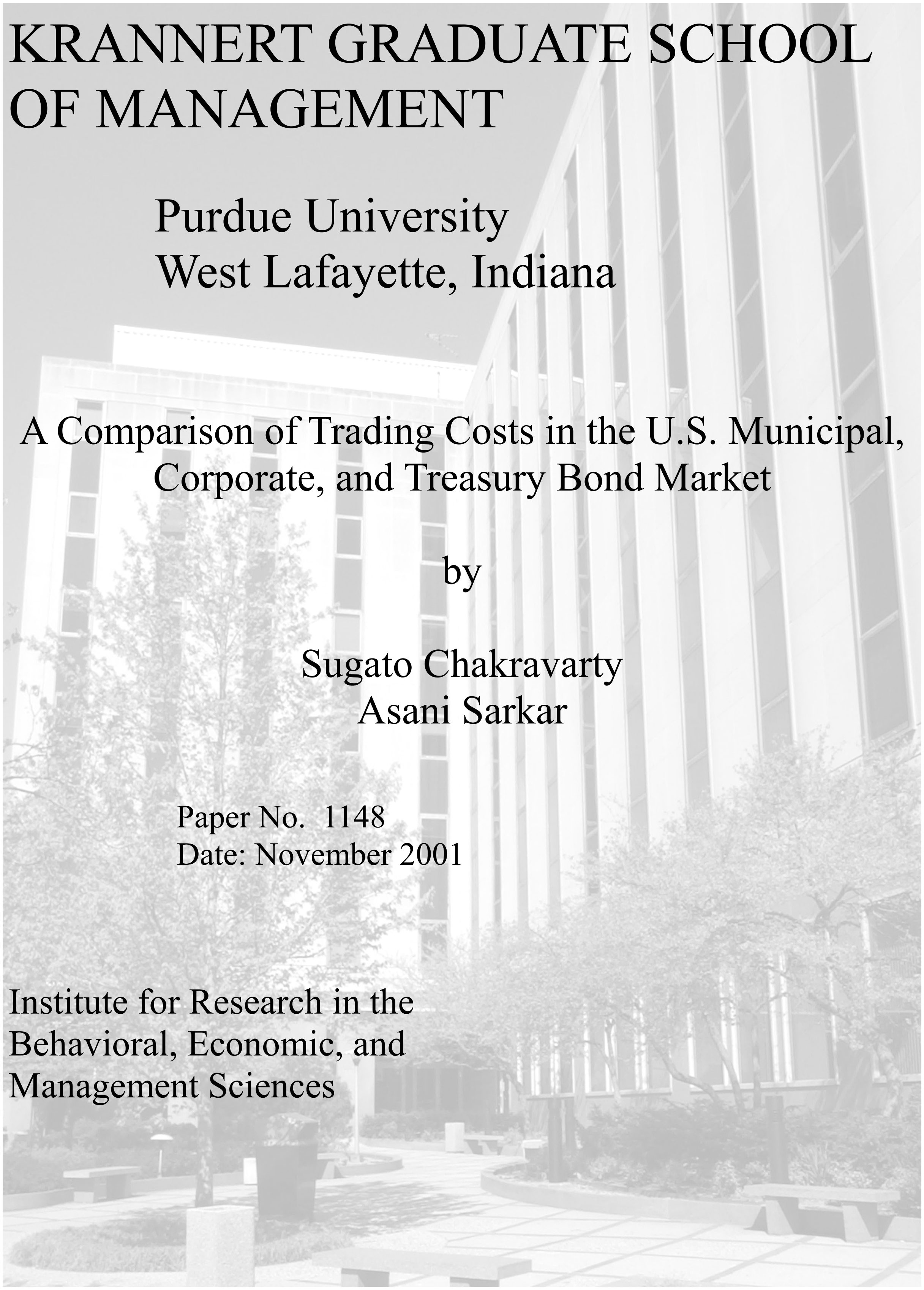

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A Comparison of Trading Costs in the U.S. Municipal, Corporate, and Treasury Bond Market

by

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A Comparison of Trading Costs in the U.S. Corporate, Municipal and Treasury Bond Markets

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Abstract

We compare trading costs in the U.S. Treasury bond market with U.S. corporate and municipal bond markets, based on newly available transaction data. We estimate that the mean bid-ask spread per $100 par value is 23 cents for municipal bonds, 21 cents for corporate bonds and 8 cents for Treasury bonds. Maturity, trading volume and credit ratings are key determinants of the bid-ask spread. After controlling for credit risk, the bid-ask spread is not statistically different for the corporate and Treasury markets but is higher for municipal bonds relative to Treasuries. Finally, we examine why institutions sometimes trade without dealers, and find that the relative volume of directly negotiated trades in a bond decreases in the bid-ask spread and the trading volume, and increases with age of the bond.

JEL Classification codes: G10, G14, G22
Keywords: U.S. bond markets, trading costs, dealers, institutions, electronic trading

The corporate, municipal and Treasury bond markets constitute about two-thirds of the average daily trading volume in the U.S. debt markets (Bond Market Association, 1999).[1] Most bond transactions occur in over-the-counter dealer markets that possess varying degrees of pre and post-trade transparency. Whereas, in the Treasury market, there is a centralized location reporting pre-trade quotes and post-trade price and quantity for inter-dealer trades, no such reporting system exists for corporate and municipal bond markets. For corporate and municipal bonds, an institution must call dealers or broadcast requests for quotes through an electronic dealer system; alternatively dealers may broadcast indicative quotes for bonds in their inventory. Thus, a recent Securities and Exchange Commission (SEC) study (SEC press release 98-81) concludes that the Treasury market is the most transparent, the corporate market the least, with poor but improving transparency in the municipal market.

In this paper, we use newly available data of secondary bond market transactions to compare trading costs in the corporate, municipal and Treasury bond markets, after controlling for interest rate risk, credit risk, trading activity and issuer-specific characteristics.[2] We estimate that the mean traded bid-ask spread per $100 par value is 23 cents for municipal bonds, 21 cents for corporate bonds and 8 cents for Treasury bonds.

It is not clear from existing research whether greater transparency in the Treasury market with respect to pre-trade quote dissemination and post-trade publication should result in higher or lower trading costs in that market.[3] We compare the bid-ask spread of Treasury bonds with

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[1] The total value of bonds outstanding was over $14 trillion in 1999 (Bond Market Association (BMA) estimates).
[2] While U.S. Treasury securities are virtually free of credit risk, corporate bonds may suffer from significant credit risk. Municipal bonds have intermediate credit risk due to the financial fragility of some municipals, and innovative issues with uncertain legal bondholder rights. The secondary market in U.S. Treasuries is highly active, with large trading volumes and narrow bid-ask spreads (Fleming and Sarkar, 1999). Corporate bonds tend to be active for the first two years after issuance, but relatively inactive thereafter.
[3] Naik, Neuberger and Viswanathan (1999) show that, with interdealer trading, greater post-trade transparency may increase or decrease investor welfare since it improves risk sharing between dealers but worsens price revision risk.

that of corporate and municipal bonds and find that, after controlling for credit risk, there is no significant difference in the bid-ask spread of Treasury and corporate bonds. However, municipal bond spreads are higher than those of Treasury bonds by 11 cents per $100 par value. Our findings imply that differences in trading cost between corporate and Treasury bonds mainly reflect differences in credit risk, rather than differences in the level of transparency.[4]

We also examine why institutions sometimes trade without dealers. Electronic bond trading systems, which are a growing part of U.S. bond markets (Bank of International Settlements, 2001), promise increased transparency and potentially allow buyers and sellers of bonds to trade directly with one other. We find that bonds with lower bid-ask spreads, lower trading volume and greater age are more likely to be traded directly by institutions, without dealer intervention. Thus, these types of bonds are more likely to migrate to more transparent electronic trading systems in the future.

In related work, Hong and Warga (2000) and Schultz (2000) use the same data set that we do.[5] These papers do not study municipal bonds, nor do they compare trading costs across markets or examine why institutions trade without dealers. Hong and Warga (2000) use a methodology similar to ours to estimate the bid-ask spread and its determinants, and compare dealer and exchange market transactions. They find that dealer and exchange market bid-ask spreads are similar in magnitude. The corporate bid-ask spread increases in age, maturity and squared returns, but is not related to total volume. We, on the other hand, find that the corporate

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Evidence from experimental settings is also ambiguous. Bloomfield and O'Hara (1999) study post-trade transparency and find that opening spreads are higher but prices are more efficient. Flood, Huisman, Koedijk and Mahieu (1999) examine pre-trade transparency and come to the opposite conclusion.

[4] Hong and Warga (2000) find that the bid-ask spread in the corporate bond dealer market is similar in magnitude to the bid-ask spread for bonds trading in the more transparent exchange markets. Hotchkiss and Ronen (1999) show that market quality is similar for high yield corporate bonds and the underlying (more transparent) stocks.

[5] Alexander, Edwards and Ferri (2000) study trading volume. Sarig and Warga (1989), Blume, Keim and Patel (1991), Warga (1992), and Crabbe and Turner (1995) use the yield or return spread as a measure of liquidity.

bid-ask spread is concave in maturity and decreasing in total volume.

Schultz (2000) estimates effective bid-ask spreads for corporate bonds by inferring daily bid quotes from a different data set with month-end quotes. Relative to our bid-ask spread measure, his procedure results in noisier estimates of trading costs but allows for a larger sample of less active bonds. Schultz (2000) does not estimate the bid-ask spread of below investment grade bonds and finds that credit ratings do not affect the spread. In contrast, we find that bond ratings are highly significant in explaining variations in the bid-ask spread both within and across markets. Schultz (2000) further finds that the bid-ask spread is lower for larger dealers and institutions. In our sample, however, large and small dealers and institutions trade less than 6 percent of corporate bonds in common, and for commonly traded bonds, we find no statistically significant difference in trading costs.

The rest of the paper is written as follows. In section 1, we discuss our data. In section 2, we estimate the traded bid-ask spread. In section 3, we discuss the theoretical determinants of the bid-ask spread and our methodology. In section 4, we study the empirical determinants of the bid-ask spread, and compare the spread across markets. In section 5, we compare the bid-ask spread for large and small dealers and for large and small institutions. Section 6 examines why institutions sometimes trade without dealers. Finally, section 7 concludes.

1. Data

A. Data Description

The data, obtained from Capital Access International (CAI), includes individual bond transactions by insurance companies. Since 1995 the National Association of Insurance Commissioners (NAIC) began providing transactions data based on Schedule D filings by all its member insurance companies, who are required to provide information on the total cost of transaction, the par amount, and the date of transaction. CAI obtains the data from A.M. Best and further verifies the bond transactions by cross-referencing against other information on their files.[6] Our sample is from January 1, 1995 to December 31, 1997. Each record in the data shows the transaction date, a bond identifier, the total dollar value of the transaction, the number of bonds traded, an indication as to whether the transaction is a sale or a purchase, and the identities of the dealers and the customers. We also obtained from CAI the Moody's and S&P credit ratings for each bond, the credit sector of issuer (e.g., whether the bond was issued by an industrial company), the bond issue date and its maturity date. Finally, we obtained data on the amount outstanding of a bond from Bloomberg.

To purge the data of errors, we use the following filters.

1. We exclude bonds of non-U.S. issuers, Rule 144A or private bonds and bonds without rating information. Commercial paper and municipal notes are also omitted.
2. A small number of corporate and municipal bonds are mistakenly categorized as Government bonds. We used the credit sector information to correctly classify these bonds. For example, if the credit sector is "finance", "industry" or "service" we classify the bonds as corporate.
3. An unusually large number of observations occurring on June 30, 1995, June 30, 1996, and December 31, 1997 are removed. According to CAI, insurance companies may have used these days to record trades that actually occurred on other dates.
4. We delete transaction dates falling on a Saturday or a Sunday and observations for which the transaction date is an estimate.
5. To eliminate outliers, we delete all observations where the transaction price is in the upper or lower one percentile of its distribution.

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[6] CAI has a security master of over 7 million issues, which they use to validate incoming security information.

The final sample has 151,012 trades in corporate bonds, 81,862 trades in municipal bonds and 21,125 trades in Treasury bonds for the sample period. We exclude days when a bond does not have both a buy and a sell transaction, since our liquidity measure is not defined for these days (see section 2). This leaves us with 7,168 corporate bond trades, 3,168 municipal bond trades and 3,912 Treasury bond trades. The number of bond days (the number of bonds times the number of days each bond is traded) is 2,600 for the corporate market, 1,227 for the municipal market and 1,246 for the Treasury market, for a total of 5,073 bond days in the three markets.

Table 1 provides the sample distributions of bond characteristics in the original sample and the sample used in the paper. The daily volume is higher for the bonds used in our study relative to the original sample bonds, suggesting that our analysis may pertain mostly to relatively active bonds likely to have lower bid-ask spreads. In other respects, however, the bonds in our study are representative of the original sample bonds. The yield, maturity, age, and coupon rate are similar in the two samples. In both samples, the time-to-maturity, duration and convexity are highest for municipal bonds, and about the same in the other two markets. The mean time-to-maturity is intermediate in all three sectors, consistent with the recent emphasis of insurance companies on shorter-duration term life policies, rather than more traditional whole-life policies. The volume is least for municipal bonds and most for Treasury bonds. The mean bond age is highest for Treasury bonds, indicating that these are mostly "off-the-run" bonds.

B. Is the Sample Representative of the Overall Bond Markets?

Hong and Warga (2000) suggest that insurance company transactions comprise about 25

Mismatched records are looked up in their security master and identified by a data specialist.

percent of the non-investment grade market and a significantly larger share of the investment grade market. For the aggregate bond market, the Merrill Lynch Domestic Master Bond Index reports daily values of bond characteristics for U.S. Treasuries and investment grade corporate and municipal bonds.[7] For 1995 to 1997, bond characteristics from the Merrill Lynch Index are reported in the last column of Table 1. A comparison shows that bonds in our sample are similar to bonds in the overall market as represented in the Merrill Lynch Index.

Insurance companies may trade the same bonds differently from other bond investors. In particular, insurance companies may buy and hold bonds till maturity. Pension funds and hedge funds, in contrast, are reputed to trade more frequently. We indirectly address this issue by comparing the trade size of Treasury bond transactions in our sample with those from GovPX, a Treasury bond transaction database covering most of the major inter-dealer brokers.[8] In our sample, for Treasury bonds with an average time to maturity of 8.9 years, the mean trade size (in million dollars) is 6.85 (Table 1). We infer from GovPX data the mean trade size for a Treasury bond of similar maturity by interpolating between the trade sizes in 1997 for the 10-year Treasury note (about 6.5 million dollars) and the 5-year Treasury note (about 8.3 million dollars). We obtain a mean trade size of about 7.9 million dollars for a GovPX bond with 8.9 years to maturity, comparable with bond trades of insurance companies.

2. Estimates of the Bid-Ask Spread in Bond Markets

For a bond with at least one buy and one sell transaction in a day, the traded bid-ask

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[7] To be included in the Merrill Lynch Index, the bonds must have at least one year to maturity and satisfy a minimum par amount.

[8] Two caveats are in order. GovPX data relate to interdealer broker trades, whereas our data are for customer-to-dealer transactions. Further, even for the same trade size, the bid-ask spread for insurance company trades may be different from, say, hedge fund trades if the dealer knows who the customer is. Smaller insurance companies,

spread per day is the difference between its mean daily selling price and its mean daily buying price. We delete observations with unusually large traded spreads (exceeding $10 in absolute value), leaving us with 4,923 observations on the bid-ask spread in the three markets. Panel A of Table 2 reports the distribution of the traded bid-ask spread for the three markets per $100 par value. The mean bid-ask spread is 23 cents for municipal bonds, 21 cents for corporate bonds, and 8 cents for Treasury bonds. In all markets, the mean bid-ask spread is generally higher for lower credit ratings. For example, in the corporate market, the mean bid-ask spread is about 14 cents for AA-rated bonds and 28 cents for below-investment-grade bonds.[9]

As discussed earlier, our spread estimates may be mainly applicable to relatively active bonds. Schultz (2000) uses a different methodology for estimating trading costs and obtains a larger sample of corporate bond trades than we do. He finds that the mean and standard deviation of the bid-ask spread is higher than what we report. To check the sensitivity of the bid-ask spread estimates to the requirement of "one buy and one sell trade" for a bond each day, we calculate the realized spread over non-overlapping two and five-day windows. For example, for the non-overlapping two-day window, we select bonds with at least one buy and one sell transaction over two consecutive trading days, say day t and day $t-1$. The 2-day bid-ask spread is the difference between the 2-day-means of the selling and buying prices. The calculation is then repeated for day $t+1$ and day $t+2$.

Panel B of Table 2 reports the distribution of traded spreads calculated over a two-day window. The number of bond days in all markets increases from 4,923 for the one-day window to 20,261 for the two-day window, a more than four-fold increase. The mean and standard

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however, typically go through a money manager, and so are likely to remain anonymous.

[9] Since we have only 48 observations in the sample for AAA-rated corporate bonds, we do not report the spread distribution for these bonds separately in Table 1.

deviation of the bid-ask spread are generally higher, especially for the corporate market, consistent with the inclusion of less active bonds. However, the relative distribution of the spread is robust to the change in the window. For example, the mean corporate bond spread remains lowest for AA-rated bonds and highest for utility sector bonds. Similar observations apply to the bid-ask spread estimated for the five-day window (panel C of Table 2). Relative to the one-day window, there is a more than three-fold increase in the number of bond days and the mean and standard deviation of the spread are higher.[10]

In the remainder of our analysis, we focus on the daily traded bid-ask spread reported in Panel A of Table 2.

3. Determinants of the Bond Bid-Ask Spread: Methodology

We use the following explanatory variables for our regressions:

Time to maturity: the difference between the trading date and the maturity date (in years).[11]

Square of maturity: the square of the time-to-maturity, for the corporate bond regression only.

Bond age: the difference between the issue date and the trade date (in years).

Total volume: we use the level of daily trading volume (in million $) for the corporate and municipal markets. Since the volume level is much higher for the Treasury market, we use the log of volume in that market.

Price: the average daily price level of the bond.

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[10] Note that, when going from the two-day to the five-day window, the number of bond days actually decreases. This is the effect of sampling every fifth observation, rather than every second observation.
[11] The effective time to maturity is lower for callable bonds. We define a callability dummy but find that the

Macroeconomic announcement dummies: dummy variables that are equal to one on days with the relevant macroeconomic announcement. We use three dummies, one each for announcements of the Employment Report (*Employment ann*), the GDP announcement (*GDP ann*) and the Industrial Production (*Ind. Production ann*) announcement.

Credit rating dummies: the dummy variables are based on Moody's credit ratings. For corporate and municipal bonds, we define three dummy variables for ratings categories *A1*, *A2* and *A3*. For example, the dummy *A1* is one for bonds rated *A1* by Moody's, and zero otherwise. For the corporate market only, we define the dummy variable *AAA/AA* for bonds rated either *AAA* or *AA* and the dummy *BAA* for bonds with ratings *BAA1*, *BAA2* or *BAA3*. The omitted rating category in the corporate market is the below-investment grade or junk category, those bonds rated *Ba* or below. For the municipal market alone, we include one dummy variable for *AAA* -rated bonds and another dummy variable for *AA*-rated bonds. The omitted rating category in the municipal market is the below-investment grade category (i.e., bonds rated *BAA1* or below).

Amt outstanding: the market value of the amount of the bond that remains outstanding (in million $) as of October 2001. Since most of our bonds are not callable, the amount outstanding is the same as the amount issued of the bond. Thus, for the most part, the lack of *historical* data on the amount outstanding makes little difference to the results. We also regressed the spread on the amount issued and found that the amount issued is not significant (results not reported, but available from the authors).

A brief explanation for including these variables is as follows. Since the traded bid-ask spread represents dealers' average daily revenues for a bond, it should be related to dealers' costs

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dummy does not have any explanatory power for the bid-ask spread regressions.

of adjusting inventory. Inventory models suggest that the bid-ask spread increases with the bond price and the risk of the security, and decreases with trading activity (Amihud and Mendelsohn (1980), Garman (1976), Ho and Stoll (1981), Stoll (1978a)). Leland (1994) and Merton (1974) suggest that the bond price should depend on the risk-free rate, provisions in the bond indenture (such as maturity date, coupon rate, and call provisions) and the probability of default. For corporate bonds, Longstaff and Schwartz (1995) predict that the credit spread for risky debt initially increases with time to maturity and then declines, suggesting a non-linear relation between time-to-maturity and the spread.

Previous research has identified other factors important for explaining bond market liquidity. Alexander et al (2000) and Sarig and Warga (1989) find that younger corporate bonds are more actively traded, and Babbel, Merrill, Meyer and Villiers (2001) show that on-the-run Treasury bonds are more liquid. So, the bond age may influence the spread.[12] Fleming and Remolona (1997) and Bollerslev, Cai and Song (1999) find that macroeconomic announcements have a significant effect on the bid-ask spread. Finally, Fisher (1959) argues that the amount outstanding of a bond is an indicator of the marketability of the bond.[13]

We do not control for the coupon rate or the risk-free rate in the regressions because these variables are highly correlated with our other explanatory variables. Time to maturity is highly correlated with duration and convexity and so we do not use duration and convexity in our regressions.[14] We initially included dummy variables for bonds of different issuer industries (e.g. industrial bonds), but later omitted them since they were not significant in the regressions.

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[12] One explanation as to why bond age may influence the spread is that institutional buyers in the bond market are buy-and-hold investors. They buy large quantities of a bond as soon as it comes to the market and hold till maturity.

[13] We thank the referee for suggesting the inclusion of the price and the amount-outstanding variables.

[14] For example, the correlation of corporate bond maturity with duration is 0.90 and with convexity is 0.95. We calculate Macaulay duration and convexity on the basis of the estimated annual bond yield. We estimate the yield

In our first empirical model, we regress $Spread_{it}$, the daily traded bid-ask spread per \$100 par value for bond i on day t, on all explanatory variables except *Amt Outstanding* and *Price*.

$$Spread_{it} = a_0 + a_1\, Maturity_{it} + a_2\, Square\ of\ Maturity_{it} + a_3\, Age_{it} + a_4\, Total\ Volume_{it} + Announcement\ Dummies_t + Credit\ rating\ dummies_i + e_{it} \qquad (1)$$

In our second model, we average $Spread_{it}$ and all the explanatory variables (except the announcement dummies) across trading days for each bond and estimate a pure cross-sectional regression. We also include *Amt Outstanding*, which has one observation per bond and so does not need to be averaged over days, and *Price*. Thus, the bid-ask spread for bond i, $Spread_i$, is regressed on the following variables:

$$Spread_i = a_0 + a_1\, Maturity_i + a_2\, Square\ of\ Maturity_i + a_3\, Age_i + a_4\, Total\ Volume_i + a_5\, Price_i + a_6\, Amt\ Outstanding_i + Credit\ rating\ dummies_i + e_i \qquad (2)$$

4. Empirical Determinants of the Bid-ask Spread and its Comparison Across Markets

In section *A*, we examine the factors that determine the bid-ask spread in each market separately. In section *B*, we compare the bid-ask spread across the three markets.

A. Estimation Results for Individual Bond Markets

For all three markets, Durbin-Watson test statistics indicate significant serial correlation in the error terms when the bid-ask spread regressions (1) or (2) are estimated with Ordinary Least Squares (OLS). Lagrange multiplier and White's tests (White, 1980) also detect the presence of heteroscedasticity in the OLS error terms. To control for autocorrelation and to

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using the semi annual coupon payments and the accrued interest from the previous coupon interest date.

avoid assuming a form for the heteroscedasticity, we use the Generalized Method of Moments (GMM) of Hansen (1982) with the Newey-West correction. The GMM weighting matrix is initialized from a 2-stage-least-squares estimation of the system. The explanatory variables are used as instruments, and the system is exactly identified. GMM estimation results for regression (1) and regression (2) for the three markets are reported in Table 3.

Considering the corporate market and results for regression (1) first, we find that the bid-ask spread is concave in *Maturity*, increasing at a decreasing rate with the bond's remaining time to maturity. The bid-ask spread increases by 1 cent when the bond ages by another year. The bid-ask spread is negatively related to the total volume, indicating that active bonds have lower bid-ask spreads. The credit rating variables are highly significant and indicate that lower rated bonds have higher spreads. Specifically, bonds rated *AAA*, *AA*, *A1*, *A2*, *A3* and *BAA* have significantly lower spreads relative to below-investment grade or junk bonds. The macroeconomic announcement day dummy is positive and significant, indicating an increase in the spread on these days. The results from regression (2) show that, in addition, the bid-ask spread is lower for higher priced bonds. But, the amount outstanding is not significant.

Results for the municipal market are similar to those of the corporate market. Time-to-maturity, volume and credit ratings are all significant and of the same sign as in the corporate market. However, the bond age, price and the amount outstanding are not significant. For Treasury bonds, volume, price and the announcement day dummy are significant and of the same signs as in the other markets. Time-to-maturity is significant in model (2) but not in model (1).

In summary, the bond bid-ask spread increases with time-to-maturity, credit risk and on announcement days and decreases with trading volume. The corporate and Treasury bid-ask spread is lower for higher priced bonds. The bid-ask spread is higher for older corporate bonds.

B. Comparison of the Bid-Ask Spread in the Corporate, Municipal and Treasury Bond Markets

We pool observations across markets to test whether the bid-ask spread is different in the three bond markets. The univariate results suggest that the Treasury bonds have lower spreads than the other two markets, perhaps due to their larger volume and lower credit risk. In the first regression, we compare the bid-ask spread without controlling for credit risk. In the second regression, we also control for credit risk. We define a dummy variable that is one for corporate bonds and zero otherwise, and another dummy variable that is one for municipal bonds and zero otherwise. A positive coefficient for the corporate or municipal dummy implies that the bid-ask spread is higher in these markets compared to the Treasury market, after controlling for other factors. To control for credit risk, we define dummy variables for every rating category except for below-investment grade bonds. To check the sensitivity of the results, we repeat our analysis for all *market pairs*.

Table 4 reports the results of the GMM estimation with pooled data. Panel A of Table 4 reports results when observations are pooled across all three markets. When we do not control for credit risk (regression 1), the market dummies are positive and significant, indicating that the bid-ask spread in the municipal and corporate markets are higher by 11 cents and 13 cents, respectively, compared to the Treasury market. However, after we control for credit risk (regression 2), the corporate dummy is no longer significant but the municipal dummy continues to be positive and significant. These results are confirmed when observations are pooled for pairs of markets. For the corporate and Treasury market pair (Panel B), the bid-ask spread is higher in the corporate market when unadjusted for credit risk, but not after controlling for credit risk. For the municipal and Treasury markets pair (Panel C), on the other hand, the municipal bond bid-ask spread is higher and remains so even after controlling for credit risk.

We conclude that, after adjusting for credit risk, the bid-ask spread is not statistically different between the corporate and the Treasury markets. However, municipal bonds have higher bid-ask spreads compared to the Treasury market, even after adjusting for credit risk and other bond characteristics.

5. The Bid-ask Spread of Trades by Large and Small Dealers and Institutions

For equity markets, Keim and Madhavan (1997) document significant differences in trading costs across institutions even after adjusting for differences in trading styles. More than in equity, differences in the bond bid-ask spread for large and small dealers and institutions may reflect differences in the type of bonds traded by them. To allow for dealer specialization in particular bonds, we rank dealers and institutions *for each bond* according to their shares of the value traded in the bond.[15] Dealers with the highest market shares in a bond, such that their cumulative shares just add up to 50 percent, are "large." The other dealers are "small."

In Table 5, we show characteristics of bonds traded by large and small dealers, and bonds that are directly traded. We exclude direct trades for the analysis in this section, but they are considered in section 6. In all markets, large dealers execute bonds with higher volatility (i.e., time to maturity, duration and convexity) and credit risk (lower proportion of investment-grade bonds). In the municipal and Treasury markets, large dealers also trade older bonds.

We calculate a dealer's bid-ask spread for a bond as the dealer's mean daily sell price minus the mean daily buy price for the bond. We use the Kruskal-Wallis chi-square statistic to test for differences in the distribution of the bid-ask spread between large and small dealers.

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[15] Our methodology for identifying large dealers is somewhat different from that of Schultz (2000), who ranks dealers and institutions by the market share in *all* bonds, rather than the share in *each* bond.

Panel A of Table 6 shows that large dealers trade only about five percent of bonds in common with small dealers in the corporate market, about three percent in the municipal market and 22 percent in the Treasury markets. Thus, there is substantial specialization among dealers with respect to the type of bonds traded. Panel B of Table 6 shows that, for all corporate bonds, large dealers earn a higher bid-ask spread than smaller dealers do, and the difference is significant. However, for corporate bonds traded in common by large and small dealers, the bid-ask spread for large and small dealer is not statistically different. The bid-ask spreads of large and small dealers in the Municipal and Treasury markets are not significantly different.

Since relatively inactive bonds have fewer dealers than active bonds, they may have proportionately more dealers with high market share. Hence, the large dealer dummy may be correlated with the activity level of bonds. We use regression analysis to control for the activity level of bonds. Specifically, the traded bid-ask spread is regressed on total volume, a dummy variable for large dealers, and bond characteristics. The results (not reported but available from the authors) show that, for all markets, the large dealer dummy coefficient is not significant after controlling for the activity level. We conclude that, after controlling for differences in the bonds traded, the bid-ask spread of large and small dealers is not significantly different in any market.

We perform a parallel analysis of the bid-ask spread for large and small institutions, and obtain similar results (not reported but available from the authors). Trading costs of large and small institutions are not different in any market, after controlling for differences in the bonds traded. For *all* corporate bonds, trading costs are lower for large institutions according to the Kruskal-Wallis test. But large and small institutions in the corporate market trade 4 percent of bonds in common and, for bonds traded in common by large and small institutions, trading costs are not significantly different.

6. Why do Institutions Sometimes Trade without Dealers?

Institutions sometimes negotiate trades directly among themselves and agree on execution at a common price. While the bid-ask spread for direct trades is zero by definition, and the dealer spread is positive, the dealer spread may reflect the value of providing liquidity to the market. For example, dealers may specialize in bonds that are more volatile or have higher credit risk. Table 5 shows that, relative to direct trades, volatility (i.e., time to maturity, duration and convexity) and volume is greater and age is lower for bonds traded by large and small dealers in all markets. In the corporate market, the share of investment grade bonds is lower for dealer trades relative to direct trades, but the reverse is true for the municipal market. This suggests that an institution's desire to trade bonds directly should be related to bond characteristics, as well as the cost of trading the bond with dealers. Thus, we regress an institution's daily share of volume traded without dealers in a bond on maturity, age, volume, the traded bid-ask spread, a dummy variable that is one if the institution is large (and zero otherwise), and the credit rating dummies.

The results, reported in Table 7, show that, in the corporate and municipal markets, institutions' share of volume traded without dealers is increasing in the age of the bond and decreasing in the bid-ask spread. One interpretation of the result is that, to remain competitive, dealers narrow the bid-ask spread for bonds that institutions find easier to trade directly. In the corporate and Treasury markets, the share of direct trades decreases in total volume. Thus, dealers appear more likely to be involved in trading active bonds. In the corporate market, institutions are more likely to trade directly if they are large in size.

Since in many cases the daily share of direct trading in total volume is zero or one, a censored regression may be a more appropriate estimation method. We estimate an accelerated failure time model, and assume that the data is censored on the left at zero and on the right at one and that the failure time follows a logistic distribution.[16] The results (not reported but available from the authors) are qualitatively similar to the results reported in Table 7.

7. Conclusion

This paper compares the traded bid-ask spread in the U.S. corporate, municipal and Treasury bond markets for 1995 to 1997, based on newly available transaction data. We estimate that the mean bid-ask spread per $100 par value is 23 cents for municipal bonds, 21 cents for corporate bonds and 8 cents for Treasury bonds. The bond bid-ask spread increases in interest rate risk (higher time-to-maturity), credit risk (lower Moody's credit ratings) and on announcement days, and decreases with greater activity (trading volume). The corporate and Treasury bid-ask spread decreases with the price of a bond. The bid-ask spread is higher for older corporate bonds. After controlling for credit risk, there is no significant difference in the bid-ask spread of corporate and Treasury bonds, but municipal bonds have higher spreads than Treasuries even after controlling for credit risk.

We examine why institutions sometimes trade without dealers and show that the volume of directly negotiated trades in a bond decreases in its bid-ask spread, indicating that dealers may lower the bid-ask spread for bonds that institutions are likely to trade directly. Direct trades are less likely if the bond volume is higher indicating that dealers provide liquidity for more active bonds. However, dealers appear to be reluctant to support older bonds. Our results are consistent with evidence that, at least initially, only bonds with relatively smaller trade sizes

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[16] By comparison, in the classic Tobit model, the failure time is normally distributed and the data is usually censored at the left. The estimates from the logistic distribution are robust since they have bounded influence functions. An influence function measures the difference in standard deviation units between estimates with and without an individual observation.

migrate to electronic bond trading systems (Bank of International Settlements, 2001).

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Table 1. Bond Characteristics in the Corporate, Municipal and Treasury Sectors

The sample consists of corporate, municipal and Treasury bond trades by insurance companies, as reported by Capital Access International, from January 1995 to December 1997. "Whole sample" includes all trades that satisfy the data filters described in the text. "Sample used" includes, in addition, only those bonds with at least one buy trade and one sell trade on the same day. The Merrill Lynch Bond Index includes daily values of bond characteristics for U.S. Treasuries and investment-grade corporate bonds. The number of bond days is the number of bonds times the number of days each bond traded. Annual yield (in percent) is the annualized yield-to-maturity calculated on the basis of the market convention for accrued interest. Time to maturity is the difference between the trade date and the bond's maturity date (in years). Bond age is the difference between a bond's issue date and the trade date (in years). Volume is in million dollars.

	Whole Sample			Sample Used			Merrill Lynch Bond Index	
	Number of bond days	Mean	Standard deviation	Number of bond days	Mean	Standard deviation	Mean	Standard deviation
Panel A: Corporate bond market								
Annual yield	93,161	7.47	1.71	2,560	7.37	1.50	6.78	0.28
Macaulay's Duration	93,161	6.54	2.72	2,560	6.11	2.57	6.82	0.10
Convexity	93,161	66.00	65.41	2,560	56.59	57.36	---	---
Time to maturity	94,752	10.31	8.89	2,584	9.12	7.31	---	---
Bond age	86,995	3.12	4.91	2,437	3.70	5.09	---	---
Coupon rate	93,866	7.67	1.53	2,572	7.77	1.53	7.68	0.15
Buy volume	60,583	4.84	9.36	2,559	4.28	6.93	---	---
Sell volume	37,849	3.97	5.21	2,600	4.32	5.39	---	---
Total volume	95,873	4.63	8.20	2,600	8.54	10.09	---	---
Panel B: Municipal bond market								
Annual yield	60,540	5.62	1.46	1,224	5.53	1.40	5.48	0.30
Macaulay's Duration	60,540	8.77	2.96	1,224	8.11	2.84	12.05	0.47
Convexity	60,540	108.50	72.90	1,224	91.64	62.64	---	---
Time to maturity	61,039	12.88	6.61	1,227	11.34	5.79	---	---
Bond age	57,545	2.57	3.77	1,226	3.52	3.67	---	---
Coupon rate	60,540	5.75	0.93	1,224	5.78	0.91	5.82	0.23
Buy Volume	43,232	2.63	3.65	1,227	2.95	3.44	---	---
Sell volume	19,025	2.43	3.44	1,218	3.36	3.90	---	---
Total volume	61,039	2.62	3.72	1,227	6.29	7.03	---	---
Panel C: Treasury bond market								
Annual yield	12,502	6.41	0.60	1,237	6.37	0.58	5.88	0.35
Macaulay's Duration	12,502	6.02	3.19	1,237	6.10	2.71	5.21	0.18
Convexity	12,502	61.05	70.29	1,237	56.92	62.34	---	---
Time to maturity	12,668	8.90	7.64	1,246	8.54	6.67	---	---
Bond age	12,631	4.21	3.73	1,245	3.46	2.66	---	---
Coupon rate	12,502	7.19	1.41	1,237	6.83	1.05	7.12	0.11
Buy Volume	7,290	6.07	19.49	1,236	5.19	13.32	---	---
Sell volume	6,610	6.44	19.31	1,242	6.14	16.84	---	---
Total volume	12,668	6.85	20.44	1,246	11.27	21.99	---	---

Table 2. The Traded Bid-Ask Spread of Corporate, Municipal and Treasury Bonds

The sample consists of corporate, municipal and Treasury bond trades by insurance companies from January 1995 to December 1997, as reported by Capital Access International, and that satisfy the data filters described in the text. The traded bid-ask spread (per $100 par value) of a bond is the difference between its mean sell price and its mean buy price. In Panel A, we calculate the daily spread for bonds with at least one buy trade and one sell trade on the same day. In Panel B, we calculate the two-day spread for bonds with at least one buy trade and one sell trade on two consecutive trading days. In Panel C, we calculate the five-day spread for bonds with at least one buy trade and one sell trade on five consecutive trading days. Bond ratings are from Moody's. Industrial co. bonds, finance co. bonds, utility and education bonds refer to bonds of issuers in the industrial, finance, utility and education sectors.

	Corporate Market				Treasury Market				Municipal Market			
	No. of bonds	No. of bond days	Mean bid-ask spread	Standard deviation of spread	No. of bonds	No. of bond days	Mean bid-ask spread	Standard deviation of spread	No. of bonds	No. of bond days	Mean bid-ask spread	Standard deviation of spread
Panel A: Traded bid-ask spread for 1-day window												
1995-1997	1819	2,542	0.21	0.88	82	1,163	0.08	1.11	1,167	1,218	0.23	0.43
AAA bonds	---	---	---	---	---	---	---	---	604	623	0.23	0.42
AA bonds	198	263	0.14	1.54	---	---	---	---	400	430	0.22	0.40
A bonds	762	1,085	0.20	0.64	---	---	---	---	133	139	0.20	0.46
BAA bonds	514	739	0.21	0.67	---	---	---	---	---	---	---	---
Below BAA bonds	285	378	0.28	1.17	---	---	---	---	---	---	---	---
Below A3 bonds	---	---	---	---	---	---	---	---	17	17	0.24	0.29
Industrial co. bonds	550	781	0.18	0.83								
Finance co. bonds	582	794	0.17	0.60	---	---	---	---	---	---	---	---
Utility bonds	255	333	0.27	1.01	---	---	---	---	225	240	0.21	0.29
Education bonds	---	---	---	---	---	---	---	---	233	243	0.22	0.41
Panel B: Traded bid-ask spread for 2-day window												
1995-1997	4,292	15,129	0.35	2.59	100	3,317	0.09	1.44	1,241	1,851	0.24	2.37
AAA bonds	---	---	---	---	---	---	---	---	626	899	0.26	2.32
AA bonds	495	1,845	0.16	2.48	---	---	---	---	416	670	0.18	2.30
A bonds	1,814	6,751	0.25	2.35	---	---	---	---	167	243	0.37	2.78
BAA bonds	1,078	3,956	0.23	2.54	---	---	---	---	---	---	---	---
Below BAA bonds	727	2,064	1.07	3.11	---	---	---	---	---	---	---	---
Below A3 bonds	---	---	---	---	---	---	---	---	27	33	0.17	2.24
Industrial co. bonds	1,193	4,313	0.30	2.87								
Finance co. bonds	1,428	5,261	0.23	2.12	---	---	---	---	---	---	---	---
Utility bonds	681	2,017	0.44	2.55	---	---	---	---	285	432	0.36	2.43
Education bonds	---	---	---	---	---	---	---	---	155	207	0.03	2.42
Panel C: Traded bid-ask spread for 5-day window												
1995-1997	4,513	13,219	0.27	2.72	102	2,281	0.07	1.38	1,428	1,977	0.37	2.27
AAA bonds	---	---	---	---	---	---	---	---	724	982	0.37	2.21
AA bonds	522	1,588	0.13	2.68	---	---	---	---	466	672	0.38	2.33
A bonds	1,903	5,834	0.11	2.39	---	---	---	---	197	269	0.34	2.22
BAA bonds	1,123	3,430	0.14	2.78	---	---	---	---	---	---	---	---
Below BAA bonds	768	1,884	1.16	3.20	---	---	---	---	---	---	---	---
Below A3 bonds	---	---	---	---	---	---	---	---	34	44	0.11	2.77
Industrial co. bonds	1,238	3,692	0.19	3.11								
Finance co. bonds	1,510	4,610	0.10	2.08	---	---	---	---	---	---	---	---
Utility bonds	720	1,797	0.46	2.57	---	---	---	---	329	489	0.45	2.27
Education bonds	---	---	---	---	---	---	---	---	173	219	0.24	2.06

Table 3. Determinants of the Bid-Ask Spread for Corporate, Municipal and Treasury Bonds

The sample consists of corporate, municipal and Treasury bond trades by insurance companies from January 1995 to December 1997, as reported by Capital Access International, and that satisfy the data filters described in the text. Included in the sample are only those bonds with at least one buy trade and one sell trade on the same day. The daily traded bid-ask spread (per $100 par value) of a bond is the difference between its mean sell price and its mean buy price. *Time to maturity* is the difference between the trade date and the bond's maturity date (in years). *Square of maturity* is the square of the time to maturity, used in the corporate bond regression only. *Bond age* is the difference between a bond's issue date and the trade date (in years). *Total volume* is the level of daily trading volume (in million $) for the corporate and municipal markets, and the log of volume in the Treasury bond market. *Price* is the average daily price level of the bond. *Employment ann* is a dummy variable equal to one on days when the Employment Report is announced. *GDP ann* and *Ind. Production ann* are dummy variables for the GDP and the Industrial Production announcements, respectively. The *AAA/AA* dummy is equal to one for bonds rated *AAA* or *AA* by Moody's and zero otherwise. *AAA*, *AA*, *A*1, *A*2, and *A*3 are dummy variables for bonds rated, respectively, *AAA*, *AA*, *A*1, *A*2, and *A*3 by Moody's. *BAA* is a dummy variable equal to one for bonds rated *BAA*1, *BAA*2 or *BAA*3 by Moody's. The omitted rating category is below-investment grade (bonds rated *Ba* or below in the corporate sector and *BAA1* or below in the municipal sector). *Amt outstanding* is the market value of the amount of the bond that remains outstanding (in million $).

In Model 1, for each market, we regress $Spread_{it}$, the daily traded bid-ask spread per $100 par value for bond i on day t, on all explanatory variables except *Amt Outstanding* and *Price*:

$$Spread_{it} = a_0 + a_1\, Maturity_{it} + a_2\, Square\ of Maturity_{it} + a_3\, Age_{it} + a_4\, Total\ Volume_{it} + Announcement\ Dummies_t + Credit\ rating\ dummies_i + e_{it} \qquad (1)$$

In Model 2, for each market, we average $Spread_{it}$ and all the explanatory variables (except the announcement dummies) across trading days for each bond and estimate a pure cross-sectional regression. Thus, we regress the bid-ask spread for bond i, $Spread_i$, as follows:

$$Spread_i = a_0 + a_1\, Maturity_i + a_2\, Square\ of Maturity_i + a_3\, Age_i + a_4\, Total\ Volume_i + a_5\, Price_i + a_6\, Amt\ Outstanding_i + Credit\ rating\ dummies_i + e_i \qquad (2)$$

The estimation method is the Generalized Method of Moments (GMM) with the Newey-West correction. t-statistic are in parentheses. Estimates significant at the 10 percent level or lower are in bold.

Table 3 (continued). Determinants of the Bid-Ask Spread for Corporate, Municipal and Treasury Bonds

	Corporate Bonds		**Municipal Bonds**		**Treasury Bonds**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
Intercept	0.24	2.16	0.58	0.57	0.25	1.41
	(3.69)	(3.93)	(3.20)	(2.47)	(3.47)	(1.95)
Time to maturity	**0.02**	**0.02**	**0.01**	**0.01**	-0.01	**0.02**
	(4.08)	(4.28)	(3.11)	(2.96)	(-0.65)	(2.07)
Square of maturity	**-0.0002**	**-0.0002**	---	---	---	---
	(-2.57)	(-2.85)				
Bond Age	**0.01**	**0.01**	-0.00	-0.00	-0.01	-0.01
	(1.69)	(1.99)	(-1.06)	(-0.84)	(-0.78)	(-0.47)
Total volume/log total volume	**-0.0048**	**-0.0040**	**-0.0045**	**-0.0039**	**-0.05**	0.01
	(-3.05)	(-3.27)	(-2.94)	(-2.69)	(-2.17)	(0.92)
Price	---	**-0.02**	---	0.00	---	**-0.01**
		(-3.76)		(0.34)		(-1.99)
Employment ann	**0.13**	---	0.03	---	-0.03	---
	(1.78)		(0.90)		(-0.13)	
GDP ann	0.03	---	**0.38**	---	0.05	---
	(0.33)		(1.80)		(0.41)	
Ind. production ann	-0.11	---	0.04	---	**0.17**	---
	(-1.59)		(0.69)		(1.74)	
AAA/AA dummy	**-0.29**	**-0.31**	---	---	---	---
	(-3.29)	(-3.22)				
AAA dummy	---	---	**-0.42**	**-0.47**	---	---
			(-2.32)	(-2.44)		
AA dummy	---	---	**-0.42**	**-0.46**	---	---
			(-2.31)	(-2.40)		
A1 dummy	**-0.14**	**-0.15**	**-0.47**	**-0.52**	---	---
	(-1.80)	(-1.82)	(-2.57)	(-2.65)		
A2 dummy	**-0.17**	**-0.17**	**-0.42**	**-0.44**	---	---
	(-2.36)	(-2.31)	(-2.17)	(-2.14)		
A3 dummy	**-0.18**	**-0.21**	-0.31	-0.32	---	---
	(-2.44)	(-2.79)	(-1.40)	(-1.37)		
BAA dummy	**-0.17**	**-0.16**	---	---	---	---
	(-2.39)	(-2.19)				
Amt outstanding	---	-0.00	---	-0.00	---	-0.00
		-(0.75)		(-1.15)		-(0.11)
Adjusted R-square	2.39	6.32	2.67	3.05	0.32	10.41
No. of observations	2,393	1.696	1,217	1,108	1,224	82

Table 4. Comparison of the Bid-Ask Spread for Corporate, Municipal and Treasury Bonds

The sample consists of corporate, municipal and Treasury bond trades by insurance companies from January 1995 to December 1997, as reported by Capital Access International, and that satisfy the data filters described in the text. Included in the sample are only those bonds with at least one buy trade and one sell trade on the same day. In Panel A, we pool observations across all three markets. In Panel B, we pool observations across the corporate and Treasury markets. In Panel C, we pool observations across the municipal and Treasury markets. The dependent variable is the daily traded bid-ask spread (per $100 par value) of a bond, calculated as the difference between a bond's mean sell price and its mean buy price for the day. The municipal (corporate) market dummy is equal to one for municipal (corporate) bond trades and zero otherwise. *Time to maturity* is the difference between the trade date and the bond's maturity date (in years). *Square of maturity* is the square of the time to maturity, used in the corporate bond regression only. *Bond age* is the difference between a bond's issue date and the trade date (in years). *Total volume* is the log of daily trading volume. *AAA*, *AA*, *A*1, *A*2, and *A*3 are dummy variables for bonds rated, respectively, *AAA*, *AA*, *A*1, *A*2, and *A*3 by Moody's. *BAA* is a dummy variable equal to one for bonds rated and *BAA*1, *BAA*2 or *BAA*3 by Moody's. The omitted rating category is below-investment grade (bonds rated *Ba* or below in the corporate sector *BAA1* or below in the municipal sector). For regression (1), the daily traded bid-ask spread for a bond is regressed on all explanatory variables except the credit rating dummies. For regression (2), all explanatory variables are used. *N* is the number of observations. R^2 is the adjusted R-square. The estimation method is the Generalized Method of Moments (GMM) with the Newey-West Correction. *t*-statistics are in parentheses. Coefficient estimates significant at the 10 percent level or lower are in bold.

Table 4 (continued). Comparison of the Bid-Ask Spread for Corporate, Municipal and Treasury Bonds

	Intercept	Municipal market	Corporate market	Log total volume	Bond age	Time to maturity	Square of maturity	AAA dummy	AA dummy	A1 dummy	A2 dummy	A3 dummy	BAA dummy
Panel A: All bond markets													
(1) Coefficient	0.04	**0.11**	**0.13**	**-0.03**	0.00	**0.01**	**-0.0001**	---	---	---	---	---	---
(t-statistics)	(1.19)	(2.85)	(3.59)	(-2.89)	(0.16)	(3.04)	-(2.02)						
N=4834 R^2=0.94													
(2) Coefficient	0.31	**0.11**	0.05	**-0.03**	0.00	**0.01**	**-0.0001**	**-0.26**	**-0.29**	**-0.19**	**-0.21**	**-0.20**	**-0.18**
(t-statistics)	(3.56)	(2.74)	(0.88)	(-2.91)	(0.36)	(2.87)	-(1.72)	(-3.27)	(-3.65)	(-2.58)	(-2.88)	(-2.73)	(-2.59)
N=4834 R^2=1.30													
Panel B: Corporate and Treasury bond markets													
(1) Coefficient	0.05	---	**0.13**	**-0.03**	0.00	**0.01**	**-0.0001**	---	---	---	---	---	---
(t-statistics)	(1.29)		(3.59)	-(2.64)	(0.36)	(2.29)	-(1.71)						
N=3617 R^2=0.83													
(2) Coefficient	0.20	---	0.15	**-0.04**	0.00	**0.01**	-0.00	-0.14	**-0.32**	**-0.14**	**-0.18**	**-0.18**	**-0.16**
(t-statistics)	(1.34)		(1.13)	-(2.72)	(0.59)	(2.01)	-(1.20)	-(0.97)	-(3.51)	-(1.80)	-(2.52)	-(2.50)	-(2.29)
N=3617 R^2=1.20													
Panel C: Municipal and Treasury bond markets													
(1) Coefficient	**0.17**	**0.13**	---	**-0.04**	**-0.01**	0.00	---	---	---	---	---	---	---
(t-statistics)	(3.72)	(3.22)		-(2.49)	-(1.87)	(0.11)							
N=2441 R^2=0.94													
(2) Coefficient	**1.11**	**0.13**	---	**-0.04**	**-0.01**	0.00	---	**-0.94**	**-0.94**	**-1.00**	**-0.94**	**-0.82**	**-0.87**
(t-statistics)	(3.01)	(2.90)		-(2.39)	-(2.19)	(0.11)		-(2.57)	-(2.56)	-(2.71)	-(2.53)	-(2.12)	-(2.35)
N=2441 R^2=1.23													

Table 5. Characteristics of Bonds Traded without Dealers, and by Small and Large Dealers

The sample consists of corporate, municipal and Treasury bond trades by insurance companies from January 1995 to December 1997, as reported by Capital Access International, and that satisfy the data filters described in the text. Included in the sample are only those bonds with at least one buy trade and one sell trade *for each dealer* on the same day. Annual yield (in percent) is the annualized yield-to-maturity calculated on the basis of the market convention for accrued interest. Time to maturity is the difference between the trade date and the bond's maturity date (in years). Bond age is the difference between a bond's issue date and the trade date (in years). Volume is in million dollars. For each bond, dealers are ranked according to their share in the value traded over the sample. Dealers with a cumulative market share of at least 50 percent are designated as "large" dealers. The remaining dealers are "small" dealers. Direct trades are those negotiated directly between institutions without involving dealers.

	Large dealers		**Small Dealers**		**Direct trades**	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Panel A: Corporate bonds						
Time to maturity	8.57	7.48	8.26	6.53	7.53	6.15
Bond age	4.15	6.23	3.95	4.73	5.16	7.20
Macaulay's Duration	5.73	2.60	5.75	2.36	5.39	2.34
Convexity	50.89	54.83	49.04	51.83	43.45	49.49
Total volume	12.76	14.14	3.70	3.69	4.74	3.94
Coupon rate	7.88	1.53	7.82	1.46	8.03	1.39
Annual yield	7.51	2.62	7.33	2.01	7.41	2.85
% investment-grade bonds	84.96	—	88.01	—	92.26	—
Panel B: Treasury bonds						
Time to maturity	10.90	7.69	7.34	6.24	4.70	3.61
Bond age	4.31	3.23	4.29	3.90	5.11	4.52
Macaulay's Duration	7.12	3.06	5.42	2.74	3.96	2.02
Convexity	78.67	74.45	46.72	56.16	23.62	25.12
Total volume	19.24	35.13	7.03	18.55	3.28	3.98
Coupon rate	7.12	1.41	7.11	1.29	6.93	1.98
Annual yield	6.45	0.57	6.53	0.78	6.51	1.09
Panel C: Municipal bonds						
Time to maturity	9.50	5.89	12.80	6.10	9.47	6.17
Bond age	4.52	5.40	3.51	1.73	7.19	7.39
Macaulay's Duration	7.07	2.99	8.89	3.07	6.98	3.39
Convexity	72.52	62.38	110.41	66.02	74.32	64.66
Total volume	3.52	4.83	1.23	1.55	2.71	2.57
Coupon rate	5.72	1.02	5.56	5.18	5.63	0.90
Annual yield	5.35	1.92	5.35	0.60	5.18	0.70
% investment-grade bonds	98.43	—	100.00	—	96.88	—

Table 6. The Bid-ask Spread for Large and Small Dealers in Corporate, Municipal and Treasury Bonds

The sample consists of corporate, municipal and Treasury bond trades by insurance companies from January 1995 to December 1997, as reported by Capital Access International, and that satisfy the data filters described in the text. Included in the sample are only those bonds with at least one buy trade and one sell trade *for each dealer* on the same day. For each bond, dealers are ranked according to their share in the value traded over the sample. Dealers with a cumulative market share of at least 50 percent are designated as "large" dealers. The remaining dealers are "small" dealers. All directly negotiated trades (i.e. without involving dealers) are excluded from the sample. In Panel A, we report the number of bonds traded in common by small and large dealers. In Panel B, we compare the daily traded bid-ask spread (per $100 par value) for small and large dealers. A dealer's traded bid-ask spread for a bond is the difference between the dealer's daily mean sell price and daily mean buy price in that bond. The Kruskal-Wallis non-parametric test shows whether the distribution of the bid-ask spread is different between large and small dealers. Differences significant at the 10 percent level or lower are in bold.

Panel A: Common and distinct bonds traded by large and small dealers

	Number of common bonds	Number of distinct bonds	Percent of common bonds in total
Corporate market	49	884	5.26
Treasury market	17	59	22.37
Municipal market	1	310	3.22

Panel B: Bid-ask spread for large and small dealers

	Large dealer trades			Small dealer trades		
	Number of bond days	Mean bid-ask spread	Standard deviation of spread	Number of bond days	Mean bid-ask spread	Standard deviation of spread
Corporate market						
All bonds	596	**0.12**	0.78	505	**0.04**	0.41
Kruskal-Wallis test	**χ^2=17.36**	**p=0.0001**				
Common bonds	57	0.12	0.66	62	0.10	0.48
Kruskal-Wallis test	χ^2=2.68	p=0.1018				
Treasury market	38	0.37	2.08	97	0.03	0.30
Kruskal-Wallis test	χ^2=0.54	p=0.4260				
Municipal market	287	0.03	0.19	26	0.01	0.02
Kruskal-Wallis test	χ^2=0.18	p=0.6742				

Table 7. Why do Institutions Trade Without Dealers?

The sample consists of corporate, municipal and Treasury bond trades by insurance companies from January 1995 to December 1997, as reported by Capital Access International, and that satisfy the data filters described in the text. Included in the sample are only those bonds with at least one buy trade and one sell trade *for each institution* on the same day. The dependent variable is an institution's daily share of volume traded without a dealer in a bond. *Time to maturity* is the difference between the trade date and the bond's maturity date (in years). *Square of maturity* is the square of the time to maturity, used in the corporate bond regression only. *Bond age* is the difference between a bond's issue date and the trade date (in years). *Total volume* is the level of daily trading volume (in million $) for the corporate and municipal markets, and the log of volume in the Treasury bond market. *Large institution* is a dummy variable equal to one when the institution is "large" and zero otherwise. For each bond, institutions are ranked according to their share in the value traded over the sample. "Large" institutions are those with a cumulative market share of at least 50 percent in a bond. *Bid-ask spread* is an institution's traded bid-ask spread for a bond, calculated as the difference between the institution's daily mean sell price and daily mean buy price in that bond. AAA, AA, $A1$, $A2$, and $A3$ are dummy variables for bonds rated, respectively, AAA, AA, $A1$, $A2$, and $A3$ by Moody's. BAA is a dummy variable equal to one for bonds rated $BAA1$, $BAA2$ or $BAA3$ by Moody's. The omitted rating category is below-investment grade (bonds rated Ba or below in the corporate sector and $BAA1$ or below in the municipal sector). The estimation method is the Generalized Method of Moments (GMM) with the Newey-West correction. Coefficient estimates significant at the 0.10 level or higher are in bold.

	Corporate Bonds		**Municipal Bonds**		**Treasury Bonds**	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	0.27	4.48	0.17	0.92	0.21	3.75
Time to maturity	0.00	0.65	0.00	-0.47	0.00	-1.31
Square of maturity	0.00	-0.62	---	---	---	---
Bond Age	**0.01**	**2.98**	**0.02**	**2.85**	0.01	0.71
Total volume/log total volume	**-0.00**	**-2.75**	0.01	1.14	**-0.05**	**-2.10**
Large institution	**0.07**	**1.81**	-0.08	-0.87	-0.06	-1.21
Bid-ask spread	**-0.20**	**-5.16**	**-0.50**	**-3.28**	0.01	0.30
AAA/AA dummy	-0.08	-1.18	---	---	---	---
AAA dummy	---	---	0.01	0.04	---	---
AA dummy	---	---	0.04	0.24	---	---
A1 dummy	0.01	0.19	-0.04	-0.19	---	---
A2 dummy	0.07	1.07	0.01	0.04	---	---
A3 dummy	0.10	1.53	-0.13	-0.78	---	---
BAA dummy	0.09	1.51	---	---	---	---
Adjusted R-square	3.53		5.40		10.50	
No. of observations	923		354		131	

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