The Value of Corporate Bond Listing

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A B S T R A C T

We study the impact of bond exchange listing in U.S. publicly traded corporate bond markets. We find that listed corporate bonds have lower estimated bid-ask spreads than unlisted corporate bonds. Specifically, we show that listed bonds have estimated spreads $0.14 lower than unlisted bond spreads. We find that execution venue matters for listed bonds, and that listed bond executions on the NYSE have higher trading costs than listed bond executions off-NYSE. We show that listed bonds are more volatile than unlisted bonds. Last, we study bond trading around earnings announcements and find a slight increase (decrease) in overall (institutional) volume on earnings announcement days compared to non-announcement days.

Keyword : corporate bond, bond market, exchange listing, bid-ask spread, earnings announcement

1. INTRODUCTION

Firms in the U.S. can choose to list bond issuances on the New York Stock Exchange (NYSE) or to issue unlisted debt. Listed bonds trade on the NYSE or any of the Trade Reporting and Compliance Engine (TRACE) bond trading platforms, while unlisted bonds trade only on TRACE bond trading platforms (and not on the NYSE). The TRACE trade report includes TRACE bond trades and excludes bond trades that execute on the NYSE.

We contribute to the corporate bond literature in three ways. First, we highlight the differences between listed and unlisted bond liquidity and trading costs. Second, we analyze listed bond trades reported to TRACE and listed bond trades that execute on the NYSE to determine if there is a market quality advantage to trading listed bonds on the listing exchange. Despite the introduction of post-trade transparency in the over the counter (OTC) corporate bond market, the market is still inefficient, possibly due to structural issues (Hendershott and Madhavan, 2015). Hence, our second contribution adds to the growing discussion on bond market execution quality. Third, we determine if listing plays a role in a bond's investor base by examining institutional trading activity in listed bonds.

We study a security (listed bonds) that trades in different environments (over the counter versus exchange). In a related paper, Hong and Warga (2000) compare retail trades on the NYSE ABS (now, NYSE Bonds) to large, over the counter (OTC) trades by insurance companies using data from 1995 to 1997. They find larger spreads for NYSE ABS trades ($0.21) compared to OTC trades ($0.13). Our paper differs from Hong and Warga's. Hong and Warga do not address bond listing or the role bond listing plays in trading activity. We analyze listed bonds and unlisted bonds and directly compare OTC trades to exchange trades in corporate bonds for 2018. Hong and Warga compare a subset of large insurer trades to bond exchange trades. Our sample is not restricted to a specific size or type of bond trade. Third, we provide a comparison of listed and unlisted bonds and also of exchange and OTC trades. Hong and Warga compare large OTC trades to small retail trades on the NYSE ABS, which we believe biases their results towards finding a higher trading cost for the NYSE.

There is a growing interest in corporate bond market structure and execution quality. Prior research details the prevalence of price dispersion in the historically opaque and fragmented corporate bond market (Bessembinder, Maxwell, and Venkataraman, 2006; Edwards, Harris, and Piwowar, 2007; and Schultz, 2001). TRACE was introduced to aid in post-trade transparency in the corporate bond market in 2002. Bessembinder, Maxwell, and Venkataraman study spreads before and after the introduction of TRACE. Using a sample of insurance firms' trades, Bessembinder, Maxwell, and Venkataraman show that spreads fall by five to eight basis points for bonds required to report under TRACE. Edwards, Harris, and Piwowar study the effect of TRACE on trading costs for corporate bonds. They find that spreads fall significantly following the introduction of transparency (after the implementation of TRACE). Goldstein, Hotchkiss, and Sirri (2007) find that spreads decline for transparent bonds following the introduction of TRACE.

Despite efforts to improve execution and transparency in the bond market, the corporate bond market still lags the equity market in terms of market quality. Rick Ketchum, CEO of the Financial Industry Regulatory Authority (FINRA), commented, "It strikes me as odd that we have spent enormous energy in equity markets to measure and save pennies or just basis points on execution quality, while in the fixed income market it is more a question of nickels, dollars, and quarters."

O'Hara, Wang, and Zhou (2018) document that activity plays a large role in execution quality for institutional traders. Less active investors pay 0.49% more for bond purchases yet receive 1.78% less for bond sales. The difference amounts to less active institutions paying an additional $4.90 on purchases, but losing nearly $18 on sales. These differences in execution quality between active and less active firms are greatest for small trades while virtually no difference exists for block trades.

Our paper fits with the above research on bond market quality. We provide evidence about differences in market quality between the OTC market and the exchange market. Since we use both TRACE and NYSE data (and since the electronic trades on the NYSE are not reported to TRACE), we conduct a clean test of market quality. We document a value to listing on the NYSE by showing better market quality for bonds listed on an exchange and provide support for the introduction of pre-trade transparency in the bond market. Further, by studying the NYSE Bond Market, we contribute to the discussion regarding the importance of electronic trading.

2. HYPOTHESES

We focus on the differences between listed and unlisted bonds. Previous work shows that bonds are more expensive to trade than equities.[1] It is not clear, however, if listed bonds offer better execution costs than unlisted bonds. Empirically, Huang and Stoll (1996) and Bennet and Wei (2006) show trading costs are lower for NYSE-listed stocks than OTC stocks. In addition, Bessembinder and Kaufman (1997) find that trading costs are higher for off-NYSE trades than for NYSE trades in NYSE-listed stocks. We predict that, similar to listed stocks, listed bonds have lower estimated spreads than unlisted bonds. In addition to comparing listed and unlisted bonds, we also compare NYSE trades to OTC trades for listed bonds. We (briefly) focus on listed bonds alone because unlisted bond trades are reported only to TRACE, while listed bonds may have trades executed on the NYSE or reported to TRACE. Previous research by Hendershott and Madhavan (2015) compares OTC trades to electronic venue trades. In our study, we compare electronic trades from the exchange market (NYSE) to traditional over the counter trades (TRACE). Hendershott and Madhavan find that electronic bond trades have lower spreads than similar sized trades in the OTC market. Their electronic venue is an auction venue with potential for price negotiation, while ours (the NYSE) is an electronic limit order book with firm prices. We hypothesize that NYSE bond trades have lower spreads than off-exchange trades in the OTC market.

Second, we focus on price efficiency. Listing also affects price efficiency, as indicated in Heidle and Huang (2002) and Baruch and Saar (2009). We measure price efficiency using volatility as in Downing and Zhang (2004). Bennet and Wei (2006) show that volatility falls for stocks that switch their listing to the NYSE, and Baruch and Saar find that a firm's choice to list on an exchange with similar firms can lead to more efficient information processing by market makers. Our second hypothesis is that price efficiency is positively related to bond listing.

Third, we focus on the relation between listing and a firm's investor base. Previous research shows that exchange listing is a way for firms to expand their investor base to include more institutional investors. Kadlec and McConnell (1994) show that NYSE listing leads to a 27% increase in the number of institutional shareholders for a firm. Given the prevalent role of institutional traders in the bond market (Bessembinder, Kahle, Maxwell, and Xu, 2009), listing may serve as a way to attract large institutional traders to certain bonds.[2] Therefore, we hypothesize that listed bonds have more institutional trading activity than unlisted bonds. Overall, our three focus areas – listing venue advantage, price efficiency, and institutional activity – provide valuable market quality indications about the corporate bond market.

3. THE OTC BOND MARKET VERSUS THE EXCHANGE BOND MARKET

United States corporate bonds can list on the New York Stock Exchange and trade in both the over the counter market and the exchange market. Unlisted bonds trade in the over the counter market only. Trades in the over the counter market are reported to TRACE, while trades executing on the NYSE are not.

TRACE was initiated in 2002 and became fully functional in 2005.[3] TRACE, the first implementation of post-trade transparency in the corporate bond market, requires that trades in corporate bonds report within fifteen minutes of execution. To date, TRACE does not facilitate pre-trade transparency. The NYSE offers an exchange environment for corporate bond trading. The NYSE Bonds platform is a transparent trading environment for bond traders. Prices are firm on the NYSE. Orders are matched on a strict price-time priority basis with the limit order book. Traders may place a limit order, reserve order, or good until cancelled order. Execution fees are charged per bond for trades that take liquidity from the order book. However, if the trade makes liquidity, there is no fee on the NYSE, thus potentially providing an incentive to be a liquidity maker on the NYSE and a liquidity taker on TRACE.

4. SAMPLE AND DATA

We use bond transaction data for the 2018 calendar year. Our bond trade data is from two sources: TRACE and the NYSE. We follow Bessembinder, Maxwell, and Venkataraman (2006) in making data deletions.[4] We require the bond to trade at least ten times during our sample period.[5] We obtain daily shares outstanding and daily stock prices from CRSP to calculate the firm's daily market capitalization, and we obtain bond issuance characteristic information from Bloomberg.

We compare listed to unlisted bonds and bond trading venues in our study. The NYSE bond market and TRACE operate with different trading hours. The NYSE offers three bond trading sessions during the day: 4:00 am - 9:30 am EST (Early Trading); 9:30 am – 4:00 pm EST (Core Trading); and 4:00 pm – 8:00 pm EST (Late Trading). TRACE reporting is allowed from 8:00 am – 6:30 pm EST. To provide a clean comparison, we use the overlapping time between TRACE reporting hours and NYSE trading hours. As a result, we use trades that execute between 8:00 am EST and 6:30 pm EST. Following all data deletions, we have 6,841,030 bond trades in 12,633 bonds for the 2018 calendar year (our full sample period). NYSE Bonds' trading hours have changed since the data used in this paper became available. We use the trading hours that applied during the time of our study.

Table 1 provides trade statistics for our sample. 73.3% of our trade sample involve an investment grade bond. 81.53% of trades involve a bond with less than ten years to maturity. We also focus on top bonds as defined by Ronen and Zhou (2013). Ronen and Zhou show that trades in some firm's bonds potentially have more information than trades in other bonds for that same firm. They designate top bonds using the number of large trades; specifically, they label a bond as a firm's top bond for the day if it has the most trades larger than $500,000 in size on that trading day. Top bonds make up the majority of trades in our sample, accounting for 52.12% of all transactions. Trades greater than $25,000 account for 47.36% of trades, while trades greater than $500,000 (institutional trades) account for only 13.44% of trades. Substantially more trades occur in bonds priced above par value (76.23%) than bonds priced below par value (23.13%).

We also divide our trade statistics by listed and unlisted bonds. Unlisted bond trades are fairly evenly split between investment grade and high yield bonds, while listed bond trades are dominated by investment grade bonds. Investment grade bonds account for 81.07% of listed bond trades, while high yield bonds account for just 18.93%. Roughly 40% of bond trading in both listed and unlisted bonds are for bonds with less than five years to maturity, while over 80% of trades in both listed and unlisted bonds are for bonds with less than ten years to maturity. The percentage of institutional trades (trades greater than $500,000) is 16.22% for unlisted bonds and 12.30% for listed bonds. Trades greater than $1,000,000 make up similar portions of listed and unlisted bonds (6.54% compared to 5.08%).

Table 2 provides summary statistics for price, dollar volume, number of daily trades, trade size, volatility, and estimated bid-ask spreads for the full sample of bonds. The sample statistics are calculated for the days each bond trades in the sample. Given the illiquidity of the bond market, there are days on which bonds do not trade during the sample. Price is the average percentage of par for each trade. Dollar volume is the average daily dollar trading volume for each bond, and number of trades is the average daily number of trades for each bond. Trade size is the average daily trade size for each bond. We estimate volatility following Downing and Zhang (2004).[6] We estimate a per trade transaction cost following Hendershott and Madhavan (2015).[7] Our spread estimations are presented as a portion of value, and the last interdealer trade is the benchmark price. Buy transactions are signed one, and sell transactions are signed negative one. Interdealer trades are given a sign of zero. The sample includes 12,633 bonds that trade during the 2018 calendar year. On average, the bonds in the sample trade at 105.49% of par. The average estimated bid-ask spread for the full sample of bonds is 1.67%. The average bond trades 4.73 times each day and transacts over $1,500,000 in daily dollar volume with an average trade size of roughly $380,000. Panel B details the summary statistics for listed bonds, and Panel C details the summary statistics for unlisted bonds. The average listed bond trades at 109.44% of par, while the average unlisted bond trades at 102.73% of par. The average listed bond trades nearly six times each day, while the average unlisted bond trades about four times each

Table 1
Trade Level Sample Statistics

Table 1 provides a trade-level description of the sample. The sample includes 6,841,030 bond trades during the year 2018. Bond trades in the sample occur from 8:00 am – 6:30 pm EST. We follow Ronen and Zhou (2013) by labeling a bond as a firm's top bond for the day if it has the most trades larger than $500,000 in size on that trading day.

	% of Total Trades	% of Listed Bond Trades	% of Unlisted Bond Trades
% investment grade bond trades	73.30%	81.07%	54.32%
% high yield bond trades	26.70%	18.93%	45.68%
% trades in bonds with less than 1 year to maturity	5.19%	3.08%	10.35%
% trades in bonds with less than 5 years to maturity	44.09%	44.15%	43.94%
% trades in bonds with less than 10 years to maturity	81.53%	81.92%	80.57%
% top bond trades	52.12%	53.96%	47.62%
% trades greater than $25,000	47.36%	46.12%	50.38%
% trades greater than $50,000	34.71%	33.23%	38.30%
% trades greater than $100,000	26.23%	24.69%	29.99%
% trades greater than $500,000	13.44%	12.30%	16.22%
% trades greater than $1,000,000	6.11%	6.54%	5.08%
% trades of premium bonds	76.23%	77.90%	72.14%
% trades of discount bonds	23.13%	21.77%	26.45%
% trades at par	0.64%	0.32%	1.41%

Table 2
Sample Summary Statistics (Bond Level)

Table 2 provides summary statistics for the sample. The sample includes 6,841,030 bond trades during the year 2018. Bond trades in the sample occur from 8:00 am to 6:30 pm EST. We follow Ronen and Zhou (2013) by labeling a bond as a firm's top bond for the day if it has the most trades larger than $500,000 in size on that trading day. Price is stated as a percentage of par. Dollar volume is the daily dollar volume for each bond, and the number of trades is the daily number of trades for each bond. Trade size is the average daily dollar trade size. Volatility is calculated as in Downing and Zhang (2004). Spreads are estimated for each bond trade following Hendershott and Madhavan (2015).

	All Bonds	*Top Bonds*	*Difference*
	Mean	*Mean*	
Panel A: Full Sample			
Price	105.49%	107.46%	-1.97%***
Dollar Volume	$1,559,216.10	$4,464,537.46	-$2,905,321.36***
Number of Trades	4.73	6.93	-2.20***
Trade Size	$381,336.29	$1,176,863.39	-$795,527.10***
Volatility	2.15	1.99	0.16
Estimated Bid-Ask Spread	1.67%	0.66%	1.01%**
Number of Bonds	12,633	8,375	
Panel B: Listed Bonds			
Price	109.44%	109.37%	0.07%
Dollar Volume	$2,192,225.57	$4,819,489.08	-$2,627,263.51***
Number of Trades	5.71	7.16	-1.45***
Trade Size	$488,023.17	$1,231,376.63	-$743,353.46***
Volatility	2.17	2.08	0.09
Estimated Bid-Ask Spread	1.12%	0.58%	0.54%**
Number of Bonds	5,199	4,725	
Panel C: Unlisted Bonds			
Price	102.73%	104.98%	-2.25%***
Dollar Volume	$1,116,518.19	$4,005,045.29	-$2,888,527.10***
Number of Trades	4.04	6.64	-2.60***
Trade Size	$306,724.36	$1,106,294.87	-$799,570.51***
Volatility	2.14	1.88	0.26**
Estimated Bid-Ask Spread	2.15%	0.79%	1.36%**
Number of Bonds	7,434	3,650	

day. Listed bonds have an average daily dollar volume of over $2,000,000, while unlisted bonds execute a daily average of slightly more than $1,000,000 in volume. Listed bonds appear to have lower estimated spreads than unlisted bonds. Listed bonds have an average estimated spread of 1.12% while unlisted bonds have an average estimated spread of 2.15%. Volatility seems to be reasonably similar between the listed and unlisted bonds.

We also provide summary statistics for the top bonds in the sample. A bond is designated as the firm's top bond, as in Ronen and Zhou (2013), if the bond has the most institutional trading (trades of $500,000 or more) out of all the firm's bonds on a given day. Throughout the sample period, 8,375 bonds are classified as a firm's top bond. Ronen and Zhou use the top bond measure as a way to gauge informational efficiency in the bond market. Historically, the bond market is thought to be less informationally efficient than the stock market, yet Ronen and Zhou show that when institutional trading is taken into account, the bond market is equally informationally efficient to the equity market. Separating top bonds from the rest of the sample is valuable because it enables us to study the most informationally efficient bonds. Top bonds trade, on average, at 107% of par and transact nearly $4,500,000 in average daily volume. Top bonds trade on average seven times per day and have an average daily trade size of over $1,100,000. The average top bond trade has an estimated estimated bid-ask spread of 0.66%.

We divide the top bonds into listed and unlisted bonds and report the statistics in Table 2. Overall, listed top bonds trade at 109% of par and transact almost $5,000,000 in daily volume. Listed top bonds trade about seven times each day, on average, and have an average trade size of over $1,200,000. The average estimated spread for listed top bonds is 0.58%. Unlisted top bonds trade above par as well, trading at 104% of par. Unlisted top bonds appear to have slightly less average daily volume than listed top bonds, but not by much. Unlisted top bonds have an average daily dollar volume of over $4,000,000 and an average trade size of over $1,000,000. Listed top bonds appear to have smaller spreads than unlisted top bonds, similar to the results documented for the full sample.

4. BOND INTRADAY TRADING

To give the reader more insight into our sample, we highlight a couple of aspects of our bonds' intraday trading activity.[8] We show the average number of bond trades and average bond trade size during thirty minute increments from 8:00 am to 6:30 pm in Figures 1 and 2. We utilize 8:00 am – 6:30 pm because it is the overlapping time between TRACE reporting hours and the NYSE bond market's hours at the time of our study. The average number of bond trades increases gradually during the day and spikes around 4:00 pm, which is when NYSE core

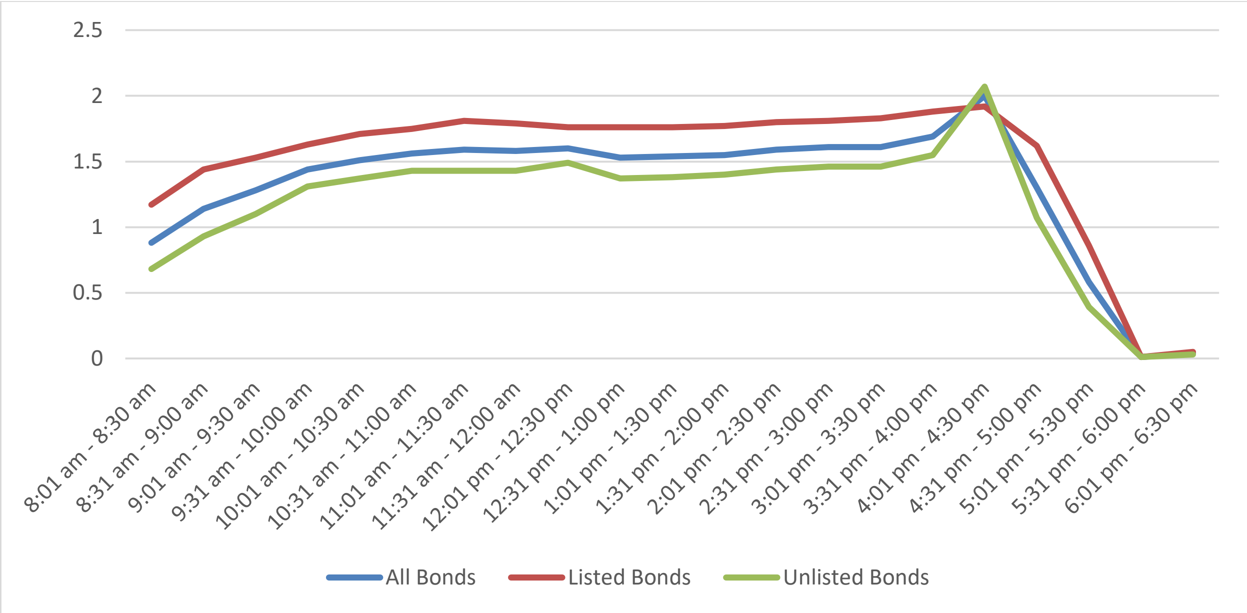

Figure 1. Intraday Average Number of Bond Trades.

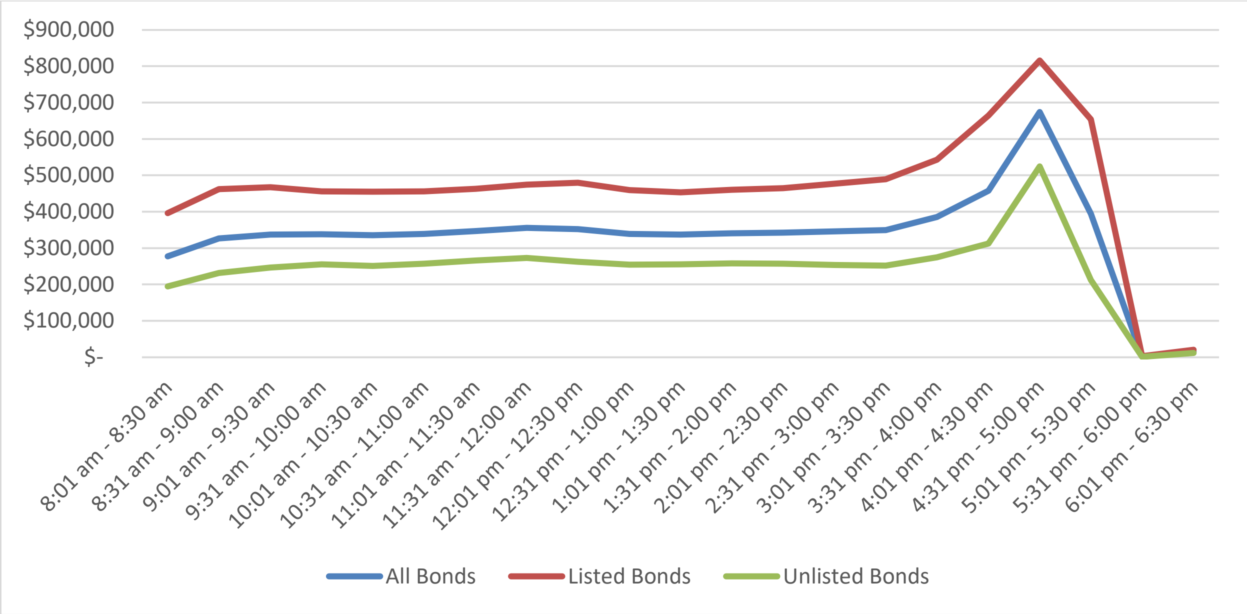

Figure 2. Average Intraday Bond Trade Size.

trading ends. We also show the average number of trades by listed and unlisted bonds. Listed bonds appear to trade, on average, more often than unlisted bonds during the trading day. Both types of bonds appear to have a trading spike around 4:00 pm, but the increase looks more dramatic for unlisted bonds. It is interesting to note that unlisted bonds, which do not trade on the NYSE platform, experience a spike in trading at the close of NYSE core trading. The average number of trades drops after 4:30 pm, approaching zero as TRACE reporting concludes at 6:30 pm.

Figure 2 illustrates that the average trade size is fairly consistent during the trading day, but increases leading up to 5:00 pm. The average trade size for listed and unlisted bonds begins to increase between 3:01 pm and 3:30 pm. Prior to the increase, the average trade size for listed bonds is just under $500,000, and the average trade size for unlisted bonds is just under $300,000. After 5:00 pm, the average trade size declines. From 4:31 pm to 5:00 pm, listed bonds have an average trade size of $800,000, whereas unlisted bonds have an average trade size of $500,000 during the same period.

5. RESULTS

5.1 Estimated Bid-Ask Spread

Listed bonds can trade on the NYSE or through the various bond trading platforms that report trades to TRACE, with the potential for execution quality and liquidity differences to exist across the trading venues. Previous research on equities documents substantial differences between trading venues. For example, Huang and Stoll (1996) find that execution costs are larger for a sample of NASDAQ stocks than for a sample of NYSE stocks; Bessembinder (1999, 2003) shows that NASDAQ stocks have higher trading costs than NYSE stocks following both tick size reductions and changes in order handling rules. We analyze a sample of listed bonds that trade on both the NYSE and TRACE reporting venues during our time period to see if differences in execution costs exist across bond reporting venues.

The market microstructure literature provides examples for estimating spreads for both corporate and municipal bonds. Hong and Warga (2000) utilize a simple but effective methodology and use contemporaneous buy and sell prices to calculate an imputed spread. The imputed spread method subracts the average sell price from the average buy price for each day. This method has limitations, though, in that it requires both a buy and a sell trade on each trading day and in that it computes a daily spread measure. The bond market's illiquidity makes the imputed spread method limiting in its usefulness. A regression approach similar to that used by Harris and Piwowar (2006) and Hendershott and Madhavan (2015) allows us to utilize our entire dataset. The regression approach also allows us to estimate a per trade transaction cost, and we utilize the last interdealer trade for each bond as the benchmark or most representative price. We define trading cost following Hendershott and Madhavan (2015).[9] In our cost estimation, the trade sign equals one for a purchase and negative one for a sell. Interdealer trades have a sign of zero.[10] Our cost estimates are expressed as a fraction of trade value as opposed to yield. The regression method allows us to assign a transaction cost to each unique trade, thus increasing the usability of our data and the effectiveness of our results.

Table 3 Panel A provides statistics on our sample of listed bonds. The summary statistics in Table 3 are calculated using the same methods as those in Table 2. Overall, there is a slight difference in the prices of listed bond trades on the NYSE and listed bond trades on the TRACE venues. On average, listed bond trades on the NYSE are less frequent, have a lower trade size, and hence, have a lower daily dollar volume than TRACE venue trades. Price volatility for NYSE trades is higher than for TRACE trades, but the difference in volatility is small (0.18). Listed bond trades on TRACE venues have lower estimated spreads than listed bond trades on the NYSE. NYSE trades have an average estimated spread of 1.89%, while TRACE trades have an average estimated spread of 1.08%. The spread differential could be driven by many factors. For one, TRACE may offer better execution quality and liquidity for bond traders. Or, the differential in spread could be driven by the fact that larger trades execute via TRACE, and there is an inverse relation between bond trade size and trading cost. Edwards, Harris, and Piwowar (2007), Harris and Piwowar (2006), and Goldstein, Hotchkiss, and Sirri (2007) document an inverse relation between trade size and trading cost in the bond market, and the smaller trade size on the NYSE could lead to a higher trading cost.

Table 3 Panel B provides statistics on the listed top bonds, the bonds with the most institutional dollar volume for each firm as defined by Ronen and Zhou (2013). There is no difference in the price of top bond trades on the NYSE and TRACE venues. Top bonds trade more times each day, have higher daily dollar volume, and have larger average trade sizes on the TRACE venues than top bond trades on the NYSE. TRACE trades in top bonds have lower estimated spreads than NYSE trades in top bonds, similar to Panel A. NYSE top bond trades have an average estimated bid-ask spread of 1.54%, while TRACE top bond trades have an average estimated spread of 0.99%, a 0.55% difference.

Listed bonds trade on either the NYSE bond trading platform or via a TRACE venue. Unlisted bonds trade only via dealers who report their executed trades to the TRACE system. One of our goals in this paper is to document (potential) differences in market quality between listed and unlisted bonds as current research suggests there is a market quality advantage to listing.[11] To accurately document or highlight differences between listed and unlisted bonds, though, we cannot ignore potential endogeneity issues in listing venue choices. We employ a two stage regression analysis following Hendershott and Madhavan (2015) when estimating transactions costs in the corporate bond market.

Table 4 provides the estimates for the first stage of the switching model. In stage one, the dependent variable is equal to one for an NYSE listed bond and zero for an unlisted bond. We separate our sample into all bonds and top bonds in Table 4. We utilize variables related to firm conditions and bond characteristics in stage one. Factors such as firm size, debt issuances, and bond issuance characteristics are likely to influence the firm's listing decision. Industry classification may also play a role in listing decisions, given that some industries, such as financials and utilities, are more heavily regulated than others. Overall, we find that larger firms and firms with larger debt issuances are more likely to list debt on the NYSE. We also find that financial firms and investment grade debt issuances are more likely to be listed on the NYSE. Lastly, we show that top bonds and bonds with greater levels of volatility are more likely to be listed on the NYSE. We find similar results for top bonds with one notable differences. Industry (ie, financial) does not matter for top bond listing. Maturity does not influence the listing decision for any bonds in our sample.

We utilize the estimates for firm size, issue size, other issue size, investment grade, maturity, top bond, and volatility in the second stage of our switching model (Table 5). We also control for trade size, execution venue (equal to one if TRACE and zero otherwise), and listing (equal to one if listed on the NYSE and zero otherwise). The *Listed* variable documents a cost advantage for listed bonds. Our main variable of interest in the regression model is the *Listed* variable. *Listed* is equal to one if the bond is listed on the NYSE, and zero otherwise. If listing offers a market quality advantage as we predict, we should document a negative relation between the *Listed* variable and estimated spreads. Edwards, Harris, and Piwowar (2007) estimate bond spreads following the initiation of TRACE. Similar to Edwards et al, we expect to find a negative relation between estimated spreads and dollar volume, number of trades, and trade size. Bonds with more dollar volume and more trades are inherently more liquid than other bonds and should have lower trading costs. Additionally, we know from previous research

Table 3
Listed Bonds: NYSE versus TRACE

Table 3 compares the average summary statistics for listed bond trades that execute on the NYSE and listed bond trades that execute on TRACE. We follow Ronen and Zhou (2013) by labeling a bond as a firm's top bond for the day if it has the most trades larger than $500,000 in size on that trading day. Price is stated as a percentage of par. Dollar volume is the daily dollar volume for each bond on each trading venue (TRACE and the NYSE), and the number of trades is the daily number of trades for each bond on each trading venue (TRACE and the NYSE). Trade size is the average daily dollar trade size on each venue (TRACE and the NYSE). Volatility is calculated as in Downing and Zhang (2004). Spreads are estimated for each bond trade for listed and unlisted bonds following Hendershott and Madhavan (2015). Significance is indicated at the 1%, 5%, and 10% levels by ***, **, and *.

	NYSE	*TRACE*	*Difference*	*T-Stat*
Panel A: All Bonds				
Price	105.84%	105.52%	0.32%*	1.87
Dollar Volume	$10,094.86	$4,090,728.88	-$4,080,634.02***	-17.87
Number of Trades	1.27	13.66	-12.40***	-22.21
Trade Size	$8,113.32	$386,042.66	-$377,929.34***	-25.50
Volatility	3.51	3.33	0.18*	1.85
Estimated Bid-Ask Spread	1.89%	1.08%	-0.81%***	-4.66
Panel B: Top Bonds				
Price	105.08%	104.93%	0.16%	0.73
Dollar Volume	$12,028.33	$7,106,201.08	-$7,094,172.76***	-21.91
Number of Trades	1.27	18.15	-16.88***	-20.14
Trade Size	$9,587.53	$611,423.91	-$601,836.38***	-25.83
Volatility	4.01	3.59	0.42***	3.05
Estimated Bid-Ask Spread	1.54%	0.99%	-0.55%***	-4.24

Table 4
Listing Selection: Stage 1 Probit Model

Table 4 provides probit models for the binary choice between NYSE debt listing for all bonds and for top bonds. The dependent variable is equal to one if a bond is listed on the NYSE and zero otherwise. Firm size is the daily stock price multiplied times daily shares outstanding. Issue size is the dollar size of the debt issuance. Other issue size is the average issue size of all other outstanding debt for a firm. Investment Grade is equal to one for an investment grade bond, as designated in the TRACE master file. Financial (utility) is equal to one if a firm is classified as a financial (utility) firm using industry classification in Bloomberg. Maturity is the number of years to maturity as of the trade date. The Top Bond is equal to one for the bond with the most institutional trading each day. A trade is categorized as institutional if it is greater than $500,000 (Ronen and Zhou 2013). Volatility is calculated following Downing and Zhang (2004). Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *.

	All Bonds	Top Bonds
Constant	-0.28	-0.36
Firm Size	1.58***	1.46***
Issue Size	1.67***	1.29***
Other Issue Size	2.06***	1.99***
Investment Grade	2.00***	1.85***
Financial	1.46***	0.52
Utility	-0.06	-0.09
Maturity	-0.21	-0.28
Top Bond	1.64***	
Volatility	2.75***	2.46***
Observations	6,841,030	919,435

Table 5
Spread Cost Model: Stage 2

The Table 4 specifications are used to estimate the second stage cost model for listed and unlisted bonds controlling for endogenous selection. Trade size is the dollar amount of each trade. The Top Bond is equal to one for the bond with the most institutional trading each day. A trade is categorized as institutional if it is greater than $500,000 (Ronen and Zhou 2013). Maturity is the number of years to maturity as of the trade date. Firm size is the daily stock price multiplied times daily shares outstanding. Investment Grade is equal to one for an investment grade bond, as designated in the TRACE master file. TRACE Execution is equal to one if a trade occurs on a TRACE reporting venue. Listed is equal to one if the bond is listed. T stats are in parentheses, and significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *. Standard errors are clustered at the bond level.

	Column 1 *All Bonds*	*Column 2* *Top Bonds*
Constant	0.03***	0.05***
	(4.64)	(2.99)
Trade Size	-0.09***	-0.14***
	(4.88)	(3.75)
TRACE Execution	0.15***	0.19***
	(5.32)	(4.25)
Listed	-1.76**	-2.33***
	(8.25)	(7.24)
Firm Size	-0.26***	-0.24***
	(5.01)	(4.33)
Issue Size	-0.29***	-0.29***
	(4.99)	(3.46)
Other Issue Size	-0.24	-0.19
	(0.01)	(0.78)
Investment Grade	-0.19***	-0.21***
	(4.99)	(4.01)
Maturity	0.46***	0.49***
	(6.23)	(4.15)
Top Bond	-0.48***	
	(7.01)	
Volatility	0.56***	0.46***
	(7.05)	(5.01)

(Goldstein, Hotchkiss, and Sirri, 2007; and Edwards, Harris, and Piwowar, 2007) that an inverse relation between spreads and trade size exists in the bond market.

Larger firms are typically less risky than smaller firms, so we expect an inverse relation between firm size and spreads. Bonds with more time to maturity have more price risk than bonds that are closer to maturity, and bonds with more time to maturity have larger spreads than bonds closer to maturity. Volatility and spreads have a positive relation. We calculate volatility following Downing and Zhang (2004).[12] We expect that top bonds (bonds with the most trades over $500,000 for each firm on a given day) will have lower estimated spreads than non-top bonds. We predict investment grade bonds will have lower estimated spreads than non-investment grade bonds as investment grade bonds represent a safer investment.

Table 5 provides results of the estimated bid-ask spread regression analysis using the second stage of our switching model. Column 1 in Table 5 includes the full sample of bond trades, whereas Column 2 in Table 5 utilizes top bond trades. We find a negative relation between our main variable of interest in the spread regressions, *Listed,* and estimated spreads. The magnitude of the coefficient indicates that listed bond spreads are 1.76% lower than unlisted bond spreads. The negative relation between bond listing and estimated spread provides evidence that bond listing gives value to bond traders in the form of reduced trading costs. The negative relation between estimated spreads and listing supports our first hypothesis that listed bonds have lower spreads than unlisted bonds.

In addition to the bond listing variable, we are interested in the *Top Bond* variable. Focusing on the *Top Bond* variable allows us to see the relation between institutional trading activity and the bond estimated bid-ask spread, given that top bonds are the bonds with the most institutional trading volume. The *Top Bond* variable is equal to one if the bond has the most institutional trading for each firm's bonds on a given day. The *Top Bond* coefficient is negative in our regression estimations. For the full sample of bonds, top bonds' estimated spreads are 0.48% lower than the estimated spreads of other bonds. Similar to Edwards, Harris, and Piwowar (2007), the regression models show that bonds with more time to maturity have larger estimated spreads. The larger spread for bonds with more time to maturity could be caused by either higher price risk for longer-term bonds and/or reduced liquidity in the longer maturity bonds. Additionally, we find that investment grade bonds have lower estimated bid-ask spreads, consistent with Edwards, Harris, and Piwowar who document a negative relation between bond spread and credit quality. The negative relation between transaction cost and listing persists in top bonds as well. Listed top bonds offer spreads that are 2.33% lower than unlisted top bonds. Otherwise, the control variables in the top bond regressions yield coefficients similar to the full sample.

The overall sample shows a market quality advantage to bond listing. Our first hypothesis in this paper is two-fold. First, we predict that listed bonds have lower estimated spreads than unlisted bonds. We support this prediction and find that listed bonds have estimated spreads that are 0.85% lower than unlisted bonds. Second, we predict that listed bond trades on the NYSE have lower trading costs than listed bond trades on TRACE. We do not document an advantage for on-exchange trading for NYSE listed bonds. We instead find that TRACE reported trades have lower estimated spreads than NYSE reported trades for listed bonds. In the next section, we turn our attention to price efficiency.

5.2 Bond Volatility

In this section, we look at the relation between listing and the price efficiency of bonds. O'Hara and Ye (2011) use volatility as a measure of price efficiency in equities and Bennet and Wei (2006) show that volatility decreases for stocks that change their listing venue from NASDAQ to the NYSE. We analyze the relation between listing and price efficiency using volatility as our measure of price efficiency. We follow Downing and Zhang (2004) in measuring volatility. We control for factors that Downing and Zhang show to influence volatility (dollar volume, number of trades, and trade size). We also control for firm size and several bond specific characteristics (listing, execution venue, top bond status, time to maturity, and credit rating).

We present our bond volatility regression estimation in Table 6. As before, our main variable of interest is the *Listed* variable. We find that listed bonds are more volatile than unlisted bonds (Column 1 in Table 6). The positive relation between bond listing and volatility conflicts with our expectation that exchange listing positively influences price efficiency. There are possible explanations for the positive relation between bond listing and volatility. One is trading activity. We previously document that listed bonds trade nearly six times each day while the average unlisted bond trades about four times each day (see Table 2). Our volatility regression shows that trading activity is positively associated with volatility.

We are also interested in the coefficient of the top bond variable. We find (weak) evidence that top bonds are more volatile than non-top bonds. A positive relation between top bond status and volatility could indicate two things. First, a positive relation between top bond status and price volatility could indicate that top bonds are less

Table 6
Bond Volatility Regressions

Table 6 presents bond volatility regressions. Volatility is calculated as $\frac{100}{Price_t}(Price_t^{Max} - Price_t^{Min})$ (Downing and Zhang, 2004). Models 1, 2, and 3 estimate volatility for the full sample of bonds, listed bonds, and TRACE bonds. Models 4, 5, and 6 estimate volatility for all top bonds, listed top bonds, and unlisted top bonds. Dollar volume is the daily bond dollar volume, and the number of trades is the daily number of trades per bond. Trade size is the dollar amount of each trade. The Top Bond is equal to one for the bond with the most institutional trading each day. A trade is categorized as institutional if it is greater than $500,000 (Ronen and Zhou 2013). Years to maturity is the number of years to maturity as of the trade date. Firm size is the daily stock price multiplied times daily shares outstanding. Investment Grade is equal to one for an investment grade bond, as designated in the TRACE master file. TRACE Execution is equal to one if a trade occurs on a TRACE reporting venue. Listed is equal to one if the bond is listed. T stats are in parentheses, and significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *. Standard errors are clustered at the bond level.

	Column 1	*Column 2*
	All Bonds	*Top Bonds*
Intercept	3.04***	3.50***
	(16.64)	(15.08)
Issue Size	0.00	0.00
	(0.45)	(0.49)
Dollar Volume	0.00*	0.00**
	(1.95)	(2.38)
Number of Trades	0.01***	0.01***
	(6.50)	(5.82)
Trade Size	-0.00***	-0.00***
	(-13.63)	(-14.20)
Top Bond	0.09*	
	(1.83)	
Years to Maturity	0.12***	0.12***
	(25.09)	(15.75)
Firm Size	-0.00***	-0.00***
	(-4.31)	(-3.20)
Investment Grade	-1.56***	-1.74***
	(-11.85)	(-9.89)
Trace Execution	-0.04	-0.33*
	(-0.27)	(-1.74)
Listed	0.34***	0.50***
	(3.72)	(3.41)
R Squared	20.00%	18.76%

price efficient than non-top bonds. Given the volume of institutional trading in top bonds, this explanation is unlikely. Second, a positive relation between top bond status and price volatility could simply indicate that top bonds are more active and trade more often than non-top bonds, especially given that trading activity and volatility have a positive relation. We document a weak positive relation between top bond status and volatility for the full sample of bonds.

We also control for several other factors shown to influence volatility. We find that bonds with more time to maturity have higher levels of volatility than bonds with less time to maturity, and bonds with investment grade ratings have lower levels of volatility that non-investment grade bonds. Generally, these findings are expected. Bonds with more time to maturity have more price risk, hence higher volatility. Additionally, investment grade bonds have less uncertainty than non-investment grade bonds, which leads to lower levels of volatility for investment grade bonds. In addition to studying volatility in the full sample of bonds, we also study the relation with top bonds in our sample. We find evidence that listed top bonds are more volatile than unlisted top bonds. In this section, we find that listed bonds are more volatile than unlisted bonds, and also that listed top bonds are more volatile than unlisted top bonds. We conclude from our regression analyses that listed bonds are less price efficient than unlisted bonds.

5.3 Institutional Trading Activity

Previous research on equities indicates that large (or institutional) traders are often informed, especially leading up to informational events like earnings announcements. Affleck-Graves, Jennings, and Mendenhall (1994) find that large traders can predict the direction of the earnings performance in the thirty days leading up to the announcement. Seppi (1992) finds that block trades reflect potentially private information about unexpected earnings performances. We investigate the relevance of earnings announcements for the corporate bond market. Since corporate bonds represent claims on the future (and current) cash flows of the firm (Wei and Zhou, 2016), the credit quality of the bonds are a reflection of the financial viability of the firm. Also, the bond market should react/absorb the information about the firm's future cash flows because the fundamental information is relevant for the firm's securities, equity and debt alike.

The bond market's performance and reaction to earnings announcements is largely unexplored. Wei and Zhou (2016) studies the bond market's performance using earnings as an informational event and find increased levels of trading in the ten days leading up to the earnings announcement. The increase in pre-announcement trading is correlated to the earnings direction, especially when the earnings performance is largely negative. The increased trading appears to be largely driven by high yield bonds, especially before large negative earnings surprises.

The bond market is dominated by large traders, and previous research shows that these traders are generally informed (Barber, Lee, Liu, and Odean, 2009; Ivashina and Zheng, 2011; Boulatov, Hendershott, and Livdan, 2013). Additionally, Datta and Dhillon (1993) find that earnings announcements have informational value for both equity markets and bond markets. Kadlec and McConnell (1994) find that exchange listing (NYSE) leads to an increase in the number of institutional shareholders in a firm and an increase in institutional trading of 27% for listed firms following earnings announcements. We study bond trading on earnings announcement and non-announcement days. Table 7 presents the preliminary results comparing earnings announcement days to non-earnings announcement days. Panel A includes all bonds in the sample. Panel B (Panel C) includes listed (unlisted) bonds. We document a slight increase in price on the earnings announcement days for the full sample of bonds. We also find a corresponding increase in dollar volume and the number of trades that execute on announcement days. Dollar volume increases by nearly $200,000 on the announcement day, while the number of trades increases only marginally.

In Panel B, we focus on listed bonds. We find that listed bond prices increase on announcement days, along with overall listed dollar volume. The average listed bond is priced at 108.70% of par on announcement days, while the average listed bond is priced at 108.51% of par on non-announcement days. Average dollar volume increases by over $150,000 for listed bonds on announcement days, but we find no significant change in either trade size or the number of trade executions on announcement days (compared to non-announcement days). Panel C provides results for unlisted bonds, and the results are similar to those shown in Panel A. We document significant increases in bond price, dollar volume, and the number of trades for unlisted bonds on announcement days.

Kadlec and McConnell (1994) focus on the relation between exchange listing and institutional shareholders. We expand on their study by focusing on institutional-sized bond trading activity on earnings announcement and non-announcement days. We follow Ronen and Zhou (2013) and classify a trade as institutional if the trade size is greater than $500,000. We provide the results of our analysis in Table 8. We focus on the price, trade size, dollar volume, number of trades, percentage dollar volume, and the percentage number of trades in Table 8. The percentage volume (percentage trades) is the portion of volume (trading activity) for which institutional-

Table 7
Earnings Announcement vs. Non-Earnings Announcement Days

Table 6 provides results a comparison of trading activity on earnings announcement days and non-earnings announcement days. Price is the average daily bond price, and trade size is the average daily trade size. Dollar volume is the average daily dollar volume, and the number of trades is the average daily number of trades. All variables are averaged at the bond level. We provide averages for the announcement day and the non-announcement day. We also provide the difference between the two days. The t-statistic is presented to denote significance. ***,**,* indicate significance at the 1%, 5%, and 10% levels.

	Ann. Day	*Non-Ann. Day*	*Difference*	*T-Stat*
Panel A: All Bonds				
Price	107.31%	107.04%	0.27%***	8.04
Trade Size	$418,804.73	$407,640.34	$11,164.39	1.48
Dollar Volume	$2,212,530.93	$2,020,380.72	$192,150.21***	4.21
Number of Trades	6.08	5.92	0.16**	2.53
Estimated Bid-Ask Spread	1.99%	1.01%	0.98%***	3.99
Panel B: Listed Bonds				
Price	108.70%	108.51%	0.19%***	5.09
Trade Size	$436,105.08	$424,602.25	$11,502.83	1.14
Dollar Volume	$2,448,079.56	$2,295,620.87	$152,458.69**	2.46
Number of Trades	6.80	6.70	0.09	1.14
Estimated Bid-Ask Spread	1.64%	0.85%	0.79%***	3.60
Panel C: Unlisted Bonds				
Price	105.29%	104.92%	0.37%***	6.24
Trade Size	$393,646.85	$382,974.62	$10,672.23	0.94
Dollar Volume	$1,870,000.05	$1,620,131.10	$249,868.95***	3.75
Number of Trades	5.04	4.79	0.25***	2.66
Estimated Bid-Ask Spread	2.09%	1.23%	0.86%***	3.75

sized trades account. For all bonds, we find an increase in the price at which institutional-sized trades execute and a slight increase in the average institutional trade size on earnings announcements days. Institutions purchase bonds priced at 106.90% of par on announcement days, compared to 106.63% of par on non-announcement days. The average trade size increases by nearly $40,000 on announcement days.

We find that institutional dollar volume declines by over $1,000,000 on announcement days, along with the number of institutional-sized trades. Perhaps the most striking result in Panel A is the percentage volume and the percentage number of trades for institutional-sized trades. On non-announcement days, institutions account for 78.31% of dollar volume. On announcement days, this percentage falls to just 43.84%. The results are similar, but not as dramatic, for the percentage of trades. On non-announcement days, institutional-sized trades account for nearly 30% of all trades. Yet, these large trades make up only 21% of trades on announcement days. The results in Panel A could indicate one of two things. Institutions are pulling back from the market on earnings announcements days or, perhaps institutions trade prior to the announcement.

We further divide the sample into listed bonds (Panel B) and unlisted bonds (Panel C). According to listing theory and Kadlec and McConnell (1994), the level of institutional activity should increase with an earnings announcement. We find the opposite in terms of activity, however. We find lower levels of institutional dollar volume and fewer institutional-sized trades on earnings announcements days. We also document a substantial drop in the percentage dollar volume and percentage number of trades for large, institutional-sized trades. Institutions account for 86.45% of dollar volume in listed bonds on non-announcement days, but only 47.64% of volume on announcement days. The same is true for the percentage of trades; institutional-sized trades account for 9.9% fewer trades in listed bonds on announcement days than on non-announcement days. The results for unlisted bonds are similar to those shown in Panel A.

In Table 8, we focus on institutional-sized trading activity. We provide results for our study of smaller, retail-sized trades in Table 9. Panel A includes all bonds in the sample. Panel B (Panel C) includes listed (unlisted) bonds. Overall, retail-sized trades have lower dollar volume on announcement days than on non-announcement

Table 8

Institutional-Sized Trading, Earnings Announcement vs. Non-Earnings Announcement Days

Table 7 provides results a comparison of institutional trading activity on earnings announcement days and non-earnings announcement days. Price is the average daily institutional bond price, and trade size is the average daily institutional trade size. Dollar volume is the average daily institutional dollar volume, and the number of trades is the average daily institutional number of trades. The percentage institutional dollar volume is the percentage of total volume for which institutions account. The percentage institutional number of trades is the portion of all trades for which institution sized trades account. All variables are averaged at the bond level. We provide averages for the announcement day and the non-announcement day. We also provide the difference between the two days. The t-statistic is presented to denote significance. ***,**,* indicate significance at the 1%, 5%, and 10% levels.

	Ann. Day	*Non-Ann. Day*	*Difference*	*T-Stat*
Panel A: All Bonds				
Institutional Price	$106.90	$106.63	$0.27***	4.94
Institutional Trade Size	$1,933,736.19	$1,895,475.25	$38,260.94*	1.92
Institutional Dollar Volume	$2,516,509.75	$3,584,444.83	-$1,067,935.08***	-19.18
Institutional Number of Trades	1.27	1.90	-0.63***	-25.69
% Institutional Dollar Volume	43.84%	78.31%	-34.47%***	-60.68
% Institutional Number of Trades	21.06%	29.61%	-8.55%***	-26.05
Panel B: Listed Bonds				
Institutional Price	$107.03	$106.84	$0.19***	3.08
Institutional Trade Size	$2,064,328.39	$2,031,984.99	$32,343.40	1.23
Institutional Dollar Volume	$2,872,678.72	$4,162,325.85	-$1,289,647.13***	-16.55
Institutional Number of Trades	1.32	2.03	-0.71***	-22.25
% Institutional Dollar Volume	47.64%	86.45%	-38.81%***	-51.76
% Institutional Number of Trades	20.74%	30.64%	-9.90%***	-23.70
Panel C: Unlisted Bonds				
Institutional Price	$106.68	$106.24	$0.44***	3.91
Institutional Trade Size	$1,696,437.68	$1,647,424.01	$49,013.67*	1.66
Institutional Dollar Volume	$1,998,574.79	$2,744,099.93	-$745,525.14***	-9.82
Institutional Number of Trades	1.20	1.71	-0.51***	-13.41
% Institutional Dollar Volume	38.31%	66.46%	-28.15%***	-33.00
% Institutional Number of Trades	21.52%	28.13%	-6.61%***	-12.52

Table 9

Retail-Sized Trading, Earnings Announcement vs. Non-Earnings Announcement Days

Table 8 provides results a comparison of retail trading activity on earnings announcement days and non-earnings announcement days. Price is the average daily retail bond price, and trade size is the average daily retail trade size. Dollar volume is the average daily retail dollar volume, and the number of trades is the average daily retail number of trades. The percentage institutional dollar volume is the percentage of total volume for which institutions account. The percentage retail number of trades is the portion of all trades for which retail-sized trades account. All variables are averaged at the bond level. We provide averages for the announcement day and the non-announcement day. We also provide the difference between the two days. The t-statistic is presented to denote significance. ***,**,* indicate significance at the 1%, 5%, and 10% levels.

	Ann. Day	*Non-Ann. Day*	*Difference*	*T-Stat*
Panel A: All Bonds				
Retail Price	$107.22	$106.97	$0.25***	7.52
Retail Trade Size	$81,253.56	$82,118.31	-$864.75	-0.87
Retail Dollar Volume	$338,559.83	$353,524.31	-$14,964.48***	-3.24
Retail Number of Trades	5.22	5.30	-0.08	-1.35
% Retail Dollar Volume	56.16%	21.69%	34.47%***	60.68
% Retail Number of Trades	78.94%	70.39%	8.55%***	26.05
Panel B: Listed Bonds				
Retail Price	$108.66	$108.49	$0.17***	4.45
Retail Trade Size	$80,019.82	$80,551.45	-$531.64	-0.43
Retail Dollar Volume	$366,479.57	$380,366.53	-$13,886.96**	-2.49
Retail Number of Trades	5.93	6.01	-0.08	-1.06
% Retail Dollar Volume	52.36%	13.55%	38.81%***	51.76
% Retail Number of Trades	79.26%	69.36%	9.90%***	23.70
Panel C: Unlisted Bonds				
Retail Price	$105.07	$104.70	$0.37***	6.17
Retail Trade Size	$83,099.13	$84,462.19	-$1,363.07	-0.81
Retail Dollar Volume	$297,959.41	$314,490.79	-$16,531.38**	-2.08
Retail Number of Trades	4.19	4.26	-0.07	-0.84
% Retail Dollar Volume	61.69%	33.54%	28.15%***	33.00
% Retail Number of Trades	78.48%	71.87%	6.61%***	12.52

days. In contrast to institutional-sized trades, retail trades account for both a larger percentage of volume and a larger percentage of trades on announcement days than on non-announcement days. Retail trades account for just 21.69% of dollar volume on non-announcement days, but increase their portion of volume to 56.16% on announcement days. The increase in the percentage number of trades is less dramatic, but still significant. Retail trades account for 70.39% of trades on non-announcement days, increasing to 78.94% on announcement days.

We divide the sample into listed and unlisted bonds in Panels B and C. We find (generally) the same results for listed and unlisted bonds. The most striking results are, again, the differences in percentage volume and percentage number of trades on earnings and non-earnings announcement days. For listed bonds, retail trades account for only 13.55% of volume on non-earnings announcement days. However, retail trades account for over 50% of volume on announcement days. The same is true for the unlisted bonds. Retail trades make up 33.54% of volume on non-announcement days, but make up over 60% of volume on announcement days. For listed (unlisted) bonds, retail traders execute 9.9% (6.61%) more trades on announcement days than non-announcement days.

Overall, we find little evidence that institutional activity increases due to a bond's listing status. While we document an increase in listed bond dollar volume on announcement days, we also find a similar increase in unlisted bond dollar volume. We divide our sample into institutional-sized trades (greater than $500,000) and retail-sized trades (less than $500,000) to determine what role, if any, listing plays. We hypothesize that institutional trading activity increases in listed bonds, and we use earnings days to test the hypothesis. We find no support for our third hypothesis, and instead find a decrease in large dollar volume on announcement days.[13]

6. CONCLUSION

Much of the research on exchange listing focuses on equities. Merton (1987) theorizes that exchange listing in the equities market can lead to an increase in investor recognition and improved liquidity for the firm. We focus on the bond market. Studying the impact of exchange listing in the bond market is valuable for several reasons. First, the bond market is typically not as liquid as the equities market. In our sample, the average corporate bond trades only five times each day, which is substantially less than the average stock. Bonds are also costly to trade and documenting a market quality or trading advantage for listed (or unlisted) bonds could be beneficial for traders. Additionally, bond market execution quality, market structure, and trading venues are becoming increasingly important to market regulators. Hendershott and Madhavan (2015) document a liquidity advantage to electronic bond trading while Harris, Kyle, and Sirri (2015) advocate for the introduction of pre-trade transparency in the bond market.

First, we study the trading differences between listed and unlisted bonds. Second, we examine the exchange and over the counter trading activity of listed bonds. Third, we determine if bond listing influences the type of trades in a particular bond (retail versus institutional). We show that listed bonds have lower spreads (by 1.76%) than unlisted bonds. Additionally, listed top bond spreads are lower by 2.33% than the spreads of other bonds. Overall, we document a market quality advantage to bond listing. We predict an advantage for trading listed bonds on the listing venue. However, we find that NYSE bond trades in listed bonds have larger estimated bid-ask spreads than TRACE trades in listed bonds. While this finding is likely driven by trade size differences in the two markets, it brings into question if both pre-trade transparency and electronic trading are beneficial to bonds.

We also study price efficiency using volatility as our measure of bond price efficiency. We find that listed bonds are more volatile than unlisted bonds, which contradicts our hypothesis. We study bond trading following earnings announcements to determine if listing influences the type of trades (institutional versus retail) in a specific bond. While Kadlec and McConnell (1994) predict listing attracts institutional investors, we find a decrease in institutional trading volume on earnings announcement days. Total trading volume increases on earnings announcements days, which could be a result of retail trading. Overall, our results indicate there is value to bond listing.

Footnotes

[1] See Goldstein, Hotchkiss, and Sirri (2007), Bessembinder, Maxwell, and Venkataraman (2006), Harris and Piwowar (2006), and Edwards, Harris, and Piwowar (2007).

[2] We follow Ronen and Zhou (2013) and classify bond trades as institutional if the trade value exceeds $500,000. Earlier bond papers, such as Edwards, Harris, and Piwowar (2007) classify trades as institutional if the trade size is greater than $100,000. In preliminary work, we use both trade sizes, $100,000 and $500,000, in all tests, to label institutional trades. We find that the results are qualitatively similar, and, therefore, we follow the more recent Ronen and Zhou paper.

[3] For a detailed summary of the initial implementation of TRACE, reference Bessembinder, Maxwell, and Venkataraman (2006); Edwards, Harris, and Piwowar (2007); or Goldstein, Hotchkiss, and Sirri (2007).

[4] We delete trades flagged as cancelled, corrected, reported after-hours, reported late, after-market trades reported late, bonds issued by private companies, bonds with missing CUSIP information, bonds trading at less than 25% of par value, and bonds that trade less than ten times during the sample period.

[5] This requirement follows Edwards, Harris, and Piwowar (2007).

[6] $\text{Volatility} = \frac{100}{\text{Price}_t}\left(\text{Price}_t^{\max} - \text{Price}_t^{\min}\right)$.

[7] $\text{Estimated Spread} = \left(\frac{\text{Trade Price}}{\text{Benchmark Price}}\right)(\text{Trade Sign})$

[8] See Chan, Christie, and Schultz (1995), Chung, Van Ness, and Van Ness (1999), Lee, Mucklow, and Ready (1993), and Wood, McInish, and Ord (1985) for more information on intraday market behavior in the equities market.

[9] $\text{Estimated Spread} = \left(\frac{\text{Trade Price}}{\text{Benchmark Price}}\right)(\text{Trade Sign})$

[10] Giving interdealer trades a sign of zero follows Hendershott and Madhavan (2015), Harris and Piwowar (2006), Bessember, Maxwell, and Venkataraman (2006), and Edwards, Harris, and Piwowar (2007).

[11] See Huang and Stoll (1996) or Bennet and Wei (2006).

[12] Downing and Zhang (2004) calculate volatility using the following methodology: $\frac{100}{\text{Price}_t}\left(\text{Price}_t^{\text{Max}} - \text{Price}_t^{\text{Min}}\right)$.

[13] We replicate all results presented in the paper using a matched sample as well. We match on a one-to-one basis similar to Boehmer (2005). However, our matching procedure differs slightly from his. He matches the sample using the time period preceding his analysis, while we match our sample based on the bond average price, daily dollar volume, investment quality, years to maturity, and firm market capitalization during our 2013-time period. For an in-depth description of the propensity score matching procedure, see Boehmer (2005). All major results for the matched sample are provided in Appendices A through D. Boehmer (2005) refers to matching differences as "matching errors." Pairwise propensity score differences are calculated using the following equation: $D_{xy} = \left|\frac{\text{Price}_x}{\text{Price}_y}\right| + \left|\frac{\text{DollVol}_x}{\text{DollVol}_y}\right| + \left|\frac{\text{Grade}_x}{\text{Grade}_y}\right| + \left|\frac{\text{Mat}_x}{\text{Mat}_y}\right| + \left|\frac{\text{MktCap}_x}{\text{MktCap}_y}\right|$.

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