Corporate Bond Trading Costs and Practices: A Peek Behind the Curtain

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1. Introduction

The corporate bond market in the United States is very large. According to the Securities Industry Association (1998), there were $3.2 trillion in corporate bonds outstanding as of the 3rd quarter of 1997. Accurate data on the amount of corporate bond trading is difficult to find, but the Securities Industry Association (1994) estimates that institutional corporate bond trading averaged $46.1 billion dollars per day during 1993, a dollar volume easily greater than that of the equities traded on the New York Stock Exchange (NYSE).

Institutions dominate this market and their participation has been growing. As recently as 1993, individuals owned 14 percent of corporate debt. By the third quarter of 1997, individual ownership of corporate bonds was estimated to have declined to 9 percent of the total while institutions were estimated to own the other 91 percent. Among institutions, life insurance companies are the biggest debtholders with about 32 percent of all corporate bonds in their portfolios. Private pension funds hold almost 10 percent of outstanding corporate debt while foreign institutions own 16 percent of U.S. corporate bonds. Public pensions, mutual funds, banks, other insurance companies and savings institutions also hold significant proportions of the U.S. corporate debt.

Almost all secondary bond trading takes place over-the-counter. While some active bonds are quoted on the NYSE, that market is regarded as the odd-lot market for bonds. The Securities Exchange Commission (1992) estimates that only .5 percent to 1 percent of corporate bond volume took place on the NYSE in 1990.

The secondary market for corporate bonds resembles the pre-Nasdaq market for equities. An institution seeking quotes for a specific bond cannot see all quotes for the bond in one place. Instead, the institution must make several calls to a number of dealers for quotes. Alternatively, institutions may broadcast a list of bonds to sell (or buy) to various dealers through Bloomberg and invite bids. Or, dealers may broadcast quotes on lists of bonds in their inventory to potential institutional customers. When dealers broadcast quotes, they are often on one side of the market only. That is they provide bid or ask quotes but not both.

Most bonds trade so infrequently that dealers do not broadcast quotes for them. There is usually an initial flurry of trading activity in a bond following its offering. Bond traders suggest this occurs because bond offerings are typically underpriced by a small amount. As with equities, flippers will buy bonds on the offering and sell shortly thereafter. Eventually though, bonds fall into the hands of institutions who intend to hold them to maturity. Institutions buy bond issues in sufficiently large quantities that even the largest issues can be held entirely by 200 or fewer institutions. So, with the bonds in the hands of a small number of institutions who intend to hold them to maturity, trading declines to almost nothing.

If an institution wants to sell or buy a bond that is not actively quoted, they can contact dealers to provide quotes. If the issue is an investment grade bond, dealers are usually able to provide a quote by comparing the bond to bonds with similar characteristics. Most of the variation in the prices of investment grade bonds is a result of fluctuations in interest rates, so bid and ask quotes for investment grade bonds are given in terms of additional yield over a treasury security of similar maturity. The yield spread between the bond and the treasury security can be estimated by comparing the bond with other bonds with similar maturities, coupon rates, bond ratings and call provisions. High yield or junk bonds are more difficult to price. High-yield bonds are quoted in dollar prices rather than a premium from treasury yields because they, like equities, are affected primarily by firm-specific factors. Thus dealers cannot determine an appropriate quote by comparing the bond to others of similar rating, coupon and maturity.

Because quotes are not automatically disseminated for these inactively traded bonds, institutions sometimes find that they get very different quotes for the same bond from different dealers. This is especially true for high-yield or junk bonds. This problem is aggravated by a dearth of information on bond market trades. Trade reports are not disseminated, so institutions have no idea if they are paying more or less than others for the same or similar bonds.

When the bond market is compared to the other security markets, the lack of transparency is striking. In a speech on September 9, 1998, Securities and Exchange Commission Chairman Arthur Leavitt remarked that

> “The sad truth is that investors in the corporate bond market do not enjoy the same access to information as a car buyer or a homebuyer or, dare I say, a fruit buyer. And that’s unacceptable. Guesswork can never be a substitute for readily available price data.”

The absence of transparency in this market has become a matter of concern to regulators and some practitioners because it is feared to lead to higher transaction costs. A Wall Street Journal article of September 21, 1998 quotes Kevin McClintock, head of taxable fixed income at Dreyfus Corp that

> "I would certainly favor a centralized location reporting all trade prices, but the Wall Street community will fight it like crazy because an inordinate amount is made in the bond-trading business due to large spreads."

In September 1998, the House Committee on Commerce began hearings on bond market transparency. However, regulatory reform of the corporate bond market is hampered by a lack of hard data on bond trading costs and practices. There is almost no academic research on the costs of bond trading faced by institutional investors. This is no doubt a result of a lack of data on dealer quotes and transaction prices that reflects the opaqueness of the market.

In this paper, I employ a large sample of institutional bond trades over 1995-1997 to describe institutional trading practices and provide some first estimates of trading costs in the over-the-counter fixed income market. I estimate round-trip trading costs investment grade bonds to be about $2.60 per bond. These costs are slightly higher than the estimates produced by Hong and Warga (1998), the only other recent study of trading costs in the over-the-counter bond market. They employ a small sample of 2,779 buy and sell trade prices for the same bond on the same day and produce an estimate of the effective spread of 7.8¢ per hundred dollar par value for investment grade bonds and 19.1¢ per hundred dollar par value for non-investment grade bonds. I also find that costs decline with trade size and larger institutions seem to pay less all else equal. I show that some institutions seem to develop relationships with some dealers. This is reflected in a disproportionate number of their trades between some dealers and institutions. However, I find that trading costs are not decreased when institutions trade with the dealers that they trade with most frequently.

The findings of this paper complement recent work on the costs of institutional equity trading by Keim and Madhavan (1997) and Chan and Lakonishok (1997). This research provides independent tests of the role of order size and institutional identity on trading costs. In addition, institutions with private information are less likely to trade bonds than stock. Bond trading costs provide a rough benchmark to measure the adverse selection component of institution's equity trading costs.

The remainder of the paper is organized as follows. In Section 2 I provide information on the data used here. Section 3 reports different estimates of trading costs for corporate bonds. In Section 4 the effects of trade size and dealer and institutional identity on trading costs are examined. Section 5 offers a summary and conclusions.

2. Data

Data on bond trades is obtained from Capital Access International. The data consists of trades of corporate bonds over 1995 - 1997. The record for each trade consists of the trade date, the identity of the institution, the identity of the dealer, the bond's cusip number, the firm issuing the bonds, a description of the bonds, the coupon rate, the maturity date, whether the trade is a buy or sell, the face value of the traded bonds and the actual dollar value of the trade. The ratio of these last two variables provides the trade price as a percentage of the bond's face value. Capital Access also provides an indicator variable that says whether each trade date is the actual trade date or whether the date is an estimate provided by Capital Access. Trades with estimated dates are not included in transaction cost estimates.

Capital Access obtains their data from several sources. Insurance companies are required to file a Schedule D with the National Association of Insurance Commissioners every quarter. Information on all bond market transactions, including the trade date, amount bought or sold, and the par value of the bonds traded is included in this schedule. Capital Access obtains Schedule D information from A.M. Best & Co. and provides further cleaning and checking of this data. Information on insurance company trades appears relatively complete, which is important because life insurance companies by themselves hold 32 percent of corporate bonds. Mutual fund managers are required to file bondholding information semiannually and some file quarterly. Capital Access collects mutual fund information directly and also receives information from Morningstar. Public pension funds are not required to file holdings but Capital Access obtains information on their trades through voluntary disclosure and through the filing of Freedom of Information Act forms.

There are several features of this data that make it well-suited for estimating institutional bond-trading costs. Prices are trade prices rather than quotes and trades are designated as buys or sells. The institution is named and the dealer handling each trade is identified. Finally, there are thousands of trades included each month. Trading records are reasonably complete for insurance companies and many mutual funds.

There are also severe limitations to this data. First, not all corporate bond trades are included. For instance, foreign institutions hold about 1/6 of U.S. corporate bonds but their trades do not show up in this data. Public pension fund trades are included, but Capital Access does not claim to have data on all public pension funds. Second, the dollar value of trades is rounded up to the nearest $1000 dollars. For small trades this could represent a significant amount of noise in the prices, but most trades in my data set are for $1,000,000 or more. In calculating trading costs, I look at differences in prices for buy and sell trades and the bias caused by rounding up trade amounts should cancel when differences in buy and sell prices are examined. Third, the data does not contain contemporaneous quotes and the trades are not time-stamped.

Table 1 provides a description of the trade data. Panel A reports the distribution of trade sizes. There are a total of 192,867 trades from January 1995 through April 1997. In general, trades are considerably larger than institutional equity trades. Keim and Madhavan (1997) examine equity trades by 21 institutional investors over January 1991 through March 1993. The median size buy order in their sample is $138,000 and the median size sell order is $386,000. In contrast, the median dollar amount of the bond trades studied here is $1,513,000. The 25th percentile of trade size is $498,000 and the 75th percentile is $4,665,000. Panel A also demonstrates that buy orders are almost twice as common as sell orders and are usually a little larger. The smaller number of sell orders reflects the practice of many institutions of holding bonds to maturity and then reinvesting the principle. The last row of Panel A shows the distribution of trade sizes for matched trades. These are trades that could be matched with information from the Fixed Income Database. This data is compiled at the University of Houston from data from Lehman Brothers on bonds that are included in their bond index. This data source provides me with the issue date, maturity date, coupon yield, duration, convexity, Moody's and S&P ratings for each bond. This data set has been used in several other academic studies including Hong and Warga (1998) and Blume, Lim and MacKinlay (1998). 117,015 of the total of 192,867 trades in the Capital Access data could be matched with this data set. The matched trades are slightly larger than the unmatched ones.

Panel B shows the distribution of times to maturity of the traded bonds. When all sample bonds are considered, the median time to maturity was 8.48 years. The 25th and 75th percentiles were 5.55 years and 11.63 years. The distribution of times to maturity is similar for bonds that could be matched with the Fixed Income Data Set.

Practitioners claim that bonds only trade actively soon after they are issued. Panel C examines this issue by providing the distribution of the percentage of the bond's life that remains at the time of the trade. This is calculated by taking the time to maturity at the time of the trade and dividing by the time to maturity when the bond was issued. Issue dates are obtained from the Fixed Income Database, thus the results reported in Panel C are based only on the 117,015 trades that could be matched with information in that source. When all matched trades are considered, the median percentage time to maturity when a trade is made is 85 percent of the time to maturity at the bonds issue. Or, put another way, half of the trades in sample bonds issued with 20 years to maturity took place in the first three years after the bonds were issued and the other half took place in the remaining 17 years. A full quarter of the trades in the sample take place in bonds that still have 97 percent of their life remaining. Sells are more likely when the bond has less of its life remaining than buys, but the median percentage time to maturity when a sell occurs is still 74 percent of the time to maturity at the bonds issue.

These results are consistent with Alexander, Edwards and Ferri's (1998) findings on the trading of high-yield bonds in Nasdaq's Fixed Income Pricing System. They show that volume is much lower for bonds that have traded for more than two years. Part of the explanation for the results in Panel C could be that there have been a lot of recent issues of debt and thus a disproportionate number of the trades in 1995-1997 occurred in recently issued bonds. However, Alexander, Edwards and Ferri (1998) cite anecdotal evidence that bonds are initially traded frequently but that bond trading declines as they fall into the hands of investors who hold the bonds to maturity.

Panel D of Table 1 shows the distribution of the percentage of the outstanding issue traded in a transaction. Information on the number of bonds outstanding is obtained from the Fixed Income Database, so attention is again restricted to the bonds that could be matched with that database. When all trades are considered, the median trade consists of .75 percent of the outstanding bonds of that issue. The 25th percentile of the percentage of outstanding bonds per trade is .24 percent and the 75th percentile is 2.00 percent. Unlike equities, a typical institutional bond trade is for a non-trivial proportion of the total outstanding bonds. The proportions in Table 1 suggest that entire bond issues are held by a relatively small number of institutions.

The distribution of bond ratings is reported in Panel E of Table 1. Again, attention is restricted to the bonds that could be matched with the Fixed Income Database. About two-thirds of the trades took place in bonds with Moody's ratings of A or Baa. Only 1.30 percent involved bonds with ratings that were lower than B.

It is often reported that the over-the-counter bond market is dominated by a small number of dealers. Table 2 shows the number of trades and dollar volume of trades for the 12 dealers with the highest dollar volume of trades in the sample. In total, 601 dealers appear in the sample and $690.36 billion dollars of bonds are traded. $169.43 billion dollars of trades are designated as taking place with "various" dealers. That is, the institution used two or more dealers to complete the purchases or sale of bonds. An additional $27.72 billion in trades were direct placements of bonds from the company to the institution and did not require a dealer. This leaves $493.20 billion in trades with an identified dealer. The top twelve dealers traded $353.98 billion dollars worth of bonds or 72 percent of the total. Merrill Lynch tops the list with 15,638 trades worth $50.43 billion, or 10.2 percent of the total. Morgan Stanley is second with 10,527 trades worth $40.50 billion.

Although trading volume seems to be dominated by a relatively small number of dealers, trading in specific bonds seems to be spread across multiple dealers. I count the number of trades in each of the 27,859 bonds with at least one sample trade. I then sort bonds into ten categories based on the number of sample trades in the bond. The majority of bonds in the sample, 20,155, have only 1 to 5 trades. The number of bonds decreases for categories defined by larger numbers of trades. There are only 64 bonds with over 100 sample trades. I next calculate the percentage of bonds in each category that are traded with different number of dealers. Results are shown in

Table 3. Here we see that more than two-thirds of bonds with six to ten trades have three or more dealers as counterparties to the trades. More than three-quarters of bonds with 40 to 50 trades have ten or more dealers involved in trades. Trading in individual bonds does not seem to be dominated by specific dealers.

There are 957 institutions in the Capital Access sample with at least one trade over the period and 384 institutions with 50 or more. Table 4 provides information on the trades of the 20 institutions with the largest total dollar amount of trades. Most of these companies are in the insurance industry. The institution with the largest dollar trading volume is Prudential Capital Management with 6,480 trades with an average value of $8,722,000. In total the 20 institutions' trades total $381 billion, about 55 percent of the total dollar value of all bonds traded in the sample. There are obvious differences in trading patterns across institutions. Mean trade sizes among the 20 institutions vary from $2,603,000 for Conseco Capital Management to $15,244,000 for TIAA-CREF. The proportion of trades that are sells also varies widely across these institutions. Fewer than 25 percent of TIAA-CREF's trades are sells while 34.8 percent of Loews Corporation trades are sells. The relative shortage of sell orders reflects the institution's propensity to hold bonds to maturity and then reinvest the proceeds.

Table 5 shows the distribution of the number of trades, the percentage of trades that are sell orders, the mean trade size and the percentage of trades that are in high yield bonds for the 384 institutions with at least 50 trades. The percentage of trades that are sells averages 32.17 percent across the institutional traders, but 10 percent of the sample institutions have 7.17 percent or fewer sells and most trades are sells for about 10 percent of the sample institutions. Trade sizes also vary considerably across institutions with 25 percent having an average trade size of less than $600,000 and 25 percent having an average trade size of more than $3,000,000. Perhaps the clearest differences across institutions is in the willingness to trade in high yield bonds. More than 25 percent of the institutions do not conduct any trades in bonds with Moody's rating lower than Baa3. However, for 10 percent of the institutions more than 35 percent of trades are in high yield bonds.

3. Estimates of Transaction Costs

3.1 Estimates from multiple trades in the same bond on the same day

The simplest and most direct way to estimate trading costs for a bond is to compare buy and sell prices for the same bond on the same day. Matched trades occur at different times during the day so this will be a noisy estimate. It seems unlikely that the non-synchroneity of matched trades will impart any biases however. A possible source of bias though is that only the most active bonds have both buy and sell trades on the same day. Thus, it is not clear whether estimates obtained in this way can be extrapolated to other bonds. Nevertheless, this technique provides a good starting point for estimating trading costs.

For every bond every day, I check to see if there are both buy and sell trades. The estimate of the round-trip transaction costs is the difference between the buy and sell prices. If there is more than one buy (sell) of a particular bond on a specific day, I use a weighted average of the buy (sell) prices where the weights are the dollar value of the transactions. In total, I find 2,835 bond-days with both buys and sells. Transaction cost estimates are shown in Table 6.

When all buy-sell combinations are considered, the average round-trip transaction cost is 26.22 basis points, or $2.62 for each $1,000 bond. The t-statistic is 2.14, indicating that the round-trip transactions costs estimate is significantly different from zero but is not estimated with much precision. The following rows of the table provide estimates of round-trip transaction costs by bond rating. With the exception of bonds rated lower than B, round-trip transactions cost estimates are positive. Costs are estimated to be $2.07 per bond for AAA rated bonds, $1.38 per bond for AA rated bonds, $3.92 per bond for A rated bonds, $1.87 for Baa bonds and $3.11 for Ba bonds. However, as a result of the small sample size, the transaction cost estimates are not estimated very precisely and are not significantly different from each other.

3.2 Can I obtain accurate estimates of bid quotes to use in measuring trading costs?

Only a small fraction of the buys in the sample can be matched with a sell in the same bond on the same day. This results in imprecise estimates of trading costs. In addition, it is likely that the pairs of trades that are uncovered are in the more active bonds. It is not clear whether the trading cost estimates from these pairs can be extrapolated to other bonds. As an alternative, I would like to use differences between trade prices and bid quotes to measure trading costs. The idea is to separately calculate average differences between sell orders and bid quotes and between buy orders and bid quotes. The difference between these differences is an estimate of the round-trip trading costs.

In addition to providing the data on ratings, issue dates and other bond characteristics, the Fixed Income Data Base compiled at the University of Houston from Lehman Brothers' data provides end-of-month bid quotes for thousands of corporate bonds. Hong and Warga (1998) find that the dealer bid quotes from Lehman Brothers that are used in this data set are similar to transaction prices from the NYSE's Automated Bond System (ABS) but appear to be better quotes. That is, the Lehman brothers bid quotes are usually higher than the ABS bids and correspond more closely to actual transactions prices.

This data set appears to be the most complete and accurate source of data on corporate bonds that is available to academics. It is not ideal for this study though. The major limitation of the data is that quotes are provided at month-end only. This means that quotes within the month have to be estimated or attention must be restricted to trades that occur at the end of the month. A second limitation is that the data only includes bonds contained in the Lehman Brothers bond index. Quotes are not available for less active bonds and recently issued bonds.

To determine trading costs for days other than the month end, I generate estimates of daily bid quotes. Much of the change in corporate bond prices from day to day can be accounted for by changes in the level of default-free interest rates, or, equivalently, by changes in the prices of treasury bonds. Indeed, dealers quote investment grade bonds in terms of additional yield over similar treasury bonds. Over short periods of time, high-grade corporate bond price changes are expected to track changes in treasury bonds.

The Wall Street Journal provides closing bid prices each day of the sample period for bonds (or notes) with one, two, three, five, seven, ten and twenty years to maturity. At the beginning of each calendar month a bond (or note) is selected that is closest to each maturity. If two or more bonds have the same maturity, I choose the bond with the price that is closest to par on the last day of the preceding month.

The idea is to estimate bond quotes within a month by assuming the percentage price change since the last available quote equals the price change observed in treasury bonds of similar maturity. To see how well this works, I examine the monthly changes in quotes in the Fixed Income Database. For each bond with quotes in consecutive months, I measure the percentage price change over the month. A simple prediction of the price change is that it is the same as the change in a treasury bond with the same maturity. To approximate that, I take a weighted average of the changes in the treasury bonds with maturities that straddle the bond in question. The weights are chosen so that the weighted average of the maturities equals the maturity of the corporate bond. So, for example, the predicted change in a corporate bond that matures in eight years will be a weighted average of the price changes of the bond that matures in seven years and the bond that matures in ten years. Two-thirds of the weight will be on the bond that matures in seven years. I use the change in the twenty year bond price to predict the change in prices of bond with more than twenty years to maturity and the one year bond price change to predict price changes for bonds with less than one year to maturity. The prediction error is defined as the difference between the actual change in the quote and the change predicted by assuming that the percentage change in the bond price is the same as the percentage change in the treasury bonds of similar maturity.

Results are described in Table 7. Panel A breaks down price changes and prediction errors by bond rating. The first column of that table gives the bond rating and the second gives the number of monthly quote changes available for bonds with that rating. The following column provides the mean prediction error, or the mean difference between the bond price change and the change in treasury securities with the same maturity. These numbers, like other price changes and prediction errors in the table are expressed in basis points of par value. So, for example, the value of 3.19 for A bonds means that the average prediction error for A Bonds was 3.19 basis points or 31.9¢ on a $1000 par value bond. This column gives an idea of the bias in using T-bond price changes as a proxy for changes in corporate bond quotes. The mean prediction errors are generally positive, which indicates that the yield spread between treasuries and corporate bonds increased over most months during the sample period. The next column provides the mean price change. Except for the small number of C and D rated bonds, the mean price change is positive. This reflects the general decline in bond yields over this period.

The next two columns report the mean absolute price change and the mean absolute prediction error. A comparison of these two columns provides the clearest indication of the usefulness of treasury bond price changes for predicting changes in the corporate bond prices. Mean absolute price changes are 100 to 150 basis points for most grades of bonds. This represents an average monthly price change of about $10 to $15 on a $1000 face value bond. For investment grade bonds, the mean absolute prediction error is typically one-half to one-third of the mean absolute price change. Thus most of the price change for investment grade bonds is captured by changes in treasury bond prices. Notice though that for bonds rated Ba3 and lower, mean absolute prediction errors tend to actually exceed the mean absolute price changes.

The last two columns show the percentage of bond price changes that are predicted more successfully with the change in treasury bonds than by predicting that bond prices will not change at all. For bonds rated Baa3 and above, treasury bond changes beat a naive prediction about 75 percent of the time. The average percentage of the price change explained by treasury bond price changes is 50 percent to 65 percent for these bonds. This is calculated by subtracting the mean absolute prediction error from the mean absolute price change and then dividing by the mean absolute price change. For bonds rated B and below, the naive prediction that the bond price will be the same at the end of the month as at the beginning usually comes closer to the true value of the bond than when T-bond price changes are incorporated. Thus by this measure, the percentage of the price change explained by treasury bond changes for the high yield bonds is negative.

It is not surprising that changes in high-yield bond prices are not explained well by changes in treasury bond prices. Anecdotal evidence suggests that price changes in investment grade bonds are usually caused by changes in interest rates while changes in high yield bond prices are more often due to changes in firm-specific factors. That is why investment grade bonds are quoted in terms of a yield premium over treasuries while high-yield bonds are quoted as a percentage of par value. Because price changes of high-yield bonds are not explained well by changes in interest rates, quote estimates within the month are very inaccurate. Therefore I do not use estimated quotes to get trading cost estimates for high-yield bonds.

The results in Table 7 provide a conservative assessment of our ability to estimate quotes for investment grade bonds. In Table 7 we are using month-end price to predict prices at the end of the following month. All of the trades in the Capital Access Database will occur closer in time to the previous quote than at the end of the month. Absolute price changes and absolute prediction errors should be much smaller.

Panel B of Table 7 has the same format as that of Panel A but breaks down bond quote changes by sample period month rather than by rating. A prediction based on T-bond price changes is superior to the naive prediction that the price will equal the previous month's price in every month except January and February 1997. Mean prediction errors, shown in the third column, are positive in some months and negative in others. There are several months where values exceed .4 or are less than -.3. These are months with significant changes in the yield spread between corporate and treasury bonds. This suggests that an adjustment for changes in the yield spread could provide a significant improvement in predicting quotes.

To summarize, one way to estimate trading costs is to estimate differences between trade prices and bid quotes for buy orders and for sell orders. A comparison of these differences provides a measure of round-trip trading costs. A complication is that the bid quotes for corporate bonds are only available on a monthly basis. However, it appears that most of the changes in investment grade corporate bond quotes from month to month can be explained by changes in the prices of treasury bonds of similar maturity. This technique does not appear to be promising for high-yield bonds though, and I do not attempt to estimate trading costs for them using estimated quotes.

3.3 Estimates of trading costs based on trade prices and estimated bid quotes.

My estimates of monthly changes in bid quotes suggests that they can be predicted well using changes in treasury bond prices. However, the large mean differences between predicted and actual quotes in some months argue that further refinements can yield more accurate predictions of quotes within the month. Thus I estimate within-month bid quotes with a three step procedure. First, for each trade, I take the bond's previous end-of-month quote and multiply by the percentage change in price over the month of treasury bonds with similar maturity to predict the month-end quote. The change in treasury bond prices is calculated as the weighted average of the price change of bonds with maturities that bracket the bond's maturity, where the weights are chosen so that the weighted average of the treasury bond's maturities equals the maturity of the corporate bond. The second step is to subtract the forecasted quote from the actual end-of-month quote and divide by the number of days in the month. This gives an average daily error from predicting that the change in the corporate bond is the same as the change in treasury bonds. These errors are calculated to make a rough adjustment for the changes in the yield spread between corporate and treasury bonds and for the idiosyncratic changes in the bonds price over the month. The third step is to take the previous end of month price, multiply by the percentage change in treasury bonds up to the trade date and add on the average daily error times the number of days from the previous month-end to the trade date. This provides the estimated bid quote for that trade date. Note that this methodology leaves the actual end-of-month quote as the estimate and that the total impact of estimated errors is small at the beginning and end of the month. If the trade price exceeds both the month-end and previous month quotes by more than 5 percent, or is less than both quotes by more than 5 percent the trade is considered a likely data error and not included. If a quote could not be found for the month-end or the previous month-end the trade is discarded.

Recall that the total number of trades in the Capital Access data was 192,867. The number remaining after eliminating trades that could not be matched with quotes from the Fixed Income Database was 117,015. To calculate trading costs using estimated bid quotes I discard all trades of bonds rated below Baa, all trades with an uncertain trade date, all trades of bonds without quotes available both at the beginning and end of the month, and all trades that take place at prices that differ by more than 5 percent from the beginning or end of month quote. I also discard all trades with a trade date of June 30, 1995 or June 30, 1996 because there are a large number of trades are attributed to those dates but appear to have taken place on a different date. A total of 63,510 trades in investment grade bonds remain.

Round-trip transactions costs are estimated from the trade price and estimated quotes by regressing the difference between the trade price and the estimated bid quote on a dummy variable that takes a value of 1 for buys and zero for sells. That is,

$$\Delta_t = \alpha_0 + \alpha_1 D_t^{Buy} + \varepsilon_t$$
$$\text{Where } \Delta_t = \text{ the price of trade t - the bid price}$$
$$D_t^{Buy} = \text{ 1 if trade t is a buy, 0 otherwise} \qquad (1)$$

The variable of interest is α_1, which provides an estimate of the difference in prices for buy and sell orders. The intercept of the regression is an estimate of the mean difference between sell prices and my estimated quotes. If the estimated quotes are systematically too high or low this will also show up in the intercept term α_0. A bias in estimated quotes should not affect α_1 unless the frequency of buy orders is correlated with errors in estimating the contemporaneous quotes. Likewise, Capital Access' procedure of rounding up transaction prices to the next $1,000 will bias α_0 upward but should not affect α_1.

The cost of any specific trade is measured with significant error with this methodology. However, just as long as there are no significant biases in estimating the trading costs, the large number of observations should allow me to draw conclusions about average trading costs and how they vary with the characteristics of the trade.

Estimates of (1) are reported in Table 8. The first row of the table reports estimates when all 63,510 trades of investment grade bonds are included. The mean difference between the sale price and the estimated quote (the regression intercept) is 5.95 basis points. The coefficient on the dummy variable for buy order provides an estimate of the round-trip trading costs of 25.96 basis points or $2.60 per $1,000 bond. This is almost identical to the estimate obtained by comparing buy and sell prices for the same bond on the same day. However, this is in good part coincidence as indicated by the large standard error on the cost estimate obtained from matching buy and sell trades. In contrast, as a result of the large number of observations the t-statistic on the buy-order dummy is in Table 8 30.00 even though the regression R^2 is only .0140. The 95 percent confidence interval for the dummy variable for buy orders is from 24.27 basis points to 27.66 basis points. Thus the large sample size permits fairly precise estimates of round-trip trading costs.

The regression is run separately for bonds with different ratings to allow estimates of trading costs for bonds with different risks. For every rating class, the estimate of round-trip trading costs is more than 21 basis points or $2.10 per bond. Trading cost estimates are significantly greater than zero for all ratings classes, but the confidence intervals for the α_1 estimates imply that we cannot detect differences in trading costs across ratings.

4. Factors that Affect Trading Costs

4.1 Trade size and institution size

Trade size varies tremendously in the sample. The median trade size was about $1,500,000 for the sample, but there are many trades of less than $100,000 or in excess of $20,000,000. On the one hand, the fixed costs of completing a trade imply that costs should be smaller for large trades. On the other hand, all else equal investors with information will be more likely to make large trades. To determine the effects of trade size on bond trading costs I run the following regression:

$$\Delta_t = \alpha_0 + \alpha_1 D_t^{Buy} + \alpha_2 \ln Size_t + \varepsilon_t$$

$$\text{where } \ln Size_t = \text{ the natural log of the trade size x 1 for buys, -1 for sells} \quad (2)$$

Results are shown in Table 9. R^2's increase when trade size is included in the regression. As before, the coefficient on the dummy variable for buy orders is positive in the regression with all investment grade bonds and the regressions for different bond ratings. The coefficients on the log of the order size are negative and highly significant for each of the regressions. Trading costs per bond are smaller for larger trades. The coefficient on the log of order size in the regression with all investment grade bonds implies that round-trip trading costs decline by about 37.5 basis points or $3.75 per bond when order size goes from $100,000 to $1,000,000. The same regression was run using trade size raised to the first through fourth powers (not shown). Results were qualitatively similar but R^2's were smaller. When the regression is run separately for trades in bonds of different ratings, the coefficient on trade size is always negative, but are closer to zero for trades in bonds rated Baa than bonds rated A or Aa. Perhaps trading costs do not fall as much with trade size for these bonds because traders in lower rated bonds are more likely to have information.

Keim and Madhavan (1997) document significant differences in equity trading costs across institutions even after adjusting for differences in trading styles. They attribute the variations to differences in trading skills across institutions. It is likely that we will see similar differences in bond trading costs across institutions. In particular, I would expect those institutions that do more trading to develop more skill at it and to have more bargaining power with bond dealers. To test this, I rerun the last regression with an additional dummy variable that takes on a value of one if the trade is a buy order from one of the 20 large institutional traders shown in Table 4, and negative one if the trade is a sell by one of these institutions. That is

$$\Delta_t = \alpha_0 + \alpha_1 D_t^{Buy} + \alpha_2 \ln Size_t + \alpha_3 D_t^{Inst.} + \varepsilon_t$$

$$\text{where } D_t^{Inst} = 1 \text{ if a buy from a large institution, } -1 \text{ if a sell from a large institution} \quad (3)$$

Regression estimates are shown in Table 10. As in the previous regressions, the coefficient on the dummy variable for buy orders is always positive and significant and the coefficient on the log of the trade size is always negative and significant. When all trades in investment grade bonds are included in the regression the coefficient on the dummy variable for a large institution has a coefficient of -5.81 with a t-statistic of -5.80. Since the coefficient represents the effect on the price of one trade of a large institution, it has to be doubled to find the round trip cost savings. In this case it means that round-trip trading costs are lower by 11.6 basis points or $1.16 per $1,000 bond for the largest institutional traders. When separate regressions are run for trades of bonds with different ratings the coefficient on the dummy variable for large institutions is always negative and is significant at the 5 percent level for trades of bonds rated Aaa, A, and B. Standard errors are too large to allow us to detect differences in the dummy variable for large institutions across different ratings classes.

Figure 1 graphs the round-trip trading costs in dollars per $1,000 face value bond for large institutions and other across different trade sizes. These estimates are derived from the regression coefficients in Table 10. Figure 1 reveals that for trades of $100,000 face value of bonds trading costs are about $5.50 per bond for large institutions and almost $7 for others.

Trading costs decline with size. The median trade size in the sample is about $1,500,000. Figure 1 shows that the round trip costs for a trade of this size will be about $1.50 per bond for large institutions and about $2.70 per bond for others.

I also test to see if the dealer is an important determinant of trading costs. It is possible that the larger and more active dealers may enjoy economies of scale that allow them to charge less for trading. It is also likely that they deal in larger, more active bonds, and can therefore charge less. On the other hand, smaller dealers may be forced to compete through price rather than service.

I run the same regression used to test whether there are differences in trading costs across institutions but now use a dummy variable that equals one for buy orders and negative one for sell orders executed against one of the 12 large dealers shown in Table 2. The dummy variable takes a value of zero for trades executed against any other dealer. Results are shown in Table 11.

The coefficient on the dummy variable for buy orders remains positive and significant. Coefficients on the log of order size remain highly significant but are now smaller. The coefficient on the dummy variable for large dealers is -5.79 and has a t-statistic of -6.62 when all trades of investment grade bonds are included in the regression. This suggests that round trip trading costs are lower by 11.58 basis points when the counterparty is a large dealer. When the trades are separated by the rating of the underlying bond, the large dealer variable remains negative in all of the regressions except for the regression for Aaa bonds. It is statistically significant at the 1% level for bonds rated B or A.

4.2 Relationships and trading costs

In the over-the-counter bond market, the same institutions trade with the same dealers repeatedly. It is sometimes claimed that the relationships that develop make trading easier and less costly. If a dealer has dealt with an institution regularly, they are more likely to know the type of bonds that the institution will buy. Also, familiarity with the trading patterns and practices of an institution make it easier for a dealer to infer whether the institution is trading on the basis of information. Institutions without information who trade with the same dealer can expect lower trading costs than if they traded with somebody who was unfamiliar with their history. Conversely, if a dealer is approached by an institution that it does not normally trade with, it may infer that the institution is likely to have information about the bond's value.

I examine the frequency with which dealers and institutions trade with each other for evidence that institutions prefer trading with particular dealers. I restrict attention to the 20 largest institutions and to the trades that are used to calculate transaction costs in the previous section, that is trades of bonds rated Baa or higher that had quotes at the beginning and end of the month. I first calculate the number of trades that each of the 20 institutions executes with each of the 12 most active dealers and with all other dealers. This yields a total of 260 dealer-institution combinations. I next calculate the expected number of trades between each combination of dealer and institution assuming independence. This is done by taking the total number of trades and multiplying by the proportion of all trades by the institution and the proportion of all trades by the dealer. The following statistic has a chi-square distribution if all institutions are equally likely to trade with all dealers

$$\text{statistic} = \sum_{i=1}^{20} \sum_{j=1}^{13} \frac{(o_{i,j} - e_{i,j})^2}{e_{i,j}} \sim \chi^2((20-1)\cdot(13-1))$$

Where $O_{i,j}$ = the observed number of trades between institution i and dealer j

$e_{i,j}$ = the expected number of trades between institution i and dealer j (4)

The calculated chi-square statistic has a value of 3,486 with 228 degrees of freedom which allows us to reject a null hypothesis that institution and dealer identities are independent at a .1% confidence level.

Table 12 provides information on which institutions trade with which dealers. Each row of the table corresponds to one institution and each column corresponds to one dealer. The cell at the junction of a row and column represents the trades of the institution with the dealer. A - in the cell indicates that the number of trades is between 50 percent and 75 percent of the expected number while a - - in a cell indicates that the number of trades between that combination of dealer and institution is less than half of the expected number. A 0 in a cell means that the number of trades is between 50 percent and 100 percent higher than expected. Cells containing a 0 0 indicate that there are at least twice as many trades between the dealer and institution as expected.

Examination of Table 12 suggests that some institutions show little preference for particular dealers. Prudential, American General, and Aeltus Investments seem to trade with almost all dealers. However, most institutions show strong preferences in their trading partners. For example, Northwestern Mutual trades frequently with Salomon Brothers and Credit Suisse while avoiding Morgan Stanley and DLJ (Donaldson, Lufkin, and Jenrette). Manulife and Transamerica on the other hand trade with DLJ frequently.

How do these relationships affect transaction costs? I define an institution and dealer as having a relationship if the institution trades with the dealer 50 percent (or 100 percent) more often than expected and as having no relation if the institution trades with the dealer less than 75 percent (or 50 percent) as much as expected. The expected number of trades is again defined as all trades multiplied by the proportion of all trades handled by the dealer and the proportion of all trades that involve the institution. I then run the following regression:

$$\Delta_t = \alpha_0 + \alpha_1 D_t^{Buy} + \alpha_2 \ln Size_t + \alpha_3 D_t^{Rel} + \alpha_4 D_t^{No\,Rel} + \varepsilon_t$$

where D_t^{Rel} = 1 (-1) if a buy (sell) from a dealer with whom the institution has a relationship

$D_t^{No\ Rel}$ = 1 if a buy (sell) from a dealer with whom the institution has a no relationship (5)

Results are shown in Table 13. The first row of the table shows regression results using all trades of investment grade bonds when an institution is defined as having a relationship with a dealer if the institution had at least 50 percent more trades with the dealer than expected. An institution is defined as having no relationship with a dealer if it has fewer than 75 percent of the expected trades with the dealer as counterparty. The regression shown in the second row of the table also includes all investment grade bond trades by the 12 leading institutions, but now a relationship is defined as at least 100 percent more trades than expected while no relationship is defined as less than 50 percent as many trades as expected.

In both cases, as expected, the dummy variable for buy order is positive while the log of order size is negative. In both regressions, the dummy variable for a dealer that the institution trades with often is negative but insignificant. Developing a relationship with a dealer doesn't seem to bring lower transaction costs. The dummy variable for a dealer that the institution seldom trades with has a negative coefficient in both regressions and it is significant at the 5% level when that variable is defined as less than 50% of the expected number of trades. Thus there is some weak evidence that it costs institutions less to trade with dealers with whom they seldom trade. This could mean that they only trade with new dealers when they are offered a particularly good deal. Alternatively, it could imply that institutions turn to dealers that they are familiar with to complete complicated trades.

5. Summary and Conclusions

The over-the-counter market for corporate bonds is not as transparent as the equity markets. Quotes are not easily obtained. Information on trades is not widely disseminated. As a result, academics and regulators know little trading practices and the costs of trading in this important market.

In this paper, I examine corporate bond trades by insurance companies, mutual funds and pension funds over 1995-1997. In total, my sample includes over $600 billion in trades by over 600 institutions. Institutional bond trades are usually larger than institutional equity trades. Median trade sizes are about $1,500,000 worth of bonds. Most of the trades have one of a dozen large bond dealers as the counterparty, but individual bond dealers do not dominate trading in particular bonds. I find that bonds that trade multiple times in my sample are typically traded by several dealers. I also find that buy orders are almost twice as common as sell orders. This is because many institutions follow the practice of purchasing bonds, holding them until maturity, and reinvesting the principle. This is also reflected in my finding that bonds tend to be traded soon after issuance. The median percentage of the bond's life remaining at the time of a trade is 85 percent. A full 25 percent of trade take place in bonds with at least 97 percent of the total time to maturity remaining. When bonds find their way into the portfolio of an investor who will hold them to maturity they stop trading.

My best estimate of round-trip institutional trading costs for all investment grade bonds is about 26 basis points, or $2.60 per $1,000 bond. This estimate is obtained by first estimating the bid quote each day from the previous month-end bid quote and the change in treasury bond price between the previous month-end and the trade date. The difference between the trade price and estimated bid price is then regressed on a dummy variable for buy orders. The coefficient on the dummy variable is an estimate of the round-trip trading costs.

There are large differences in trading costs by trade size and the identity of the dealer and institution making the trade. Larger trades are cheaper. Round-trip costs for trades of $100,000 are about 67.5 basis points or $6.75 per bond for small traders and about 55.8 basis points or $5.58 per bond for the largest institutions. Round-trip trading costs for trades of $1,000,000 are about 32.9 basis points for most institutions and about 26.3 basis points for the 20 largest institutions. After adjusting for trade size and the size of the institution, round-trip trading costs are about 11.6 basis points or $1.16 per bond lower when the trades are transacted with one of the 12 largest dealers. Although institutions appear to develop relationships with particular dealers, there is no evidence that these relationships bring lower trading costs.

Table 1. Summary statistics. The sample consists of 192,867 Institutional bond trades from January 1995 through April 1997 compiled by Capital Access Inc. Trade data consists of the bond's cusip , the date of the trade, the bond's maturity date, whether the trade was a buy or sell, the par value of the bonds , the amount paid or received for the bonds, the identity of the institution and the identity of the dealer. 117,015 were matched with bond information from the Fixed Income database compiled by the University of Houston. For the matched bonds, ratings, durations, amounts outstanding, issue dates, coupon amounts and information on call provisions are available.

Panel A. The distribution of trade sizes (in thousands of dollars)

	Observations	5%	25%	Median	75%	95%
All Trades	192,867	67	498	1,513	4,665	13,747
All Sells	69,518	46	444	1,320	4,059	11,694
All Buys	123,349	85	500	1,675	4,913	14,864
All Matched Trades	117,015	96	508	1,650	4,745	13,467
Panel B. The distribution of times to maturity in years						
All Trades	192,867	3.00	5.55	8.48	11.63	29.59
All Matched Trades	117,015	3.22	5.99	8.71	11.60	29.73
Panel C. The distribution of the percentage of the bond's life remaining at the time of the trade						
All Matched Trades	117,015	40%	67%	85%	97%	100%
Matched Sells	43,088	33%	60%	74%	87%	97%
Matched Buys	73,927	47%	73%	91%	100%	100%
Panel D. The distribution of the percentage of outstanding bonds traded in a transaction.						
All Matched Trades	117,015	.03%	.24%	.75%	2.00%	7.20%
Matched Sells	43,088	.04%	.25%	.80%	2.13%	7.07%
Matched Buys	73,927	.03%	.22%	.71%	2.00%	7.29%

Panel E. The proportion of matched trades that are in bonds of different ratings.

AAA	Aa	A	Baa	Ba	B	< B
2.17%	10.24%	42.77%	25.73%	9.80%	8.07%	1.30%

Table 2. Trading by the Top Twelve Sample Dealers. The sample is obtained from Capital Access Incorporated and consists of 192,867 institutional trades from January 1995 through April 1997.

Dealer	Number of Trades	Total Market Value of Trades ($ billions)
Merrill Lynch Capital Markets	15,638	$50.43
Morgan Stanley and Co.	10,527	$40.50
Goldman Sachs	10,383	$40.22
Salomon Brothers	8,157	$35.90
Lehman Brothers	8,640	$35.23
Credit Suisse First Boston	6,571	$28.22
J.P. Morgan Securities	6,198	$25.14
UBS Securities	5,456	$22.14
Donaldson, Lufkin, Jenrette	6,581	$22.03
Bear Stearns and Co.	6,597	$20.37
Smith Barney and Co.	7,734	$18.90
Paine Webber Inc.	5,805	$14.90
Total	98,287	353.98

Table 3. The number of dealers trading different bonds. The number of trades in each bond in the Capital Access Data over January 1995 through April 1997 is counted along with the number of dealers appearing as a counterparty to trades in the bonds. Bonds are categorized by the number of trades, and the percentage of bonds in each category traded with different number of dealers are displayed in the table.

	Percentage of Bonds with a Given Number of Trades with Different Numbers of Dealers as Counterparties										
Number of Trades in the Bond	1 Dealer	2 Dealers	3 Dealers	4 Dealers	5 Dealers	6 Dealers	7 Dealers	8 Dealers	9 Dealers	10 + Dealers	Total Number of Bonds
1-5	74.26	17.53	5.84	1.97	0.41	0.00	0.00	0.00	0.00	0.00	20,155
6-10	11.78	19.68	21.87	17.16	13.36	9.52	4.17	1.80	0.61	0.07	2,785
11-15	3.42	9.62	11.68	11.75	11.18	14.03	12.18	10.76	8.41	6.98	1,404
16-20	1.10	3.81	6.52	8.93	9.73	10.73	10.33	9.83	10.33	28.69	997
21-30	0.54	1.98	3.50	5.21	5.84	6.65	8.99	9.08	8.45	49.78	1,113
31-40	0.49	0.17	0.82	3.13	4.78	3.79	5.11	5.44	8.24	68.04	607
41-50	0.00	0.90	0.90	1.51	2.11	0.90	3.01	6.02	6.02	78.61	332
51-75	0.00	0.00	0.30	0.60	0.90	1.50	2.10	3.59	4.19	86.83	334
76-100	0.00	0.00	0.00	0.00	0.00	1.47	0.00	1.47	0.00	97.06	68
> 100	0.00	0.00	3.13	0.00	0.00	0.00	0.00	0.00	0.00	96.88	64

Table 4. Institutions with the Highest Trading Volume. The sample is obtained from Capital Access Incorporated and consists of 192,867 institutional trades from January 1995 through April 1997.

Institution	Number of Trades	Number Sells	Mean Trade Value ($ 000's)	Total Trade Value ($ billions)
Prudential Capital Management	6,480	2,575	$8,722	$56.52
Metropolitan Life Insurance	4,142	1,612	$10,917	$45.22
The Travelers Investments	6,850	2,998	$4,858	$33.28
New York Life Insurance Co	2,796	1,314	$9,950	$27.82
American General Corporation	5,368	1,936	$5,025	$26.97
Aeltus Investment Management	1,836	667	$10,827	$19.88
Conseco Capital Management	7,061	3,149	$2,603	$18.38
Northwestern Mutual Life	2,707	1,060	$6,444	$17.44
CIGNA Investments	4,867	2,081	$3,265	$15.89
Alliance Capital Management	2,360	986	$6,404	$15.11
Allstate Insurance Companies	2,296	729	$6,468	$14.85
Hartford Investment Manage	2,515	788	$5,760	$14.49
AEGON U.S.A. Investment Mn	3,950	1,570	$3,466	$13.69
Lincoln Investment Management	3,023	1,158	$3,937	$11.90
Loews Corporation	1,875	1,001	$6,298	$11.81
GNA Capital Management	1,869	516	$5,274	$9.86
TIAA-CREF	641	158	$15,244	$9.77
Transamerica Investment	1,505	390	$6,305	$9.49
Manulife Financial	1,404	670	$6,117	$8.59
John Hancock Mutual Life	1,608	706	$5,267	$8.46
Total	65,153	26,064		$389.42

Table 5. The Distribution of trade characteristics across the 384 Institutions with at least 50 trades during January 1995 - April 1997. Data is from Capital Access and consists of 192,867 institutional corporate bond trades.

	Mean	5^{th} Percentile	10^{th} Percentile	25^{th} Percentile	Median	75^{th} Percentile	90^{th} Percentile	95^{th} Percentile
Number Trades	481.66	56	63	95	165	427	1,175	2,149
% Sells	32.17%	2.05%	7.17%	20.66%	33.72%	43.07%	51.21%	58.66%
Mean Trade Size ($000's)	$2,196	$118	$201	$599	$1,288	$3,020	$5,244	$6,909
Total Value Trades ($ millions)	$1,778.1	$9.8	$20.47	$72.24	$220.1	$1,120.2	$4,101.6	$8,421.0
% High Yield	11.39%	0%	0%	0%	3.6%	15.6%	35.9%	53.0%

Table 6. Estimates of Round-trip trading costs obtained from bonds with purchases and sales on the same day. Data is obtained from Capital Access Incorporated and consists of institutional trades over January 1995 through April 1997. Round-trip trading costs are obtained by subtracting the price of the sell trade from the price of a buy trade in the same bond on the same day. When there is more than one buy or sell during a day, a weighted average transaction price is used where the weights are the dollar values of the individual trades. Costs are expressed in basis points.

	Percentage Round-trip Costs	T-Statistic	Number of Trades
All Investment Grade Bond Trades	26.22	2.14	2,562
Aaa Bond Trades	20.66	0.74	878
Aa Bond Trades	13.76	1.89	186
A Bond Trades	39.15	1.82	904
Baa Bond Trades	18.67	6.81	594
All High-Yield Bond Trades	23.81	2.20	273
Ba Bond Trades	31.07	3.16	165
B Bond Trades	37.07	2.11	94
< B Bond Trades	-15.07	-1.18	14

Table 7. Month to month price changes in corporate bonds and the ability of treasury bond price changes to explain them. For every bond in the Fixed Income Database with bid quotes in two consecutive month ends, I calculate the bond's price change and the absolute value of its price change. I also calculate a prediction of the price change which equals the previous month-end price multiplied by the price change of treasury bonds with the same maturity over the month. The prediction error is the difference between the actual quote and the predicted quote. Errors and price changes are expressed in basis points.

Panel A. Price changes and predicted price changes by bond rating category.

Rating	Number	Mean Prediction Error	Mean Price Change	Mean Absolute Price Change	Mean Absolute Prediction Error	% Prediction Improves	Avg % Change Explained by Tbond Changes
Aaa	133,981	9.45	11.56	7.527	44.39	67.53%	41.03%
Aa	23,030	0.40	16.63	117.39	44.20	77.32%	62.35%
A	69,231	3.19	15.23	118.65	40.06	78.91%	66.24%
Baa	36,350	3.82	14.96	126.96	50.80	76.64%	59.99%
Ba	10,316	18.64	23.69	130.45	111.57	55.27%	14.47%
B	14,058	9.40	15.47	159.12	186.27	38.23%	-17.06%
< B	10,843	4.75	-0.42	125.01	160.68	31.92%	-28.53%

Table 7 (continued).
Panel B Price changes and predicted price changes by month.

Month	Number	Mean Prediction Error	Mean Price Change	Mean Absolute Price Change	Mean Absolute Prediction Error	% Prediction Improves	Avg % Change Explained by Tbond Changes
1/95	8,918	.0277	1.0857	1.1969	.5099	85.47%	57.40%
2/95	9,017	.3109	1.6669	1.7191	.6998	88.87%	59.29%
3/95	9,096	.0644	.1425	.3896	.3743	56.34%	3.93%
4/95	9,190	.0153	.7878	.8954	.4436	83.13%	50.46%
5/95	9,379	-.6197	2.9014	2.9959	1.2580	77.44%	58.01%
6/95	9,535	-.1612	.2052	.4444	.4233	52.84%	4.75%
7/95	9,780	.3981	-.6688	.8636	.6130	66.75%	29.02%
8/95	9,746	-.0194	.6226	.8569	.5486	69.00%	35.98%
9/95	10,079	-.0937	.3599	.5967	.4621	61.58%	22.55%
10/95	10,329	-.3280	.5491	.8322	.6556	67.15%	21.22%
11/95	10,637	-.2441	.8667	1.0264	.6190	68.05%	39.69%
12/95	10,778	-.2044	.7153	.8391	.5515	64.98%	34.27%
1/96	10,812	.0752	.1868	.5044	.4271	63.03%	15.33%
2/96	10,989	.5810	-2.0434	2.1710	.9902	73.36%	54.39%
3/96	11,309	.4148	-1.0268	1.1560	.6280	71.15%	45.68%
4/96	11,533	.3782	-.9640	1.0707	.5367	75.87%	49.87%
5/96	11,667	.2689	-.5181	.6869	.3915	72.59%	43.01%
6/96	11,882	-.0572	.6292	.7787	.4258	77.74%	45.32%
7/96	12,096	.0921	-.2263	.3787	.3004	59.28%	20.67%
8/96	12,259	.2236	-.5874	.7499	.4242	73.11%	43.44%
9/96	12,337	-.1188	1.0877	1.1697	.4780	83.06%	59.14%
10/96	12,384	-.2433	1.3949	1.5366	.7025	77.90%	54.28%
11/96	12,619	-.4067	.9779	1.2078	.7170	70.53%	40.64%
12/96	12,750	.4372	-1.2703	1.3987	.7911	64.91%	43.44%
1/97	12,722	.2523	-.1746	.4598	.4762	39.29%	-3.55%
2/97	12,917	.3430	-.1226	.4204	.4773	45.22%	-13.52%
3/97	13,049	.2255	-1.5065	1.5573	.6358	80.82%	59.17%

Table 8. Regression estimates of round trip trading costs. Differences between the prices of institutional bond trades and the estimated contemporaneous bid price for the bond are regressed on an intercept and a dummy variable that takes a value of one for buys and zero for sells. Bond trade data are obtained from Capital Access Inc. Month-end quotes are obtained from the Fixed Income Database. Within-month quotes are estimated in three steps. First, the bid quote from the previous month end is multiplied by the percentage change in the price of treasury bonds of similar maturity to obtain an estimate of the end of month price for the corporate bond and the estimated price is compared with the actual end of month quote. Second, the difference between estimated end-of-month bid quote and the actual end-of-month bid quote is divided by the number of days in the month to obtain an estimate of the average daily change in the yield curve. Finally, within-month quotes are estimated by multiplying the previous month-end quote by the change in treasury bonds of similar maturity between quote date and the trade date and then adding on the average daily change in the yield curve multiplied by the number of days from the previous month end to the trade date. The sample period is January 1995 through April 1997.

Bond Rating	Mean Sale Price - Lehman Quote (Basis Points)	95% Confidence Interval	Mean Buy Price - Mean Sale Price in Basis Points	95% Confidence Interval	Number of Obs.	Adj. R^2
All Investment Grade	5.95 (8.92)	4.65 - 7.26	25.96 (30.00)	24.27 - 27.66	63,510	.0140
Aaa	13.48 (3.54)	6.02 - 20.93	34.60 (6.77)	24.59 - 44.61	1,921	.0228
Aa	4.66 (2.62)	1.17 - 8.15	21.40 (9.37)	16.92 - 25.87	8,465	.0101
A	2.34 (2.66)	0.61 - 4.07	29.01 (25.77)	26.80 - .3122	34,725	.0187
Baa	11.65 (8.99)	9.11 - 14.20	22.70 (13.07)	19.29 - 26.10	18,399	.0091

Table 9. The effects of trade size on bond trading costs. Differences between the prices of institutional bonds trades and the estimated contemporaneous bid price for the bond are regressed on an intercept, a dummy variable that takes a value of one for buys and zero for sells, and the natural logarithm of the trade size (measured in thousands of dollars). Bond trade data are obtained from Capital Access Inc. Month-end quotes are obtained from the Fixed Income Database. An estimate of within month quotes is obtained in three steps. First, the bid quote from the previous month end is multiplied by the percentage change in the price of treasury bonds of similar maturity to obtain an estimate of the end of month price for the corporate bond and the estimated price is compared with the actual end of month quote. Second, the difference between estimated end-of-month bid quote and the actual end-of-month bid quote is divided by the number of days in the month to obtain an estimate of the average daily bond-specific change in price. Finally, within-month quotes are estimated by multiplying the previous month-end quote by the change in treasury bonds of similar maturity between quote date and the trade date and then adding on the average daily bond-specific price change multiplied by the number of days from the previous month end to the trade date. The sample period is January 1995 through April 1997.

Bond Rating	Intercept	95% Confidence Interval	Dummy for Buy Order in Basis Points	95% Confidence Interval	Log of Order Size	95% Confidence Interval	Number of Obs.	Adjusted R^2
All Investment Grade	-53.44 (-24.68)	-57.69 -49.20	142.39 (34.47)	134.30 150.49	-8.15 (-28.82)	-8.71 -7.60	63,510	.0267
Aaa	-36.19 (-2.94)	-60.34 -12.04	131.26 (5.62)	85.44 177.07	-6.79 (-4.24)	-9.94 -3.65	1,921	.0314
Aa	-66.75 (-12.01)	-77.64 -55.86	1.6033 (15.27)	139.76 180.91	-9.90 (-13.55)	-11.33 -8.47	8,465	.0311
A	-66.48 (-23.97)	-71.91 -61.04	163.43 (31.06)	153.12 173.74	-9.47 (-26.14)	-10.18 -8.76	34,725	.0377
Baa	-26.02 (-5.70)	-34.96 -17.08	97.48 (11.01)	80.12 114.84	-5.13 (-8.61)	-6.30 -3.96	18,399	.0131

Table 10. Trading costs for large and small institutions. Differences between the prices of institutional bonds trades and the estimated contemporaneous bid price for the bond are regressed on an intercept, a dummy variable that takes a value of one for buys and zero for sells, the log of the trade size, and a dummy variable that takes a value of one if the institution is one of the 20 with the largest dollar trading volume in the sample. Bond trade data are obtained from Capital Access Inc. Month-end quotes are obtained from the Fixed Income Database. An estimate of within month quotes is obtained in three steps. First, the bid quote from the previous month end is multiplied by the percentage change in the price of treasury bonds of similar maturity to obtain an estimate of the end of month price for the corporate bond and the estimated price is compared with the actual end of month quote. Second, the difference between estimated end-of-month bid quote and the actual end-of-month bid quote is divided by the number of days in the month to obtain an estimate of the average daily bond-specific change in price. Finally, within-month quotes are estimated by multiplying the previous month-end quote by the change in treasury bonds of similar maturity between quote date and the trade date and then adding on the average daily bond-specific change in price multiplied by the number of days from the previous month end to the trade date. The sample period is January 1995 through April 1997. Order size is measured in thousands of dollars of par value. Large institutions are the 20 institutions with the largest dollar volume of trade in the sample.

Bond Rating	Intercept	95% Confidence Interval		Dummy for Buy Order	95% Confidence Interval		Log of Order Size	95% Confidence Interval		Dummy for Large Institution	95% Confidence Interval		Number of Obs.	Adj. R^2
Investment Grade	-50.60 (-22.80)	-54.95	-46.26	136.55 (32.12)	128.22	144.88	-7.50 (-24.66)	-8.10	-6.90	-5.81 (-5.80)	-7.77	-3.85	63,510	.0272
Aaa	-29.38 (-2.33)	-54.13	-4.63	117.79 (4.91)	70.73	164.85	-5.38 (-3.15)	-8.72	-2.03	-15.88 (-2.40)	-28.84	-2.91	1,921	.0338
Aa	-64.78 (-11.31)	-76.01	-53.56	156.17 (14.33)	134.81	177.54	-9.47 (-11.97)	-11.02	-7.92	-4.13 (-1.42)	-9.84	1.57	8,465	.0312
A	-63.58 (-22.32)	-69.17	-58.00	157.42 (28.97)	146.77	168.07	-8.82 (-22.55)	-9.58	-8.05	-5.86 (-4.40)	-8.46	-3.25	34,725	.0382
Baa	-23.06 (-4.98)	-32.15	-13.98	91.58 (10.17)	73.93	109.24	-4.38 (-6.93)	-5.62	-3.14	-6.70 (-3.55)	-10.40	-3.01	18,399	.0137

Table 11. Regression estimates of trading costs when the log of the trade size and a dummy for large dealers is included. Differences between the prices of institutional bonds trades and the estimated contemporaneous bid price for the bond are regressed on an intercept, a dummy variable that takes a value of one for buys and zero for sells, the natural logarithm of the order size (in thousands of dollars) and a dummy variable that takes a value of one if the dealer is one of the 12 largest sample dealers. Bond trade data are obtained from Capital Access Inc. Month-end quotes are obtained from the Fixed Income Database. An estimate of within month quotes is obtained in three steps. First, the bid quote from the previous month end is multiplied by the percentage change in the price of treasury bonds of similar maturity to obtain an estimate of the end of month price for the corporate bond and the estimated price is compared with the actual end of month quote. Second, the difference between estimated end-of-month bid quote and the actual end-of-month bid quote is divided by the number of days in the month to obtain an estimate of the average daily bond-specific price change. Finally, within-month quotes are estimated by multiplying the previous month-end quote by the change in treasury bonds of similar maturity between quote date and the trade date and then adding on the average daily bond-specific price change multiplied by the number of days from the previous month end to the trade date. The sample period is January 1995 through April 1997.

Bond Rating	Intercept	95% Confidence Interval		Dummy for Buy Order	95% Confidence Interval		Log of Order Size	95% Confidence Interval		Dummy for Large Dealer	95% Confidence Interval		Number of Obs.	Adj. R^2
Investment Grade	-51.16 (-24.99)	-58.42	-49.92	143.52 (34.73)	135.42	151.62	-7.76 (-26.86)	-8.83	-7.19	-5.79 (-6.62)	-7.50	-4.08	63,510	.0277
Aaa	-35.46 (-2.87)	-59.67	-11.24	130.50 (5.58)	84.65	176.36	-7.07 (-4.31)	-10.29	-3.86	4.29 (0.81)	-6.05	14.64	1,921	.0312
Aa	-66.99 (-12.05)	-77.88	-56.09	160.66 (15.29)	140.08	181.25	-9.72 (-13.03)	-11.19	-8.26	-2.56 (-1.13)	-7.00	1.88	8,465	.0311
A	-67.27 (-24.24)	-72.71	-61.83	164.60 (31.28)	154.29	174.91	-9.00 (-24.33)	-9.73	-8.28	-6.80 (-6.60)	-9.00	-4.60	34,725	.0386
Baa	-27.21 (-5.95)	-36.17	-18.24	99.69 (11.23)	82.30	117.08	-4.72 (-7.80)	-5.91	-3.54	-6.57 (-3.64)	-10.10	-3.03	18,399	.0137

Table 12. Trading frequency for dealers and institutions. The cell for a dealer-institution combination contains 00 if trades are twice as frequent as expected, a 0 if trades are 1.5 time as frequent as expected, - if trades are 50% -75% as frequent as expected and - - if trades are less than half as frequent as expected.

	Merrill Lynch	Morgan Stanley	Goldman Sachs	Salomon Brothers	Lehman Bros.	Credit Suisse	J.P. Morgan	UBS Secs.	DLJ	Bear Stearns	Smith Barney	Paine Webber
Prudential				-								
Met Life			0 0		0		-	0	-			-
Travelers		0			-				-		0	
New York Life		-				0			-		- -	
American General				-						-		
Conseco Capital			-			-	0 0		- -	0		
Aeltus Investments				-		-						
Northwestern Mut	-	- -	-	0 0		0 0			- -		-	
CIGNA Invsts	-				- -		-		-	- -	-	0
Alliance Capital								- -	-	0		
Allstate Ins				-	0 0	0					0 0	-
Hartford Invst					0	-		0	0	-		-
AEGON U.S.A.		-	-		-	-	-	0 0			- -	
Lincoln Invst.	0					-	- -				0	-
Loews Corp.	-	0		-				-			-	
GNA Capital			-					-	-	-	- -	
TIAA-CREF	- -		0	-			0	-	- -		- -	
Transamerica	-	-						- -	0 0			
Manulife Fin.		-	-		-	- -		- -	0 0		- -	
John Hancock		- -			-	0						

Table 13. The effect of dealer-institutional relations on the costs of trading. Differences between the prices of institutional bonds trades and the estimated contemporaneous bid price for the bond are regressed on an intercept and a dummy variable that takes a value of one for buys and zero for sells, and dummy variables for dealers with which the institution trades frequently and infrequently. Bond trade data are obtained from Capital Access Inc. Month-end quotes are obtained from the Fixed Income Database. An estimate of within month quotes is obtained in three steps. First, the bid quote from the previous month end is multiplied by the percentage change in the price of treasury bonds of similar maturity to obtain an estimate of the end of month price for the corporate bond and the estimated price is compared with the actual end of month quote. Second, the difference between estimated end-of-month bid quote and the actual end-of-month bid quote is divided by the number of days in the month to obtain an estimate of the average daily bond-specific price change. Finally, within-month quotes are estimated by multiplying the previous month-end quote by the change in treasury bonds of similar maturity between quote date and the trade date and then adding on the average daily bond-specific price change multiplied by the number of days from the previous month end to the trade date. The sample period is January 1995 through April 1997.

Ratio of observed to expected trades to define relationship (no relationship)	Intercept	Dummy for buy order	Log of order size	Dummy for relationship with dealer	Dummy for no relationship with dealer	Number of Obs.	Adj. R^2
> 1.5 (< .75)	-8.01	54.44	-2.99	-3.37	-2.26	18,434	.0018
	(-1.59)	(5.52)	(-4.94)	(-1.66)	(-0.99)		
> 2.0 (< .50)	-7.01	52.50	-2.94	-2.32	-17.24	18,434	.0020
	(-1.40)	(5.34)	(-4.83)	(-0.69)	(-2.49)		

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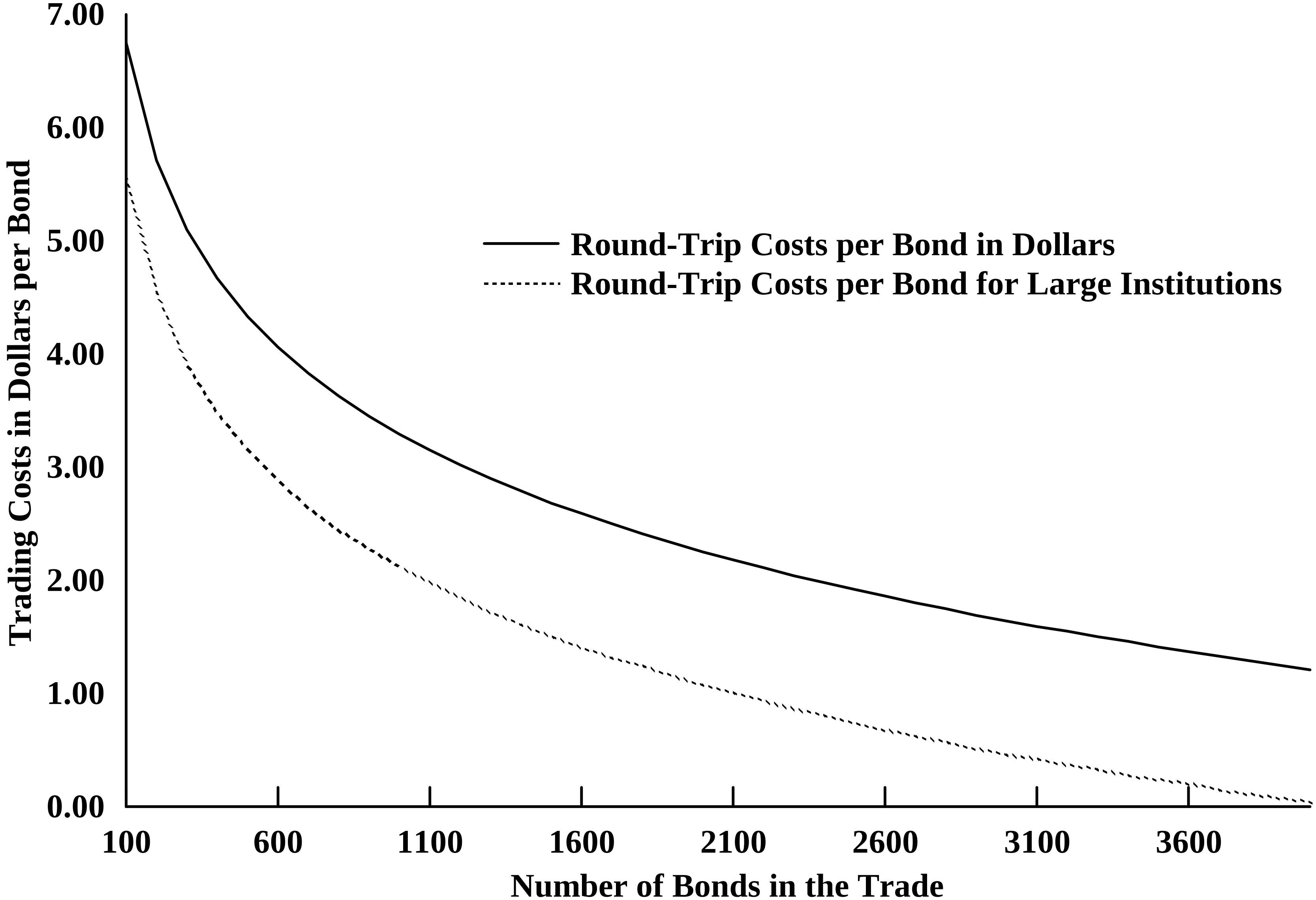
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Trading Costs in Dollars per Bond
Round-Trip Costs per Bond in Dollars
Round-Trip Costs per Bond for Large Institutions
100
600
1100
1600
2100
2600
3100
3600
Number of Bonds in the Trade