

relative maturity of the new issuance may play an important role in determining the liquidity of preexisting bonds Potential differences in rating and seniority of new and preexisting bonds may affect the liquidity of the preexisting bonds. Additionally, it may be that if the leverage of the firm changes dramatically with the new issuance, the liquidity of the preexisting bonds may decline.

We use different measures of liquidity to represent different aspects of liquidity classified by Schestag, Schuster, and Uhrig-Homburg (2016). That is, we analyze bid-ask spreads as representing the transactions cost dimension of liquidity and analyze the Amihud (2002) measure as representing the price impact (depth) dimension of liquidity.

The next section of this research describes the hypotheses in detail where we describe, for example, why the liquidity may increase according to one hypothesis but decrease due to an alternative hypothesis. After that we describe the data and models used. Then we give the empirical results and, finally, summarize the research in the conclusion.

2. Hypotheses

The literature concerning the liquidity of financial instruments has grown remarkably in recent years. Important topics include the how to measure liquidity in decidedly different markets. Numerous studies have analyzed the liquidity that is specific to equities, futures, and bonds. There have been numerous attempts to analyze cross sectional and time series patterns of liquidity for all types of financial instruments issued by firms. Common topics include how liquidity is affected by the volume of the instrument outstanding, how liquidity is affected by the amount of information about the firm available, and how issuance of new securities is affected by liquidity.

With regard to common equities, Kothare (1997) has analyzed the impact of rights offerings and somewhat surprisingly, given that the volume of equity outstanding for the firm increases,

found that bid-ask spreads increase after rights offerings due to concentrated ownership. Balakrishnan, Billings, Kelly, and Ljundgqvist (2014) find that equity liquidity and firm value may well increase when firms voluntarily disclose more information than mandated by regulations. Hanselaar, Stulz, and Van Dijk (2019) find that firms issue more equity when there is greater liquidity.

We now offer hypotheses concerning the behavior of corporate bond liquidity upon the issuance of new corporate bonds wherein previous issues of the specific firm are still outstanding. As given below, we draw upon the theory of information cost and investor preferences to develop these hypotheses.

Hypothesis 1a. A new issuance will increase the liquidity of existing bonds because there is now a greater volume of debt outstanding for the firm. This hypothesis assumes that the new issuance and the existing bonds are good substitutes and approximately the same security. The effect is similar to that of a new common stock issuance increasing liquidity of equity. For example, Kothare (1997) [2] finds that, in contrast to rights offerings, public underwritten offerings of seasoned equity increases the liquidity of the firm's common stock; this may occur simply because there are more shares outstanding making for a wider and more dispersed market.

Hypothesis 1b. A new issuance will increase the liquidity of existing bonds because there is an increase in public information about the firm. That is, when a firm issues a security, there is an increase in public information about the firm that is thoroughly scrutinized by underwriters, rating agencies, investment bankers and other involved parties. In other words, information

[2] Kothare (1997) contrasts the effects of rights offerings versus publicly underwritten offerings where publicly underwritten offerings tend to decrease bid-ask spread and thus improve liquidity. In contrast, he finds bid-ask spreads increase after rights offerings where ownership and trading may become more concentrated.

asymmetry among potential bond buyers may well be reduced as the firm releases a great deal of public information at issuance. For more about this point of view, see Qian (2011).

Hypothesis 2. The new issuance will decrease the liquidity of the existing bonds since those trading in the bonds of the firm will tend to trade in the new issuance, as opposed to other outstanding bonds, because the new issue attracts greater market attention. This is partially because the effort by investment bankers to market the new bonds will be strong and obviously focused on the new bonds as opposed to already outstanding bonds of the firm. Such a point of view may be directly related to the market for U.S. Treasury bonds where there is thought to be a preference for "on the run" issues. The evidence is quite strong where, due to liquidity differences, the most recent Treasury issue may well trade at a lower yield than older issues with the same maturity. See, for example, Vaynos and Weill (2008) for how strong the "on the run" impact can be in bond valuation.

Hypothesis 3. A new issuance may affect the overall credit quality of the firm and its debt instruments. If the new bond issuance significantly increases the leverage of the firm, as measured by debt divided by assets, then the riskiness of the firm has increased and the liquidity (bid-ask spread) of the existing bonds will decrease. In recent years, a very common example of a leverage increasing issuance is one where new bonds are issued to repurchase common stock. Furthermore, relative credit quality of the new issuance compared to the existing bonds can be represented by the relative bond rating and seniority of the bonds. If the preexisting bond has a better credit rating than the new bond issuance, the liquidity of the existing bond may improve. Similarly, if the preexisting bond is more senior than the new issuance, the liquidity of the existing bond will improve.

3. Data and Methodology

We collect straight debt offerings made by U.S. public firms from July 2002 to December 2018 from the Securities Data Corporation's (SDC) Global New Issues database. No bonds with an embedded call or put are included and no convertible bonds are included. Bond price data are gathered from the Trade Reporting and Compliance Engine (TRACE), which provides comprehensive coverage of bond trades. TRACE began providing bond transaction data for AAA, AA, A, BBB bonds with issue size greater than $1 billion in July 2002. Since that time, data pertaining to other grades of bonds has also been disseminated and TRACE's records of bond transactions in the OTC market thus became comprehensive in 2005. FINRA currently applies dissemination caps to large-size trades in corporate bonds—i.e., trades that exceed $5 million for investment-grade corporate bonds, and $1 million for non-investment grade corporate bonds. For trades at or below the caps, FINRA disseminates the security identifier, whether the trade was between dealers versus between a dealer and a customer or affiliate, whether the FINRA member involved in the trade bought or sold the security, and the price and full size of the trade. For trades above the dissemination caps, FINRA disseminates all of the same information, but with the size of the trade capped as "5MM+" (for IG) and "1MM+" (for non-IG). We use the TRACE Enhanced data set which provides trading volume for all transactions.

We require that: 1) bond price data be available on TRACE, 2) firm accounting information be available from the Compustat Fundamentals Annual dataset, and 3) bond-specific information on covenants and other features of bonds be obtainable from the Mergent Fixed Income Security Database (FISD). For multiple debt offerings issued by the same firm on the same day, we calculate the weighted average maturity and seniority level. The component weights are the proceeds of each bond issuance relative to total offering proceeds.

Prior studies of straight debt offerings use various sources to identify debt offering announcement dates as there is no one universal dataset that provides reliable date information.[3] We use four datasets to verify the first announcement date of new debt offerings: SDC, FISD, Bloomberg and Factiva. Since it is possible that the firm publicly announced the offering prior to the actual offering, we therefore use Factiva to identify the first announcement date for new debt offerings. In the window from one month before to one month after the date of a new debt issue date (collected from SDC), we manually check the following dates using Factiva: 1) the first time the company or its underwriter announced the new bond issue, 2) the rating agencies' press release date, and 3) the first time the announcement is released on Reuters.

We estimate effective bid-ask spreads using transaction records. Hong and Warga (2000), and Chakravarty and Sarkar (2003) calculate the "traded bid-ask spreads" or "round-trip costs" over a one-day window in the corporate bond market. Specifically, this approach takes the average of the differences between selling prices and buying prices on the same day as the effective bid-ask spread. The traded bid-ask spread is the difference between the average daily selling price and average daily buying price divided by their sum.

Assigning i to each individual bond and t to time periods, we have

$$Spread_{it} = \frac{\overline{Sell}_{it} - \overline{Buy}_{it}}{\overline{Sell}_{it} + \overline{Buy}_{it}},$$

where $\overline{Sell}_{it}$ and $\overline{Buy}_{it}$ are the average daily selling price and buying price, respectively. We calculate the spread each day on which there is at least one buy and one sell trade and

[3] Dann and Mikkelson (1984), Eckbo (1986), and Mikkelson and Partch (1986) use the earliest date of the issuances reported in the *Wall Street Journal* as the debt offering announcement date. Kolodny and Suhler (1988) define the announcement date as one day before the announcement appearing in the *Wall Street Journal*. Akhigbe et al. (1997) define the announcement date as the filing date in the Securities and Exchange Commission's Registered Offerings Statistics file and Moody's Bond Survey. Dutordoir and Hodrick (2012) identify the debt offering announcement date as the earliest of the filing date reported in SDC and the date at which the issuance is first mentioned in Factiva.

use the monthly (quarterly) mean as a monthly (quarterly) transaction cost measure.

Similar to Dick-Nielsen, et al. (2012), we use the Amihud (2002) illiquidity measure as a proxy for the depth dimension of liquidity. We estimate the Amihud measure as the following

$$Amihud_{id} = \frac{100}{T} \times \sum_{t=2}^{n} \frac{abs\left(ln(p_{itd}) - ln(p_{i,t-1,d})\right)}{q_{itd}/1{,}000{,}000}.$$

where *T* represents the number of trades of that particular bond on day *d*. This measure captures the change in price for a given quantity traded, which is what the theoretical model of Kyle (1985) suggests. Monthly and quarterly measures of the price impact are obtained as the means of daily measures.

We use a cleaning procedure for the TRACE bond data where the cleaning follows the processes of Dick-Nielsen (2009) and (2014). We filter the bond transaction data by eliminating bonds with abnormal prices (prices greater than $200 or less than $10), bond trading with subsequent corrections, cases where the bond trading side is not indicated, and bond trading affected by price reversions. Additionally, we require that the bond be rated by Moody's or Standard & Poor's (S&P) and have maturity information available in Mergent FISD. Firm characteristic data is obtained from Compustat. To compute same-bond-same-day effective bid-ask spreads, we further require bonds to have at least one buy and one sell transaction within a day as in Hong and Warga (2000), Chakravarty and Sarkar (2003) and Goldstein et al. (2007).

Table 1 describes the characteristics of the firms and bonds used in the sample and Appendix A contains the definitions of the variables as given by Compustat. There are 1,872 firms in the sample where the median total assets is 19,019 million and the median book to debt ratio is 0.32. Capital expenditures, at the median, are 2% of total assets. For new bond issuances, the median maturity was 10.02 years, the median rating was Baa2 (9.00), and the median coupon

was 4.31%. For bonds existing before the new issuance, the median maturity was 5.64 , the median rating was Baa1 (8.00), and the median coupon was 4.80%. The median number of bonds traded daily in the six months prior to issuance was 1,718.

4. Results

Issuing debt is a choice and is therefore endogenous to the liquidity in the market. It is possible that firms issue debt when liquidity, and therefore yield spreads, are favorable for the firm. Such a tendency could introduce selection bias on our treated (debt-issuing) firms. Thus, we develop a control sample comprised of firms that are matched based on likelihood of issuing debt. In this context we estimate a logit model for debt issuance where the variable and results are given in Table 2. The sample is all firms available in Compustat that have accounting variables used in the logit regression. We select variables similar to those used by Badoer and James (2016) to estimate the propensity score of issuing debt. Similarly, Cheng (2003) uses propensity score matching to analyze equity performance related to seasoned equity issuance. Li and Zhao (2006) also use propensity matching scores to analyze abnormal performance after a seasoned equity offering. Tykvova and Borell (2012) use propensity matching to analyze company buyouts.

Table 2 shows contains coefficients from a propensity score matching procedure used to compute the propensity to issue debt. The propensity score, p(x), is the probability of issuing bonds conditional on x. That is,

$$p(x) = pr\ (D=1 \mid x\ )$$

where D is the event of issuing debt. The great majority of the variables explaining the propensity to issue debt are strongly significant.

The "treated" sample used below is from the new debt issue firms which have all variables available in the above propensity score estimation. That is, we can estimate the likelihood of a firm

issuing debt based on the Table 2 regression. The matched samples in Table 3 includes firms that ***do not*** issue debt but nonetheless have a likelihood of issuing debt closest to the treated sample.

In other words, we first estimate the logit model in Table 2 to obtain the estimated coefficients for the determinants of new debt issue. Using these estimated coefficients, we can compute the likelihood of issuing debt for each firm in each month including our treated sample, the firms issuing debt. For each likelihood score of each firm in our treated sample, we find the closest likelihood from the firms that **did not** issue debt within the same month and use it as the *matched sample*. For instance, let's suppose, one of our new debt issue firms in February, 2015 has a likelihood of 0.98. Within the non debt-issue firms in February 2015, we find a firm that has the closest likelihood to 0.98. We thus go on to have an improved basis for estimating bond liquidity around a new issuance of debt by a particular firm.

For periods surrounding a new bond issuance, Table 3 presents the change in bond liquidity for preexisting bonds of the same firm. Panel 3A represents changes in bid-ask spread for a month before and a month after a new bond issuance whereas Panel 3B represents changes in bid-ask for a quarter before and a quarter after the new bond issuance. As in related papers, daily changes are not used as such changes are temporary and not a more lasting change in liquidity. For example, see Dick-Nielsen, Feldhutter, and Lando (2012) and Friewald, Jankowitsch, and Subrahmanya (2012).

The universal sample includes all new debt issuances that have a calculable bond liquidity measure within our event window. The treated sample includes all new debt issuances that have bond returns and can be matched based on likelihood of issuing debt computed from Table 2. The matched sample, in the last columns of Table 3, provides an interesting and useful comparison.

Consistent with this perspective, our results show that there is not a difference in matched sample liquidity in the monthly and quarterly periods.

In Panel 3A, for the universal sample, the median bid-ask spread is 61.55 basis points for one month prior to the new issuance and 56.52 one month after issuance where the difference is significant at the 1% level. In the treated sample of Panel 3A, the median bid-ask spread is 61.09 basis points for one month prior and 55.28 basis points for one month after where, again, the difference is clearly significant strongly suggesting that liquidity is greater in the month after the issuance. In contrast to the universal and treated sample, the bid-ask results for the matched sample are not significantly different in months before and after the new bond issuance. Panel 3B reports results comparing bid-ask spreads for quarterly, not monthly, observations. Again, the results strongly suggest that the market for the preexisting bonds is more liquid after the new issuance. We note that the results comparing means, versus medians, given in Table 3A and 3B, are very similar to the median results reported above.

In a parallel fashion, Panel 3C reports *month before* and *month after* results for the Amihud liquidity measure. The results are very similar to that of the bid-ask spread. For the universal sample in Table 3C, the median Amihud measure declines from 29.48 in the month before the new bond issuance to 25.28 in the month after the new issuance. For the treated sample, the median declines from 31.24 before new bond issuance to 27.26 in the month after issuance. Both the universal and treated sample differences are strongly significant. As before, in the matched sample, there is not a significant difference between the month before and month after. Panel 3D compares the quarter before to the quarter after the new issuance for the Amihud measure and the results are very similar to the monthly results. That is, both the median universal and treated

Amihud measure significantly decline from the quarter before to the quarter after. Also, as above, the matched sample does not change significantly in Panel 3D.

Table 4 reports analysis of the maturity and rating differences surrounding new debt issuance where, again, panels 4A and 4B refer to bid-ask and panels 4C and 4D refer to the Amihud measure. As one would expect, there are relatively few cases of rating difference to observe in Panel 4B because the ratings of different bond issues of the same firm are usually, but not always, equally rated. In Panel 4A, when the maturity of the new issue is greater than the existing bond, the median change in monthly bid-ask is -1.89 compared to 0.84 when new issue has a lesser maturity than the existing bond. It is curious that the sign is negative for a new bond maturity greater than existing but positive for a new bond maturity less than existing. The difference (-2.73) is significant at the 5% level. For quarterly comparisons, in Panel 4A, the result patterns are quite similar where the difference (-4.88) is again clearly significant. Thus, liquidity change for existing bonds upon a new bond issuance depends on the maturity of the new bond relative to the preexisting bond.

The impact of difference in ratings upon bid-ask is addressed in Panel 4B. When the rating of the new issue is less credit worthy than the existing bond, the median difference is -1.30 for monthly observations whereas the difference is positive 4.07 if the rating of the new bond is greater than the existing bond. It is curious that the signs are different for relative ratings of the new versus the existing bonds. The difference is clearly significant showing that the change in liquidity of existing bonds depends on the relative maturity. For quarterly observations, the results are roughly similar. However, in the quarterly case, the change is negative for new bonds having a greater rating than existing and the difference is not as strongly significant. Still, there is strong evidence that the liquidity of existing bonds after the new bond issuance depends on the relative bond rating.

With regard to the monthly Amihud measure, Panel 4C shows that when the maturity of the new issue is greater than the existing bond, the median change in the liquidity measure of existing bonds of the same firm is -0.38. In contrast, the median change is positive 0.79 when the maturity of the new bond is less than the existing bond. The difference in the median is strongly significant which shows that the liquidity change of the existing bonds depends on the relative maturity of the new issuance compared to existing bonds. For quarterly Amihud measures in Panel 4C, the results are quite similar to the monthly results where the difference in medians is clearly significant.

Panel 4D examines the impact upon the Amihud measure according to the the relative rating of the new issuance and the evidence of a differential impact is not strong. The monthly median Amihud decreases (liquidity improves) after issuance if the new rating is less than the existing rating. Similarly, the quarterly Amihud decreases if the rating of the new bond is greater than the existing bond. The difference between the ratings cases is not significant. When quarterly analysis in Panel 4D is performed, the difference between ratings is again not significant.

The above results are interesting and strongly suggest how liquidity of existing bonds may change upon a new issuance. We now provide an extended statistical analysis to accommodate simultaneous and interactive effects in the form of a regression where the change in spread is a function of hypothesized relations. The change in spread is the spread for the month (quarter) after the new bond issuance less the spread for the month (quarter) before the new bond issuance. Furthermore, we include control variables to represent other factors that may affect liquidity but are not directly related to hypotheses.

More specifically, with regard to hypotheses, we model change in spread as dependent upon the leverage ratio, relative seniority of the new issuance, and the ratings of the bonds. We also

include bond maturity, the ratio of new debt issuance to total assets, volume of bonds traded in the prior six months, the crisis period of December 2007-July 2010, the MOVE index and the VIX index. For example, if the financial markets become more stable, one might expect spreads to decline. The MOVE index is an implied volatility on one- month Treasury options whereas the VIX is a measure of equity volatility.

Table 5A contains results for changes in the monthly bid-ask spread where the dependent variable is the change in bid-ask, i.e. the bid-ask spread in the month after issuance less the bid-ask in the month before issuance. If the maturity of the new issuance is greater than the maturity of the existing, there is a negative impact upon the spread which is consistent with Table 4A. Separately, using only the logarithm of maturity of the existing bond, the impact upon the spread is positive[4]. Also, if the new bond is less senior than the existing bond, the bid-ask spread tends to decline. Furthermore, if the new bond has a rating reflecting lower credit quality than the existing bond, where the dummy variable is 1 in such a case, the spread on preexisting bonds declines. The leverage ratio does not have a significant effect. Lastly, we note that the more bonds traded in the previous six months tends to increase the spread although this is not true in the last two specifications of Table 5A.

Table 5B contains results for changes in the monthly Amihud measure where the dependent variable is the Amihud in the month after issuance less the Amihud in the month before issuance. The results are similar to Table 5A. The dummy variable for maturity of the new bond being greater than the existing bond remains marginally significant but seniority and credit quality are not. The Amihud measure declines in the period December 2007 to July 2010.

[4] This result may can be related to the positive 0.84 change in median bid-ask for monthly computations in Table 4A.

Table 6 estimates changes in quarterly liquidity where Table 6A considers changes in the bid-ask spread. New bond maturity greater than the existing bond has a strong negative impact, new bond seniority less than existing bond seniority has a negative impact. If the new bond has a lesser credit quality-than the existing, there is evidence that the bid-ask declines. We also note that VIX has a strong negative impact whereas average daily bond traded six months prior has a positive effect.

Table 6B, analyzing the quarterly Amihud measure, has fewer significant coefficients. Still, the effect of new maturity greater than existing is strongly negative. As before, average daily bonds traded 6 months prior has a positive effect and VIX has a negative effect.

5. Conclusion

The liquidity premium is large part of corporate bond yields and has gotten enhanced attention since the financial crisis began in 2008 wherein the liquidity premia was extremely large. Many researchers have analyzed how changes in regulation affect bond liquidity. Some research suggests that the corporate bond market has become less liquid due to enhanced regulation from the Dodd-Frank Act, the Volcker Rule, and announcement of Basel III. On the other hand, Trebbi and Xioa (2019) suggest that the corporate bond market has not become less liquid. Other recent research has found that most alternative measure of bond market liquidity are strongly correlated and that dealers adjust their behavior to address inventory risk.

Our purpose is to analyze how a firm's issuance of a new bond affects liquidity of preexisting outstanding bonds of the same firm. On one hand, one might expect liquidity of preexisting bonds to increase since there is a greater quantity of that firm's bonds outstanding. On the other hand, it is well known that investment bankers aggressively attempt to sell the new

issuance as their performance is based on how well the new issuances sell; thus, it is easy to imagine that the liquidity of the firm's previously outstanding bonds could decline upon a new issuance. Furthermore, the relative rating, seniority, and maturity of the preexisting bonds compared to the new issuance may affect the resultant liquidity of preexisting bonds upon issuance of a new bond by the firm. Our primary finding is that the liquidity of preexisting bonds, as measured by bid -ask spread and the Amihud measure improves upon a new bond issuance. Also, if the rating of the new issue is a lesser credit quality than preexisting bonds, the liquidity of existing bonds improves. These results tend to stronger and more clear for the bid-ask measure of liquidity as opposed to the Amihud measure.

References

Adrian, Tobias, Boyarchenko, N. and Shachar, O. (2017). "Dealer balance sheets and bond liquidity provision." Journal of Monetary Economics, 89, 92-109.

Akhigbe, A., Easterwood, J. C., and Pettit, R. R. (1997). "Wealth effects of corporate debt issues: The impact of issuer motivations" Financial Management, 32-47.

Amihud, Y. (2002). "Illiquidity and stock returns: cross-section and time series effects." Journal of Financial Markets" Journal of Financial Markets,5,31-56.

Bao, J. , Pan, J. and Wang, J. (2011). "The illiquidity of corporate bonds" Journal of Finance, 66, 911-946.

Bao,J., O'Hara, M. and Zhou, A. (2018). " The Volcker Rule and corporate bond market making in times of stress" Journal of Financial Economics, 130,95-113.

Badoer, D.C., and James, C.M. (2016). "The determinants of Long-Term Corporate Debt Issances" Journal of Finance, 71, 457-493.

Balakrishnan, K., Billings, M.B, Kelly, B. and Ljundgqvist, A. (2014). "Shaping Liquidity: On the Causal Effects of Voluntary Disclosure", Journal of Finance, 69, 2237-2278.

Bessembinder, H., Jacobsen, S., Maxwell, W. and Venkatarman, K. (2018). "Capital Commitment and Liquidity in Corporate Bonds" ,73, 1615-1660.

Cai, F., Han,S., Li, D., and Li, Y., (2019). "Institutional herding and its price impact: Evidence from the Corporate Bond Market", Journal of Financial Economics, forthcoming.

Chakravarty, Sugato and Asani Sarkar (2003). "Trading Costs in Three U.S. Bond Markets," Journal of Fixed Income, June 2003, 13, 39–48.

Chen, H.,Cui, R., He, Z.,and Milbradt, K. (2018) "Quantifying Liquidity and Default Risks of Corporate Bonds over the Business Cycle", Review of Financial Studies, 31,852-897.

Cheng, Y. (2003). "Propensity Score Matching and the New Issues Puzzle." Manuscript, 2003.

Dann, L. Y., and Mikkelson, W. H. (1984). "Convertible debt issuance, capital structure change and financing-related information: Some new evidence", Journal of Financial Economics, 13(2), 157-186.

Dick-Nielsen, J., Feldhutter, P., and Lando,D. (2012)," Corporate bond liquidity before and after the onset of the subprime crisis", Journal of Financial Economics, 103, 471-492.

Dick-Nielsen, J. and Rossi, M. (2019). "The Cost of Immediacy for Corporate Bonds.", Review of Financial Studies, 32, 1-40.

Dick-Nielsen, J., (2009, 2014). “Liquidity biases in TRACE”, Journal of Fixed Income, 19,43-55.

Dutordoir, M., and Hodrick, L. S. (2012). “Self-selection and stock returns around corporate security offering announcements.” Columbia Business School Research Paper, (12-11).

Eckbo, B. E. (1986). “Valuation effects of corporate debt offerings.” Journal of Financial Economics, 15(1), 119-151.

Friewald, N., and Nagler,F., (2019)” Over-the-Counter Market Frictions and Yield Spread Changes”, Journal of Finance, forthcoming.

Friewald, N,, Jankowitsch, R., and Subrahmanya, M.G., (2012) “ Illiquidity or credit deterioration: A study in the US corporate bond market during financial crises”, Journal of Financial Economics, 105:18-36.

Goldstein, M.A., and Hotckiss, E.S. (2019). “ Providing Liqudity in an Illiquid Market: Dealer Behavior US corporate bonds.” Journal of Financial Economics, forthcoming

Goldstein, Michael A., Edith S. Hotchkiss, and Erik R. Sirri. 2007. “Transparency and liquidity: A controlled experiment on corporate bonds”, Review of Financial Studies 20: 235–73.

Hanselaar, R., Stulz,, R.M. and Van Dijk, M. (2019). “ Do firms issue more equity when markets become more liquid?”. Journal of Financial Economics, 133, 64-82.

Helwege, J., Huang,J., and Wang, Y. (2014). “Liquidity effects in corporate bond spreads”, Journal of Banking and Finance, 45,105-116.

Hong, Gwangheon and Arthur Warga (2000), “An Empirical Study of Bond Market Transactions,” Financial Analysts Journal, 56, 32–46.

Kolodny, R. and Suhler, D.R. (1988). “The effects of new debt issuances on existing security holders”, Quarterly Journal of Business and Economics, 27, 51-72.

Kothare, Meeta (1997). "The effects of equity issues on ownership structure and stock liquidity: A comparison of rights and public offerings." Journal of Financial Economics 43.1: 131-148.

Li, X., and Zhao,X. (2006). “Propensity score matching and abnormal performance after seasoned equity offerings” Journal of Empirical Finance, 13, 351-370.

Mikkelson, W. H., and Partch, M. M. (1986). “Valuation effects of security offerings and the issuance process” Journal of Financial Economics, 15(1), 31-60.

Qian, Hong (2011). "Liquidity changes around seasoned equity issuance: Public offerings versus private placements" Financial Review 46.1 (2011): 127-149.

Schestag,R., Schuster, P., and Uhrig-Homburg, M. (2016). “Measuring Liquidity in Bond Markets,” Review of Financial Studies, 29, 1170-1219.

Trebbi, F., and Xioa, K. (2019). “Regulation and Market Liquidity”, Management Science, 65,1949-1968.

Tykvova,T., and Borell, M., (2012)” Do private equity owners increase risk of financial distress and bankruptcy”, Journal of Corporate Finance, 18,138-150.

Wang, X., and Zhong, Z. (2019) “ Post-crisis regulations, market timing, and liquidity in the corporate bond market” manuscript

Table 1. Sample Descriptive Statistics

Definitions of variables can be seen in the Appendix A. Sample period is from July, 2002 to December, 2018.

Variables	N	Q1	Mean	Median	Q3
Total assets (million$)	1,872	7,036.16	54,696.95	19,019.42	44,623.00
Market to Book Ratio	1,872	1.09	1.75	1.46	2.06
EBIT to Total Assets (%)	1,872	0.01	0.02	0.02	0.03
PPE to TA	1,872	0.09	0.34	0.25	0.59
Debt Ratio	1,872	0.23	0.34	0.32	0.45
Dividend Dummy (%)	1,872	0.00	0.09	0.00	0.00
CAPEX to Total Assets (%)	1,872	0.01	0.03	0.02	0.04
New debt proceeds (million$)	1,872	0.17	0.29	0.27	0.38
Proceeds/Total assets (%)	1,872	400.00	1,125.37	600.00	1,150.00
Leverage	1,872	0.02	0.06	0.04	0.08
New bond maturity (years)	1,872	7.05	11.11	10.02	12.05
New bond rating	1,872	7.00	8.75	9.00	10.00
New bond security level	1,872	2.00	2.01	2.00	2.00
New bond coupon (%)	1,872	3.30	4.58	4.31	5.63
Existing bond coupon (%)	12,508	3.25	4.76	4.80	6.20
Existing bond maturity (years)	12,508	2.80	9.35	5.64	9.59
Existing bond rating	12,508	6.00	7.48	8.00	9.00
Existing bond security level	12,508	2.00	2.06	2.00	2.00
Avg. daily bonds traded -6 months (# of bonds)	12,508	873.11	4,194.00	1,718.14	3,408.64
Maturity: New>Existing	12,508	0.00	0.70	1.00	1.00
Rating: New<Existing	1,064	0.00	0.45	0.00	1.00
Seniority: New<Existing	511	0.00	0.25	0.00	1.00

Table 2. Logit Model of New debt issues-Compustat Sample

We use the estimated coefficients below to calculate the propensity score of issuing debt. Then we use the propensity score matching to find the matched sample in the Table 3. Control variables are typically included in empirical studies of debt issuance. See, for example, Leary and Roberts (2005) and Badoer and James (2016). Definitions of variables can be seen in the Appendix A.

	Coefficients	P-value
Treasury Weighted Maturity	0.108	0.00
Term Structure 10y-6month	0.122	0.00
Moody's BBB-AAA30Y	0.294	0.00
Quarterly GDP Growth	22.171	0.00
Market to Book Ratio	-0.006	0.00
EBIT to Total Assets	-0.001	0.94
PPE to TA	0.567	0.00
Book-Debt Ratio	0.011	0.00
Dividend Dummy	0.293	0.00
Log(Sale)	0.603	0.00
CAPEX to Total Assets	0.043	0.74
Intercept	-9.193	0.00
Pseudo R-square	0.19	
# of Observations	356,588	

Table 3. Changes of bond market liquidity around new debt issuance

Panels A (C) and B (D) report the change of monthly and quarterly bid-ask spread (Amihud price impact) surrounding the new debt issuance.

Panel A, Bid-Ask	Universal Sample			Treated Sample			Matched Sample	
Event window	N	Mean (bps)	Median (bps)	N	Mean (bps)	Median (bps)	Mean (bps)	Median (bps)
Month-1	5,378	82.09	61.55	1,872	80.35	61.09	106.75	69.75
Month+1	5,378	71.93	56.52	1,872	70.92	55.28	96.66	69.59
Difference		-10.16***	-5.03***		-9.43***	-5.81***	-10.09	-0.16

Panel B, Bid-Ask	Universal Sample			Treated Sample			Matched Sample	
Event window	N	Mean (bps)	Median (bps)	N	Mean (bps)	Median (bps)	Mean (bps)	Median (bps)
Quarter-1	5,835	81.45	61.80	1,872	82.34	63.51	104.27	71.50
Quarter+1	5,835	74.14	59.02	1,872	75.52	59.28	96.60	71.01
Difference		-7.31***	-2.78***		-6.82***	-4.23***	-7.67	-0.49

Panel C, Amihud	Universal Sample			Treated Sample			Matched Sample	
Event window	N	Mean	Median	N	Mean	Median	Mean	Median
Month-1	5,754	44.75	29.48	1,872	46.49	31.24	54.44	34.98
Month+1	5,754	35.76	25.28	1,872	37.60	27.26	54.69	35.60
Difference		-8.99***	-4.20***		-8.89***	-3.98***	0.25	0.62

Panel D, Amihud	Universal Sample			Treated Sample			Matched Sample	
Event window	N	Mean	Median	N	Mean	Median	Mean	Median
Quarter-1	5,835	44.58	30.96	1,872	46.92	32.91	54.27	37.19
Quarter+1	5,835	37.46	27.32	1,872	39.62	29.45	54.51	36.02

Difference	-7.12***	-3.64***	-7.30***	-3.46***	0.24	-1.17

Table 4. The impact of bond maturity and rating difference between new and existing bonds on the liquidity change for existing bonds surrounding a new debt issue announcements.

Panels A (C) and B (D) report the change of monthly and quarterly bid-ask spread (Amihud price impact) surrounding the new debt issuance.

Event window	N	Mean (bps)	Median (bps)	N	Mean (bps)	Median (bps)	Mean (bps)	Median (bps)
Panel A, Bid-Ask		Maturity: New>Existing			Maturity: New<Existing		Difference	
Monthly	1,750	-1.97*	-1.89***	1,087	0.20	0.84	-2.17*	-2.73**
Quarterly	1,750	-6.54***	-4.53***	1,087	-1.32	0.35	-5.22***	-4.88***

Event window	N	Mean (bps)	Median (bps)	N	Mean (bps)	Median (bps)	Mean (bps)	Median (bps)
Panel B, Bid-Ask		Rating: New<Existing			Rating: New>Existing		Difference	
Monthly	144	-12.59***	-1.30*	230	1.35	4.07	-13.94**	-5.37***
Quarterly	144	-11.27**	-4.28**	230	-4.21	-2.22	-7.06*	-2.06*

Event window	N	Mean	Median	N	Mean	Median	Mean	Median
Panel C, Amihud		Maturity: New>Existing			Maturity: New<Existing		Difference	
Monthly	1,750	-1.86***	-0.38***	1,872	-0.73	0.79	-1.13*	-1.17***
Quarterly	1,750	-1.76***	-0.98***	1,872	0.02	0.35	-1.78*	-1.33***

Event window	N	Mean	Median	N	Mean	Median	Mean	Median
Panel D Amihud		Rating: New<Existing			Rating: New>Existing		Difference	
Monthly	144	-7.14	-0.81	230	-4.06*	-1.82*	-3.08	1.01
Quarterly	144	4.04	1.04	230	-1.34	-0.01	5.38	1.05

Table 5. The determinants of bond market monthly liquidity changes surrounding new debt issuance

Using data from the "treated" sample above, the dependent variables are, respectively, the change in the bid-ask spread (Panel A) and Amihud measure (Panel B) from the month before the new debt issuance to the month after the new bond issuance. The sign in parentheses are the predicted sign. We run the following regression in first panel: Δ(BA) = f (size/A, dummy variable for difference of maturity, dummy variable for investment rating bonds, leverage, control variables). In the second panel, the dependent variable is the Amihud measure. To avoid underestimating the standard deviation associated with the potential correlation in liquidity measures within the same firm, we estimate the regressions using firm clustered residuals. P-values for the significance of the coefficients are reported.

Panel 5A. Dependent variable (Bid-Ask) : ΔSpread= Spread_Post_Month- Spread_Pre_Month

	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value
New debt issuance/total asset (+)	3.08	0.81	2.62	0.84	67.74	0.20	16.89	0.62
Dummy variable for maturity: new>existing (-)	-2.61	0.07						
Log of maturity for preexisting bonds (+)			1.21	0.02				
Dummy variable for seniority: new<existing (-)					-25.74	0.01		
Dummy variable for rating: new<existing (-)							-11.54	0.03
Dummy for investment rating bonds (+)	1.39	0.59	1.43	0.56	14.77	0.20		
Leverage ratio (+)	0.77	0.92	0.73	0.92	-18.32	0.62	-11.08	0.60
log of avg. daily bonds traded -6 months (+)	2.16	0.00	2.26	0.00	2.43	0.55	1.19	0.64
2007 December- 2010 July	-1.62	0.69	-1.64	0.68	-25.12	0.15	-31.87	0.04
MOVE index (-)	0.05	0.38	0.06	0.33	0.10	0.70	0.19	0.18
VIX index (-)	-0.43	0.05	-0.43	0.05	-0.80	0.48	-1.21	0.13
Intercept	-13.56	0.09	-18.55	0.01	-10.49	0.81	3.80	0.89
R-squared	0.02		0.03		0.03		0.02	
N	12,431		12,460		489		1,042	

Panel 5B. Dependent variable (Amihud): ΔDepth= Depth_Post_Month- Depth_Pre_Mouth

	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value
New debt issuance/total asset (+)	0.97	0.91	0.06	0.99	82.85	0.15	26.71	0.42
Dummy variable for maturity: new>existing (-)	-1.46	0.10						
Log of maturity for preexisting bonds (+)			0.89	0.00				
Dummy variable for seniority: new<existing (-)					3.65	0.62		
Dummy variable for rating: new<existing (-)							0.66	0.84
Dummy for investment rating bonds (+)	-0.49	0.74	-0.63	0.67	3.10	0.63		
Leverage ratio (+)	-2.52	0.43	-2.10	0.51	-34.92	0.02	-17.10	0.12
log of avg. daily bonds traded -6 months (+)	1.03	0.06	1.03	0.05	4.82	0.31	3.27	0.24
2007 December- 2010 July (-)	-4.91	0.04	-5.03	0.03	-5.96	0.71	-12.20	0.25
MOVE index (-)	0.00	0.89	0.00	0.96	-0.24	0.40	0.14	0.26
VIX index (-)	-0.04	0.69	-0.04	0.71	0.99	0.27	-0.33	0.48
Intercept	-4.61	0.38	-7.34	0.12	-32.32	0.44	-28.31	0.21
R-squared	0.01		0.02		0.04		0.01	
N	12,430		12,458		489		1,042	

Table 6. The determinants of bond market quarterly liquidity changes surrounding new debt issuance

Using data from the "treated" sample above, the dependent variables are, respectively, the change in the bid-ask spread (Panel A) and Amihud measure (Panel B) from the month before the new debt issuance to the month after the new bond issuance. The sign in parentheses are the predicted sign. We run the following regression in first panel:: $\Delta(BA) = f$ (size/A, dummy variable for difference of maturity, dummy variable for investment rating bonds, leverage, control variables). In the second panel, the dependent variable is the Amihud measure. To avoid underestimating the standard deviation associated with the potential correlation in liquidity measures within the same firm, we estimate the regressions using firm clustered residuals. P-values for the significance of the coefficients are reported.

Panel 6A. Dependent variable (Bid-Ask): ΔSpread= Spread_Post_Quarter- Spread_Pre_Quarter

	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value
New debt issuance/total asset (+)	9.08	0.47	7.02	0.57	84.50	0.23	43.51	0.33
Dummy variable for maturity: new>existing (-)	-4.63	0.00						
Log of maturity for preexisting bonds (+)			1.62	0.00				
Dummy variable for seniority: new<existing (-)					-22.71	0.05		
Dummy variable for rating: new<existing (-)							-11.52	0.09
Dummy for investment rating bonds (+)	5.14	0.13	5.46	0.10	6.93	0.67		
Leverage ratio (+)	-6.61	0.51	-6.41	0.52	-24.45	0.61	-18.53	0.53
log of avg. daily bonds traded -6 months (+)	3.68	0.00	3.90	0.00	9.37	0.02	7.03	0.00
2007 December- 2010 July (-)	-3.37	0.39	-3.71	0.35	-35.63	0.14	-31.45	0.14
MOVE index (-)	0.01	0.82	0.03	0.66	-0.14	0.67	0.20	0.39
VIX index (-)	-0.78	0.00	-0.80	0.00	-2.47	0.09	-3.31	0.01
Intercept	-18.67	0.05	-27.04	0.00	-14.02	0.73	-9.79	0.71
R-squared	0.02		0.02		0.15		0.11	
N	12,431		12,460		489		1,042	

Panel 6B. Dependent variable (Amihud): ΔDepth= Depth_Post_Quarter- Depth_Pre_Quarter

	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value
New debt issuance/total asset (+)	12.40	0.04	11.97	0.05	24.12	0.33	35.64	0.11
Dummy variable for maturity: new>existing (-)	-1.92	0.00						
Log of maturity for preexisting bonds (+)			1.13	0.00				
Dummy variable for seniority: new<existing (-)					-3.67	0.52		
Dummy variable for rating: new<existing (-)							-0.74	0.81
Dummy for investment rating bonds (+)	1.94	0.16	1.87	0.17	-0.84	0.87		
Leverage ratio (+)	-2.88	0.36	-2.66	0.40	-19.76	0.17	-14.31	0.18
log of avg. daily bonds traded -6 months (+)	1.42	0.00	1.41	0.00	2.73	0.35	1.80	0.23
2007 December- 2010 July (-)	-3.01	0.10	-3.26	0.07	7.21	0.58	-2.61	0.77
MOVE index (-)	0.02	0.45	0.03	0.35	-0.08	0.68	0.13	0.24
VIX index (-)	-0.29	0.00	-0.29	0.00	-0.86	0.21	-1.15	0.01
Intercept	-7.69	0.03	-11.18	0.00	6.11	0.81	-2.01	0.86
R-squared	0.01		0.01		0.05		0.03	
N	12,430		12,458		489		1,042	

Appendix A.

Variable	Description
Market to Book Ratio	Market-to-book ratio. Measured by Compustat variables ((lt-txditc+prcc_f*csho+preferred)/at). Where "preferred" is measured by "pstkl," "pstkrv," or "pstk."
EBIT to Total Assets	Earnings before interest and taxes, scaled by total assets. Measured by Compustat variables ((ib+xint+txt)/at).
PPE to TA	Property, plant, and equipment, scaled by total assets. Measured by Compustat variables (ppent/at).
Book-Debt Ratio	Book-debt ratio. Measured by the Compustat variables ((dltt+dlc)/at).
Dividend Dummy	Indicator variable; takes a value of one if the firm declared dividends on common stock. Measured by the Compustat variable "dvc."
Log(Sale)	Natural logarithm of "Sales."
CAPEX to Total Assets	Net capital expenditures relative to total assets
Treasury Weighted Maturity	The average maturity of outstanding Treasury debt value-weighted by outstanding principal.
Termstructure 10y-6mth	The difference between the percentage yields of 10-year and six-month Treasury securities, measured monthly.
Moodys BBB-AAA30Y	The difference between the percentage yields of Moody's 30-year BBB- and AAA-rated corporate bond indices, measured monthly.
Quarterly GDP Growth	Growth in real GDP over the past quarter (fraction), measured quarterly.
New bond maturity (years)	The number of years before the bond is expired; For multiple debt offerings issued by the same firm on the same day, I calculate an average maturity, rating and seniority level as the weighted average of each component offering's maturity, rating and seniority level in these cases, where the component weights are the proceeds of each bond issuance relative to total offering proceeds.
New bond rating	A value of 1 (2,3,…) is assigned to Moody's rating of Aaa (Aa1, Aa2,…); for multiple debt offerings, the calculation of a firm's new bond rating is the same as new bond maturity.
Existing bond maturity (years)	The number of years remaining before the bond matures
Maturity: New<Existing	Dummy variable if a new bond's maturity is shorter than existing bond.
Existing bond rating	A value of 1,2,3,… is assigned to Moody's rating of Aaa,Aa1, Aa2, Aa 3….
Avg. daily bonds traded -6 months (# of bonds)	The average number of bonds traded daily in the past six months.