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Know When to Hold Them, Know When to Fold Them: Dealer Behavior in Highly Illiquid Risky Assets

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Abstract

This study examines dealer behavior in a sample of 14,749 corporate bonds that vary in credit rating and liquidity. Our unique data set allows us to identify purchases and sales by individual dealers, enabling us to determine how long a dealer holds a bond purchase in inventory and how much of that initial purchase the dealer sold to customers, and the spread on those sales to customers, and how these vary with credit rating and liquidity of the bond in the past 30 days. We examine 1,477,286 different institutional size purchases by individual dealers and their subsequent sales across 14,749 bonds from August 7, 2002 to July 31, 2008. We find that as dealers holding periods do not necessarily decline as liquidity increases; in fact, dealer's holding periods for some of the most illiquid bonds (with trades less often than once every three days) are shorter than those bonds that trade five times a day or more. Dealers are also more likely to sell all of their purchase for the less liquid bonds. These effects become stronger as credit quality decreases. Interestingly, previous liquidity or illiquidity has little effect on the spreads dealers charge customers.

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Abstract

This study examines dealer behavior in a sample of 14,749 corporate bonds that vary in credit rating and liquidity. Our unique data set allows us to identify purchases and sales by individual dealers, enabling us to determine how long a dealer holds a bond purchase in inventory and how much of that initial purchase the dealer sold to customers, and the spread on those sales to customers, and how these vary with credit rating and liquidity of the bond in the past 30 days. We examine 1,477,286 different institutional size purchases by individual dealers and their subsequent sales across 14,749 bonds from August 7, 2002 to July 31, 2008. We find that as dealers holding periods do not necessarily decline as liquidity increases; in fact, dealer's holding periods for some of the most illiquid bonds (with trades less often than once every three days) are shorter than those bonds that trade five times a day or more. Dealers are also more likely to sell all of their purchase for the less liquid bonds. These effects become stronger as credit quality decreases. Interestingly, previous liquidity or illiquidity has little effect on the spreads dealers charge customers.

"You got to know when to hold 'em, know when to fold 'em,
Know when to walk away and know when to run.
You never count your money when you're sittin' at the table.
There'll be time enough for countin' when the dealin's done."

The Gambler by Kenny Rogers

Dealers face a variety of challenges when trying to serve their clients and make markets in highly illiquid risky assets. For example, all dealers assume inventory risk upon purchasing an asset from a client. As a result, dealers are concerned both with how long they must hold the asset as well as the underlying risk of the asset. While dealers of highly liquid assets also are concerned about these two risks, the risks are mitigated by very short time period the dealer must wait before an interested counterparty arrives. These risks are substantially magnified, however, for dealers in highly illiquid risky assets, as it may be a long time until a counterparty arrives.

Dealers of highly illiquid risky assets therefore face substantial holding period risk, and therefore have strong incentives to mitigate this risk. Standard market microstructure models such as Glosten and Milgrom (1985) generally assume that dealers stand by relatively passively and await the arrival of liquidity traders, who arrive via some external Poisson process. These models were generally created to describe US equity markets, which, compared to most markets, are relatively liquid. Therefore, these theoretical models may be most appropriate as models of equity market dealers or other dealers facing reasonably large natural demand.

However, as liquidity decreases, dealers face increasing holding period risk, particularly for riskier assets. It seems reasonable, therefore, that dealers may follow other strategies to mitigate this increased liquidity risk. One reasonable way for dealers to mitigate this risk is not to stand by passively but instead to search actively for counterparty offers. Duffie, Garleanu, and Pedersen (2005) create a model that suggests that as illiquidity increases, agents increasingly engage in costly search mechanisms in order to find the opposite side of a trade. In their model, marketmakers contact investors directly to search for counterparties. Marketmakers and agents endogenously increase their search as liquidity decreases. In contrast, as liquidity increases, more orders come to the marketmakers and they naturally engage in less (costly) search.

Therefore, dealer behavior may vary as illiquidity increases. How, and how much so, remains an empirical question. This paper attempts to examine this question of how dealers' behavior changes for increasingly illiquid assets by focusing on dealer behavior in increasingly illiquid U.S. corporate bonds. Corporate bonds are a good asset to use to examine the combined effects of illiquidity and risk. In the United States, corporate bonds primarily trade in over-the-counter dealer market, in which dealers facilitate trades and help foster liquidity. However, as demonstrated by Goldstein, Hotchkiss, and Sirri (2007) and others, many corporate bonds are very illiquid, with a substantial portion of bonds in the market trading infrequently or not at all. This relative paucity of trading in some bonds imposes significant inventory risk on dealers. In addition, unlike treasuries, corporate bonds vary in default risk. While not perfect, the varying credit ratings on corporate bonds provide an external estimate of the relative risk of the bond, and therefore allow us to examine dealers' behavior across risk profiles as well as liquidity.

In this paper, we use TRACE data for 14,749 corporate bonds that vary in credit rating and liquidity.[1] Our unique data set allows us to identify purchases and sales by individual dealers, enabling us to determine how long a dealer holds a bond purchase in inventory and how much of that initial purchase the dealer sold to customers, and the spread on those sales to customers, and how these vary with credit rating and liquidity of the bond in the past 30 days. We examine 1,477,286 different institutional size purchases by individual dealers and their subsequent sales across 14,749 bonds from August 7, 2002 to July 31, 2008.

[1] See Goldstein, Hotchkiss, and Sirri (2007) and Goldstein and Hotchkiss (2009) for detailed descriptions of TRACE and the U.S. corporate bond market.

We first demonstrate that U.S. corporate bonds are highly illiquid. Well over half of the bonds trade less than once a day on average; some trade only once a month, if that. While other papers such as Dick-Nielsen, Feldhutter, and Lando (2009) or Goldstein, Hotchkiss, and Pedersen (2009) exclude such infrequently traded bonds, these highly illiquid bonds are the focus of this study. To examine these highly illiquid bonds, we divide our sample into different subgroups based on two different measures of liquidity: number of trades in the past 30 days, and volume in the past 30 days. We limit ourselves to these two basic liquidity measures as they do not require many trades to calculate. Other measures, such as the measure in Amihud (2002), were created for equity market analysis and implicitly assume and require multiple trades per day for calculation. Therefore, while a modified Amihud measure is used by Dick-Nielsen, Feldhutter, and Lando (2009) and Goldstein, Hotchkiss, and Pedersen (2009), this measure requires at two trades per day and would therefore preclude the analysis from examining the highly illiquid bonds that are the focus of this study.

We focus on initial institutional size trades by examining individual dealer trades which involve a single initial purchase of 100 bonds or more from a single customer. However, as our data set allows us to examine the trading of each dealer individually, we then follow the sales of this dealer to other customers, regardless of size, associating the subsequent sales by that dealer to different customers with that initial purchase. As a result, the initial purchase by the dealer from a customer may be associated with more than one sale at a variety of sizes to a variety of other customers. We then analyze the collective trades as a group.

Notably, we find that as dealers holding periods do not necessarily decline as liquidity increases; in fact, dealer's holding periods for some of the most illiquid bonds (with trades less often than once every three days) are shorter than those bonds that trade five times a day or more. For example, dealers' average holding period for AAA bonds that traded on average only once every 3 to 10 days in the previous 30 trading days (or between 0 and 9 times over the past 30 days) was about 6.57 days, which is less than AAA bonds that traded either 1-2 per day (7.00 days) or even AAA bonds that traded 3-5 per day (7.09 days). Similar results were found by conditioning on trading volume over the past 30 days; dealers' holding period of 5.64 days for AAA bonds which had a cumulative trading volume of 150 bonds or less over the past 30 days is notably less than the7.62 day holding period for AAA bonds which had around twenty times the volume traded -- between 2501 and 3500 bonds -- over the previous 30 days.

Holding periods also vary by credit rating. Interestingly, the holding period for high-yield bonds is noticeably shorter than that for investment grade bonds. While dealer holding periods were in the seven to nine day range for investment grade bonds, they were in the two to five day range for high-yield bonds. Generally, the lower the rating, the shorter the holding period, which is consistent with dealers not wishing to hold risky bonds in inventory for very long. Again, however, holding periods were interestingly relatively invariant to the liquidity over the previous 30 days. For example, CC rated bonds that had only traded 1 to 10 times over the previous 30 days (about once every 3 to 10 days) had an average dealer holding period of only 2.10 days, and the holding period for CC rated bonds that traded less often than once a day was all under three days, while the average dealer holding period for CC rated bonds that traded 3 to 5 times per day was a full day longer at 3.17 days. Dealers in even the most active bonds, which traded more than 150 times in the previous 30 days (and averaged around 30 trades per day), held CC rated bonds for 2.35 days, or *longer* than they held the least liquid bonds. Again, very similar results were found for segmentation by volume. Regressions comparing actual holding periods to that expected based on the average trading (or volume) over the past 30 days and which control for avariety of factors such as size, age, maturity, and other factors confirm these results.

Interestingly, dealers manage to accomplish this shorter holding period for illiquid bonds primarily by selling to other customers a large percentage of their initial purchase on the *same* day on which the dealer purchased the institutional size order. In fact, despite the lower liquidity of these bonds, the dealers somehow manage to offload to other customers *more* of the illiquid bonds than the liquid bonds on average. For example, for the least liquid AAA bonds that had only traded one to ten times in the previous 30 days, somehow dealers were able to find customers on the same day as the institutional purchase and sell all of their holdings from that purchase 49% of the time, while for most liquid AAA bonds that traded much more frequently (at least 150 times in the past 30 days), the dealers were able to sell to customers their entire purchase on the same day only 36% of the time. For high-yield bonds, the effects are even stronger. For CC rated bonds that rarely trade (once every 3 to 10 days), dealers were able to get rid of their entire purchase to customers within one day 84% of the time, while for the most frequently traded CC bonds (trading on average 30 times a day) this happened only 64% of the time. Similar results are found when conditioning on volume. These results are complementary to Zitzewitz (2010), which find paired trading between customer-dealer and interdealer trades more prevalent for non-institutional size trades.

Going beyond the same day completion, we also find that dealers are also more likely to eventually sell all of their purchase for the less liquid bonds to customers. These effects become stronger as credit quality decreases. Examining the cumulative sell ratio, or what proportion of the initial trade is sold to customers over the next 60 days, we find similar results. Using censored regressions to control for the (0,1) nature of the cumulative sell ratio, we find that, even after segmenting by credit rating and controlling for a variety of bond characteristics, dealers somehow seem to be able to sell to customers more of their initial purchase for the least liquid bonds than the most liquid.

Interestingly, previous liquidity or illiquidity has little effect on the spreads dealers charge customers. In fact, the data indicates that weighted average dealer roundtrip spreads tend to be smaller for the least liquid bonds (as measured by trading frequency in the previous 30 days) than the most liquid bonds. This result is also generally true when condition on previous volume, although the effect becomes stronger as credit rating becomes weaker.

Our paper is organized as follows. Section I reviews the current literature on corporate bonds and liquidity. Section II reviews some liquidity measures and Section III describes our data and provides some results related to the relative illiquidity. Section IV examines how long dealers hold onto purchases that they make from customers, and how these vary with both liquidity and risk. Section V then compares how much of the inventory the dealer offsets. Section VI then checks to see whether, given the risk mitigation techniques of the dealers, the spreads dealers charge customers vary with increasing degrees of illiquidity and risk.

I. TRACE, Corporate Bonds, and Liquidity

On July 1, 2002, the National Association of Securities Dealers (NASD) began a program of increased posttrade transparency for corporate bonds, known as the Trade Reporting and Compliance Engine (TRACE) system. With the July 2002 introduction of TRACE, all NASD members were required for the first time to report prices, quantities, and other information for all secondary market transactions in corporate bonds. Some market participants and regulators initially were concerned that public dissemination of this data for smaller and lower grade bonds might have an adverse impact on market liquidity.

Therefore, as of July 2002, the trade information collected by the NASD was publicly disseminated only for investment grade bonds (rated BBB and above) with issue sizes greater than $1 billion. Dissemination of trade information for all other bonds was gradually phased in, allowing regulators to assess the impact of transparency on liquidity at each phase. In March 2003, dissemination was expanded to include all bonds rated above BBB with issue sizes greater than $100 million. In October 2004, dissemination was expanded to include BBB and below bonds, with the exception of bonds which did not meet a trading frequency threshold. However, dissemination of trade information for newly issued bonds was delayed until day 3 of trading for BBB bonds, and until day 11 for lower grade bonds.[2] Lastly, on January 9, 2006 these delays were removed and trades were immediately disseminated

[2] The dissemination delays on less actively traded bonds were changed in February 2005 to apply only to trades over $1 million; delays in dissemination of newly issued bonds (3 days for BBB and 10 days for high yield) remained.

for all non-144A corporate bonds. A chronology of the reporting and dissemination rule changes is provided in the Appendix.

II. Liquidity measures and Illiquidity

One of the notable difficulties in corporate bond research is the relative lack of data from which to create liquidity measures. As noted by Nashikkar and Subrahmanyam (2006), "the absence of frequent trades in corporate bonds makes it difficult to use market micro-structure measures of liquidity based on quoted/traded prices or yields to measure liquidity, as has been done in the equity markets" (p.2).

One important issue is that many of the measures used in market microstructure require multiple trades per day. For example, in implementing the measure in Amihud (2002) which measures the price impact of trades, Dick-Nielsen, Feldhutter, and Lando (2009) require at least two trades per day. Other measures, such as using a daily Roll (1984) measure, also require multiple trades in the same day. More importantly, measures such as the Amihud measure or the Roll measure were created for market microstructure tests in the much more active equity market, where trades are more frequent. The inherent assumptions underpinning these measures may likely be more accurate in the active equity market than in markets where assets seem to trade by appointment. Similarly, the "unique roundtrip trade" measure in Feldhutter (2010) requires two or three trades in a day.

To get around this issue, some have used more oblique measures of liquidity. Chen, Lesmond, and Wei (2007) use the LOT measure from Lesmond, Ogden, and Trzcinka (1999) which relies on zero return days as an estimate of liquidity. However, as Chen, Lesmond and Wei (2007) note, even the LOT measure requires a certain minimum of trading frequency, as "too many zero returns (i.e., where more than 85% of the daily returns over the year are zero) also renders this measure inestimable" (p.123). Over a 30 day period, therefore, the LOT measure requires that there be trading activity on at least 6 days (to create 5 daily returns). Dick-Nielsen, Feldhutter, and Lando (2009) also note that when used on TRACE data the LOT measure is not reliable, becoming "unrealistically large" (p.3). Others, such as Nashikkar and Subrahmanyam (2006), eschew the use of market microstructure based measures of liquidity. Nashikkar and Subrahmanyam (2006) use private data on corporate bond holdings to create a measure of "latent" liquidity. However, as they also use CDS data to control for default risk, the bonds that are examined are limited to those with CDS data.

As a result, many papers focus only on the more liquid bonds. However, many bonds trade rather infrequently. As Goldstein, Hotchkiss, and Sirri (2007) note, the median BBB bond traded only every other day, only trading on 17% of the days.[3] The data used in this paper suggests that 27% of the bonds only trade once or twice a month, if at all. In addition, many of the market microstructure models of dealer behavior, such as the Kyle (1985) model or the Glosten and Milgrom (1985), while they do not explicitly assume frequent trades, have implicit assumptions about the competitive nature of the market and the frequency of new information arrival which imply the more frequent trading of the equity markets. As a result, an analysis of dealer behavior in infrequently traded risky assets is needed.

III. Data and Summary Statistics

Our initial sample of TRACE data starts on July 8, 2002 and runs through July 31, 2008. As we later look at trading over the previous 30 calendar days, the sample that gets analyzed starts on August 7, 2002 and runs through July 31, 2008, or just shy of six years of data. The TRACE data is then merged with data from Mergent, and all convertible bonds and medium term notes are dropped. A bond must also trade at least once during the time period, or it is dropped from the sample. As Goldstein and Hotchkiss (2007) among others note that trading is unusual near the initial offering date, all trades within 180 calendar days of the offering date are also dropped from the sample.

[3] Given that the median bond only traded on 17% of the days, 83% of the days had a zero return. Therefore, almost half of the bonds in that sample would not meet the requirement for the LOT measure that there be no more than 85% of the days with a zero return.

In addition to other variables, our TRACE data include an indicator of whether the reporting dealer is buying or selling the bonds and an identifier for the counterparty to the transaction, which allows us to separate customer and interdealer trades. We use TRACE data to compute various trading activity, holding period, sell ratio, and spread measures.

The base unit for our analysis is an initial dealer purchase of bonds from a customer. We then follow this same dealer's sales of the same bond to other customers. Our analysis focuses solely on those trades where the dealer initially bought bonds from a customer and later sold bonds back to a different customer or different customers. For a given dealer, we create round trip transactions for a given dealer by following bonds from an initial purchase by that dealer from customer to the sale of the bonds to another customer *by the same dealer*. Of course, while some purchases of bonds by that dealer from a customer are then followed by a single sale of the same size to another customer, some purchases are followed by more than one sale. We aggregate all sales by that dealer to a customer that can be associated with the initial purchase from a customer into a single dealer roundtrip transaction. Therefore, all dealer roundtrip transactions in this analysis have a single dealer purchase from a customer but may have more than one dealer customer sales.

To focus on the inventory effects faced by the dealer, we limit our analysis of dealer roundtrips to initial purchases by the dealer of more than 100 bonds. A purchase of bonds of this size would likely be considered large by a dealer, especially in illiquid or risky issues, and would likely have the dealer focused on inventory risk issues. Such purchases of over 100 bonds are generally considered institutional size and are therefore likely purchased from institutional clients, as noted in Goldstein and Hotchkiss (2007) or Goldstein, Hotchkiss, and Pedersen (2009). However, while we limit the dealer's initial purchase from a customer to over 100 bonds, we do not limit the size of the dealer's subsequent sales to customers, which could be of any size. Therefore, we put no constraints on sale size for the dealer to offset his inventory.

A first question is how liquid or illiquid are corporate bonds in general? To examine this, we first calculate the median number of trades per month of any type or size per bond, limiting the sample only to those bonds that have at least one customer-dealer-customer roundtrip over the entire time period. To make this set comparable to data used later in the paper, we first delete the first 180 days of a bond's trading, as per the results in Goldstein and Hotchkiss (2007). As this might result in a partial month, we move forward to the first full month. If this is before July 2002, we start in July 2002; otherwise, we start at the first full month. We then calculate the number of trades per month until the bond is redeemed, called, or matured. To avoid partial months, we do not include the final month. If the bond is still in existence as of July 2008, we use June 2008 as the last month. If there was no trading in a month for a bond, that bond has zero trades in that month. We then calculate the median number of trades per month.

The bonds in our sample are highly illiquid. Figure 1 shows the median number of trades of any type per month for the bonds in our sample. It is clear that bonds are rarely traded; for 17.5% of the bonds, the median number of trades per month is zero. Just 27% of the bonds have two or fewer trades per month, or only one trade every ten days or so, and over half (51.6%) have ten or fewer trades per month, or only one trade every two to three days. About 70% of the bonds have 23 trades per month, or about one a day. Figure 1 ends at 200 trades per month (or about 10 trades a day), covering 96.8% of all bonds in the sample.

Table 1 describes the sample more directly. As we will be analyzing dealer roundtrips, statistics are first calculated as of the initial institutional size purchase from a customer by a dealer as part of a dealer round trip, then averaged for each bond. For example, the average rating for a bond is the mean rating of the bond at the beginning of each CDC or dealer roundtrip. Panel A of Table 1shows the distribution of bonds across the rating categories (AAA to C), the percentage of bonds in each rating that are 144a bonds, the average number of CDC (or dealer rountrips) per bond in each rating category, and the average issue size per rating. Panel A of Table 1 also shows the average time to maturity and the average age of the bond (time since issuance) per rating category. The number of bonds clearly varies across rating categories, with the bulk near the investment grade/high yield divide (the A, BBB, BB, and B categories). There are relatively few AAA and CC bonds, and only 75 C rated bonds.

Otherwise, the sample is relatively similar across ratings. As a percentage, there are over twice as many 144a bonds in the upper ends of the high yield category than in investment grade, but the average number of dealer roundtrips per bond (around 100) and issue size ($300 to $400 million, with the exception of the AA category at $800 million) are relatively similar across ratings. Higher rated bonds (AAA to BB) have about 10 years remaining until maturity, while bonds rated B and below have about six years remaining. Bonds were issued about five years ago, except for AAA bonds which are about 7 years old and B bonds which are only 3 years old.

Panels B and C of Table 1 give further breakdowns of liquidity by rating, using the sample previously used in Figure 1. An important measure of liquidity at very low liquidity levels is trading frequency, as the ability to even observe a price is a function of their being a trade. Panel B describes the sample by the median number of trades per month, broken into seven different liquidity categories: 0 to 9 trades per month (about one every three to ten days), 10 to 19 trades per month (about one every two to three days), 20 to 40 trades per month (about one a day), 41 to 60 trades per month (about one to two a day), 61 to 90 trades per month (about 2-3 per day), 91 to 150 trades per month (about 3 to 5 per day), and more than 150 trades per month (over 5 a day). As is evident from Panel B, most of the bonds are relatively illiquid. Most bonds are in the first three highly illiquid categories, but this is relatively consistent across rating. Based on trading frequency, most bonds hardly trade, and this pattern is relatively consistent across credit rating.

However, bonds that trade infrequently may still trade large amounts when they trade, and so could be liquid based on volume. Panel C examines the sample based on median monthly volume, again broken into seven liquidity categories: 0 to 150 bonds per month, 151 to 500 bonds per month, 501 to 1500 bonds per month, 1501 to 2500 bonds per month, 2501 to 3500 bonds per month, 3501 to 5500 bonds per month, and over 5500 bonds per month. In this distribution, there are more bonds in either the least liquid or most liquid categories (with more than twice as many in the most liquid category than the least liquid), and relatively uniform in the middle. However, it is still true that this distribution does not vary much across credit ratings.

As the main focus of this paper is the dealer roundtrip (or CDC), we now switch to some summary statistics based on the distribution of dealer roundtrips. As dealers are likely more concerned with recent history and current credit ratings, we now change slightly how liquidity categories and credit ratings are calculated. Specifically, as the current rating is likely important to the dealer, we now use the rating at the time the dealer bought the initial purchase of 100 or more bonds from the customer. In addition, as it is likely the most recent liquidity environment with which the dealer is concerned, we now examine either the number of trades or the cumulative volume across all trades over the 30 days immediately prior to the day of the initial purchase. However, we retain the same seven liquidity categories as before.

Table 2 provides some distribution detail regarding the number of dealer roundtrips per rating and liquidity category. Panel A provides data on liquidity groups measured by the number of trades in the previous 30 days. Not surprisingly, there are many more dealer roundtrips observed for the most frequently traded, most liquid group, as demonstrated in Panel A. However, the number of dealer roundtrips observed for the six other categories is relatively constant and this pattern is relatively constant across credit ratings. Panel B provides data based on cumulative volume over the previous 30 days. While the cumulative volume distribution in Panel B is similar to that in Panel A, the two most illiquid categories (500 bonds and under) have half to a quarter of the number of dealer roundtrips as the next three categories, with the number of dealer roundtrips increasing by 50% for the 3501 to 5500 category before jumping dramatically for the most liquid category (over 5500 bonds in the previous 30 days).

In addition to the number of dealer roundtrips, Table 2 begins to introduce the first elements of dealer behavior varying by liquidity. While the dealer roundtrip starts with an initial purchase of more than 100 bonds by the dealer, the dealer can dispose of the bonds in more than one transaction to more than one customer. In theory, if the dealer is standing by passively and waiting for the arrival of counterparties, it is not obvious why this will vary across liquidity groupings or credit ratings. However, if the dealer is actively looking for counterparties to mitigate risk for less liquid bonds, we might expect to see the dealer dispose of his/her inventory in fewer transactions as liquidity and credit rating decreases. In fact, we see that the number of sell transactions per dealer roundtrip is consistently smaller for the least liquid categories measured either by number of trades or cumulative volume. For example, the dealer makes an average of 2.76 sales as part of the dealer roundtrip for BBB bonds that traded over 150 times in the previous 30 days, but somehow manages to get rid of his/her inventory in only 1.35 transactions for BBB bonds that only traded 9 times or fewer in the past 30 days. Similarly, the dealer makes 2.18 transactions for BBB bonds which traded over 5500 bonds in the previous 30 days, but somehow managed to do the same in only 1.52 transactions for BBB bonds that traded 150 or fewer bonds in the previous 30 days. This effect becomes more pronounced as the credit rating declines; for C bonds that traded 150 bonds or fewer, the dealer completed the roundtrip in only 1.07 transactions.

IV. Holding Periods

As demonstrated in Table 2, the number of transactions that it takes a dealer to complete a roundtrip seems to vary with both types of risk: liquidity and default risk. The real risk to the dealer, of course, only occurs while the dealer is holding the bond: once disposed of, the dealer no longer has any risk. Therefore, a major factor in a dealer's risk profile is how long he or she holds the bond.

Since we can track when the dealer initially bought the bonds and how he disposes of them, we can track the holding period of the dealer for a round trip. We therefore now turn to examine dealers' holding periods and how they vary across liquidity groupings and credit ratings. As before, a dealer roundtrip begins when the dealer buys an institutional size of more than 100 bonds from a customer, and we track these sales to multiple customers. The holding period is how long it takes for the dealer to dispose of the purchase to his/her customers.

A natural way to think about holding periods is to examine the liquidity of the bond in question over the past 30 days. If you think of the dealer as passively waiting for customers to arrive via a Poisson process as in many market microstructure models, it should take longer for a dealer to dispose of a large purchase for less liquid bonds, simply because it takes a while for natural liquidity to show up. It seems reasonable that it will take a while for a dealer to dispose of an institutional size purchase for a bond that has only traded once or twice in the past 30 days. On the other hand, if a bond trades more than five times a day, the dealer should be able to sell that initial purchase to new customers rather quickly. The same would be true for volume: it would likely take the dealer a while to sell bonds in low volume bonds but if a bond has had very high volume over the past 30 days, it should be easier to offload the initial purchase.

One issue not to overlook regarding these liquidity categories: they are liquidity categories for the bond, not the dealer or the dealer in that bond. So, when a liquidity category says the trading frequency was a trade very three to ten days (actually zero to ten trades in the past 30 days), this is across *all* dealers, and not just for the dealer that just made the purchase. For the dealer for whom the roundtrip is being calculated, the liquidity is likely less than this category, as the category marks the cumulative liquidity across all dealers. Only if the dealer captured all the liquidity would it be true that the overall liquidity of the bond is what that dealer experienced.

Table 3 notes the mean weighted average holding period for dealer purchases of over 100 bonds by rating and liquidity category. The holding period for each purchase is first calculated by calculating how many days after the initial purchase from a customer the subsequent sale to a customer of any size took place. A sale on the same day, where the sell date and buy date are the same, is treated as having a holding period of zero days. Then, the holding period for all sales in a particular roundtrip are then weighted by the number of bonds that were sold on that day to develop a weighted average holding period for that roundtrip. The holding periods for roundtrips are then averaged within their rating and holding period groups. Any roundtrip for which the holding period longer is longer than 60 days is deleted, as it is possible that some data was missing. However, so as not to unduly bias the results with large outliers and to be conservative, any holding period in excess of 30 days is given a holding period value of 31 days.

Panel A of Table 3 examines the holding period across ratings for liquidity categories based on the number of trades in that bond over the 30 days previous to the initial purchase by the dealer of the institutional sized order. For ease of interpretation, the categories are presented in terms of trading frequency: one trade every three to ten days (0-9 trades in the past 30 days), one trade every 2 to 3 days (10 to 19 trades in the past 30 days), about 1 trade a day (20 to 40 trades in the past 30 days), 1-2 trades per day (41 to 60 trades in the past 30 days), 2-3 trades per day (61 to 90 trades in the past 30 days), 3-5 trades per day (91 to 150 trades in the past 30 days), and 30 trades per day (over 150 trades per day; the average for this category corresponds to 30 trades per day). This last category contains the most liquid bonds that trade as often as some stocks, and therefore is not really representative of "illiquidity".

The first thing to note in Panel A of Table 3 is that the holding periods are much longer for investment grade bonds than for high-yield bonds. For investment grade bonds, for all but the most liquid category, the holding period is about 8 to 9 days on average, while for high-yield bonds, the holding period is around five days for BB bonds and it drops to two days for CC and C bonds. Overall, it seems like the holding period decreases as credit rating decreases. Holding liquidity constant, dealers clearly try to and somehow are able to get rid of risky bonds faster than investment grade bonds.

Within a credit rating, the holding periods are amazingly similar across liquidity categories, even though the liquidity varies tremendously. For example, it is not true that the least liquid category has the longest holding period; in fact, that is not true for any of the credit rating categories except one (AA bonds). For example, for bonds rated BBB, the least liquid category (0 to 9 trades in the past 30 days, or a trade every 3 to 10 days) has a holding period of 8.89 days, which is less than the holding period length of 9.48 days for BBB bonds that trade every twice as much (10 to 19 trades in the past 30 days, or a trade every 2 to 3 days), or even the holding period of 9.00 days for BBB bonds that trade about once a day (20 to 40 trades in the past 30 days). For high yield bonds, the story is even stronger. For BB bonds, the holding period of the least frequently traded category is less than all other categories except for those that trade over 3 times per day, and for all other high yield bonds, the least liquid bond category has a shorter holding period than all bonds except those in the most liquid category.

Further examination of the data suggests that as credit rating deteriorates, holding periods are not monotonically decreasing with liquidity. Instead, not including the most liquid category (which has an average of 30 trades a day), holding periods seem the largest around one or two trades a day, and decline both with more liquidity and with less liquidity. More importantly, holding period does not decline with trading frequency, but appears relatively constant. One could create an estimated holding period based on trading frequency which would get shorter and shorter as frequency increases, and it is obvious that this is not the case here.

Using volume instead of trading frequency gives similar, if not stronger, results. Panel B of Table 3 examines liquidity based on cumulative volume over the past 30 days across all dealers. Again, there is a difference between investment grade and high yield bonds, with investment grade holding periods are around 7 to 8 days, while high yield holding periods drop from about five days for BB bonds to two to three days for CC and C bonds.

However, even more striking are the results for holding period across liquidity groups based on volume. Panel B indicates that the least liquid group (150 bonds or less over the previous 30 days) has a holding period similar to and often less than almost all other liquidity categories for investment grade bonds. For example, the 7.96 day holding period for A rated bonds that only traded 150 bonds or less over the previous 30 days is about the same as the holding period for A rated bonds that traded over ten times that amount, as the holding period for 1501-2500 bonds is 7.95, and lower than the intermediary groups. For BBB rated bonds, the lowest volume bonds have a holding period of 8.11, and it is not until the second most liquid category (3501-5500) that the holding period is lower than that at 8.01.

For high yield bonds, the volume results are dramatic. High yield bonds whose cumulative volume was less than 150 bonds have a lower average holding period than even the <u>most</u> liquid bonds. In fact, once again, holding periods increase with liquidity groups before they again decrease, so once again holding periods do not change monotonically with liquidity based on previous volume. In addition, holding periods once again do not vary with what one might expect based on cumulative volume: transactions of over 100 bonds should likely take a month (or at least a long time) for bonds that only trade 150 bonds per month, but a day for bonds that trade 3501 to 5500 bonds per month, and yet the holding periods for each are reasonably similar.

How might this be? One very reasonable possibility is that dealers actively manage their positions and attempt to mitigate their risk by managing their holding periods. Instead of passively waiting for customers to arrive, dealers may actively search out counterparties as suggested in Duffie, Garleanu, and Pedersen (2005). As such search is costly, they may be more inclined to do so as either natural liquidity decreases or default probability increases.

To investigate this possibility, Table 3a examines the percentage of roundtrips by dealers that were completed on the same day. As before, Panel A examines liquidity based on trading frequency; Panel B examines liquidity based on cumulative volume. Again, for both panels, there are far greater differences between investment grade and high yield than there are across liquidity groups. For investment grade bonds, about 33% of the time the dealer managed to complete the round trip within the same day, while for high-yield bonds, the dealer somehow managed to complete the round trip in the same day about 50% of the time for BB bonds, but around 75% of the time for the lowest two credit ratings of CC and C. However, within a single credit rating, there is not much variation in the percentage of time that a dealer can complete a roundtrip on the same day, whether or not the bond trades only once every 10 days or thirty times a day! Again, for the high yield categories, and even for credit ratings A and BBB, the least liquid bonds have *more* roundtrips completed in a day that even the most liquid bonds.[4]

Since the number of roundtrips completed in the same day does not seem to vary across liquidity groups, it seems clear that the dealers must be engaging in some sort of optimal search behavior to find the opposing side of a trade. Of course, our data does not allow us to see this search behavior, but these results are consistent with such optimal search, so that regardless of liquidity, the holding period is approximately constant. We also find that holding period varies by credit rating, holding rather steady for some of the investment grades but decreasing as credit rating deteriorates. This change with credit rating would also be consistent with dealers engaging in search for customers to serve as counterparties.

Of course, these are univariate statistics, and so it is possible that there are some uncontrolled differences across these categories. To examine this issue, we first create a very simple "expected" holding period based on either the number of trades or the volume in that bond over the past 30 days. For the number of trades, to get an expected holding period, we divide the number of trades in the past 30

[4] The one exception is in Panel A for BBB bonds, where 42% of the least liquid bonds (0-10 trades in the past 30 days) complete their roundtrips on the same day, while it is 44% for the most liquid bonds (more than 5 trades per day). However, Panel B indicates that in terms of volume, the least liquid BBB bonds have a slightly higher same-day roundtrip percentage (43%) than the most liquid (42%).

days into 30. As a result, the expected holding period is how many days we expect to wait for another trade. By doing this, we are implicitly assuming that the entire transaction can be completed in that next trade. While this is a strong assumption, the data in Table 2 and Table 3a indicate that this is not far from the truth. More importantly, it is a conservative estimate of expected holding period; if we used the data from Table 2, we would generate longer expected holding periods, as it should take more than one transaction to complete the roundtrip. To get an expected holding period for volume, we divide 30 by the cumulative volume over the past 30 days. We then take the difference between the actual holding period (truncated at 31 days) and the expected holding period, which becomes our dependant variable *dexhp2*.

We then control for a variety of variables that might affect our results. We first control for the natural log of the size in the number of bonds of the initial purchase (*lsize*) , as larger initial purchases may be harder. As there may be differences across time, including different transparency regimes, we include a trend variable (*trend*) based on which quarter the initial purchase by the dealer for that roundtrip took place. We also include a dummy variable (*dtc144a*) that is equal to 1 if the bond is subject to Rule 144a, and zero otherwise. We also control for the time to maturity (*ttm*) and the age of the bond (*age*). As the initial size of the bond may affect liquidity, we also control for the original offering amount (*OfferingAmt*). Finally, as different bonds over different times were subject to different dissemination regimes, we include a dummy variable (*dissem*) for whether or not the bond's transactions were publicly disseminated by TRACE.

Finally, as we are interested in liquidity, we include six dummy variables for liquidity, corresponding to the appropriate liquidity categories. The most liquid category, which for trading frequency corresponds to more than 150 trades in the past 30 days and for volume corresponds to a cumulative volume of over 5500 bonds in the past 30 days, does not have a dummy, but instead is captured by the intercept. We use dummy variables for the liquidity groups as the data in table 3 indicated that it is not clear that holding periods are either linear or monotonic with liquidity.

Since Table 3 indicated that there are notable differences based on credit rating which also seem non-linear and not necessarily monotonic, we run a separate regression for each credit rating. Therefore, for each credit rating category, we separately run:

$$dexhp2 = \alpha + \beta_1 d_1 + \beta_2 d_2 + \beta_3 d_3 + \beta_4 d_4 + \beta_5 d_5 + \beta_6 d_6 + \beta_7 lsize + \beta_8 trend + \beta_9 dtc144a + \beta_{10} ttm + \beta_{11} age + \beta_{12} OfferingAmt + \beta_{13} dissem + \varepsilon$$

Table 4 shows the difference between the expected and actual weighted average holding periods. Interestingly, the results in Table 4 both for trading frequency (Panel A) and volume (Panel B) indicate that, after all the other variables are controlled for, the difference between the expected holding period and the actual holding periods for the least liquid bonds is less than that for the most liquid bonds. As credit rating deteriorates in the high-yield group, this becomes true also for the next least liquid bonds. In addition, the effects are non-monotonic across liquidity groups for investment grade bonds. While there is little monotonicity for high yield bonds in Panel A based on trading frequency, there is some evidence for the high yield bonds in Panel B that as a bond gets more liquid as measured by volume, the difference between expected and actual increases slightly.

Beyond this, the control variables come in as expected. Across both panels and all credit ratings, the difference is statistically significantly negatively related to size. Besides the AAA bonds, there is some evidence of a trend over time. Being a 144a bond matters but the sign varies for Panel A; for Panel B, it is generally negatively related except for AAA and CC bonds, both of which have fewer observations. Time to maturity and age also generally seem to matter and have the opposite signs. Generally speaking, dissemination appears to increase the difference, but less so for lower credit ratings.

Overall, Tables 3, 3a, and 4 indicate that holding period does not vary with liquidity in a way that suggests that the dealers are just passively sitting by waiting for clients to arrive. Instead, it appears that the holding period results imply that dealers engage in search to find clients to manage and reduce their holding periods, as suggested by Duffie, Garleanu, and Pedersen (2005). It appears that dealers actively engage in search more when natural liquidity is low, and less when natural liquidity increases, and that this search results in relatively uniform holding periods across liquidity regimes. Even so, holding periods are not monotonic or uniform across liquidity; instead, holding periods appear a bit U shaped. Dealers are more likely to engage in search and reduce holding periods for high yield bonds than for investment grade bonds, and within high yield, they are more likely to reduce their holding period the worse the credit quality of the bond.

V. Sell Ratios

Another measure of dealer activity is to see how much of their initial purchase they ultimately sell to another customer. Dealers could, of course, not wait for other customers but instead sell to other dealers, but presumably they would prefer to sell to other customers. A variety of papers have suggested that trading with customers is good for dealers. For example, Green, Hollifield and Schurhoff (2007b) show that in the municipal bond market, price dispersion is largely due to small trades which occur at a wide range of prices almost simultaneously. Similarly, Goldstein, Hotchkiss and Sirri (2007) show the presence of a substantial number of outliers in price within the TRACE data, suggesting that customers trading near in time often pay (or receive) widely differing prices. In his AFA Presidential address, Green (2007) models the dealer behavior leading to observed price dispersion when there is a lack of transparency in secondary markets. An important implication of his model is that dealers' ability to discriminate between informed and uninformed customers is reduced with the introduction of transparency.

We therefore examine the percentage of the initial purchase of bonds by the dealer that is ultimately sold to a customer by examining the sell-ratio for each round trip. The sell ratio is the ratio of the volume of all subsequent customer sells by the dealer related to this roundtrip divided by the volume of the initial purchase from a customer by the dealer that started the roundtrip. *Ex ante*, there is no reason why this sell ratio should vary either by liquidity group or by credit rating.

Table 5 examines sell ratios for these roundtrips by credit rating and liquidity groups. As in Table 3, Panel A again uses the same trading frequency liquidity groups; Panel B uses the same cumulative volume groupings as in Table 3. These two panels show similar results. For investment grade bonds, the sell ratio is highest for the least liquid groups at around 84%, and sell ratios monotonically decrease as liquidity increases to around 50% based on the number of transactions (Panel A) and 60% based on volume (Panel B). These results are similar for high-yield bonds, but as credit deteriorates, the sell ratio increases. In fact, for CC bonds, the sell ratio is 94% for the least liquid bonds in both panels and 76% (Panel A) to 78% (Panel B) for the most liquid bonds. Based on the results from Table 5, it again appears that dealers seem to be searching out customers more for less liquid and lower rated bonds, further confirming the inferences from Tables 3, 3a, and 4.

To investigate this further, we again run individual regressions for each credit rating on sell ratio. As the dependent variable (*sellratio*) is a variable that only can go from 0 to 1, we run a censored regression, especially since there are many observations with a sell ratio of 1. The independent variables are as in Table 4, along with output for Sigma.

Table 6 contains the results for the censored regressions on sell ratio, with a lower bound of 0 and an upper bound of 1. Panel A provides liquidity categories by trading frequency; Panel B provides liquidity categories by cumulative volume. As in Table 4, the most liquid category in either Panel A or B has not been dummied out, so all results are relative to the most liquid bonds. The results of both panels suggest that even after controlling for the variety of factors (initial transaction size, time trend, 144a, maturity, age of the bond, offering amount, and whether the bond's prices are disseminated) the sell ratio for the least liquid groups are higher than for the most liquid category. In both panels, across investment grade and high yield bonds, the coefficients on the liquidity dummies are positive and monotonically decreasing as liquidity increases. While not as pronounced as in Table 5, the magnitude of the coefficients for the high yield bonds are generally larger than those for investment grade bonds. Overall, the results in this regression support those in Table 5.

Overall, Tables 5 and 6 indicate that dealers more frequently offload their inventory to customers for less liquid and lower credit quality bonds. These results are again consistent with the dealers not passively waiting for customers but actively engaging in search, as customers should be more difficult to find for less liquid bonds, not easier as these results imply. When combined with the results in Tables 2, 3, 3a, and 4, these results help suggest that dealers actively search for customers and reduce their holding period over what might naturally happen by searching for customers and selling more of their inventory sooner to these customers they found than they do for the most liquid bonds, where they can wait for the customers to arrive.

VI. Pricing and Spreads

Given that such search is costly, do dealers charge more to their customers, particularly for less liquid bonds? Or do they provide very large discounts, so as to attract customers? After all, an alternative to the costly search would be to provide discounts to customers who search out the dealers, as in Leach and Madhavan (1993). However, the market structure is quite different in corporate bonds than it is in stocks and so, given the lack of a public quoting mechanism, quoting discounts may not drive volume. In addition, Leach and Madhavan (1993) indicate that such behavior is unlikely in a multiple dealer system. Therefore, the question of what dealers charge is an empirical one.

To answer this question, we examine the cost of a roundtrip trade, similar to that in Goldstein, Hotchkiss, and Sirri (2007) and others. In this case, as we are able to follow the same dealer, we compare the price the dealer bought the initial institutional size purchase with the weighted average of the prices of all of the subsequent sales to customers. Since Table 5 indicated that not all sales from the initial purchase ultimately go to customers, we weight the price of each subsequent sale to a customer by the number of bonds of that sale divided by the total number of bonds sold to customers from that roundtrip. In this way, we are able to calculate a weighted average spread for these dealer purchases. Spreads are quoted as per $100 of face value. To prevent errors from adversely affecting the data, observations were winsorized at the 1% level. As a result, weighted average spreads of less than $-2.75 or spreads higher than $6 were removed.

Table 7 shows the mean weighted average spread by rating and liquidity category. As these roundtrips started from institutional size purchases by a dealer from a customer (although they could have been removed by retail size sales), the weighted average spreads are all less than $1. These roundtrip spreads are of similar magnitude to those found by Edwards, Harris, and Piwowar (2007), Goldstein, Hotchkiss, and Sirri (2007), and others.

Panel A of Table 7 shows the results for liquidity groups based on trading frequency. Again, spreads seem to be relatively uniform for investment grade bonds, but seem to increase (holding liquidity constant) as credit rating deteriorates for high yield bonds. Even more interestingly, the spreads on the least liquid bonds seems as low or lower than the spreads on the most liquid bonds for all ratings above CCC. For example, for BBB bonds, the spread for bonds that trade only once every 3 to 10 days is about 0.43, but the spread on bonds that trade 30 times a day on average is higher, at 0.76. Generally, spreads either seem to undulate across liquidity categories or decrease and then increase again in a type of U-shaped pattern. Overall, however, holding credit rating constant, there is surprisingly little variation in spreads across very different liquidity patterns.

Panel B of Table 7 shows mostly similar results for liquidity based on volume. Again, in general the investment grade bonds, especially the AAA, AA, and A ratings, seem to have spreads similar in magnitude holding liquidity constant, at somewhere around 0.35 to 0.40. High yield bonds seem to have generally higher spreads, from around 0.47 to around 0.73. For investment grade bonds rated AAA, AA, and A, spreads appear to decrease with liquidity based on previous cumulative volume, although there is a slight uptick in spreads at the two most liquid categories. For BBB bonds, spreads are actually lower for the least liquid category than for the most liquid, although this is not true for the high-yield bonds. However, for the BBB, BB, and B bonds, spreads are at times lower for relatively medium liquidity bonds than for the most liquid bonds, so that spreads again demonstrate a U-shape.

To investigate this further, we again run a regression on spreads similar to that in Table 4. The results in Panel A for trading frequency indicate that spreads are smaller for the less liquid categories than the most liquid group in general, and particularly for the BBB, BB, and B rated bonds. Overall, however, the coefficients across liquidity groups are not monotonic. The results in Panel B for liquidity based on previous trading volume suggests that while spreads for the most liquid group are smaller than those for the six less liquid categories for investment grade bonds rated AAA, AA, and A, this is not true for bonds rated BBB and below. Even for the three A ratings, the coefficients on the liquidity dummies are not uniformly positive and are not monotonically increasing or decreasing with liquidity.

The results in Tables 7 and 8 suggest that while holding period and sell-ratio may vary across liquidity due to costly search for customers by the dealer, the dealers are not either uniformly raising or lowering costs. In fact, the results in Tables 7 and 8 suggest that *realized* roundtrip spreads do not vary much with liquidity for highly illiquid bonds, measured either by trading frequency or cumulative volume. This result may therefore explain why previous research relating measures of secondary market liquidity to secondary market yield spreads on corporate bonds find somewhat mixed results depending on the measures used (see, for instance, Bao, Pan, and Wang (2009), Chen, Lesmond, and Wei (2007), Dick-Nielsen, Feldhutter, and Lando (2009)), although many of these papers examine much more liquid bonds than the ones here due to their data requirements of multiple trades per day.

To the extent that roundtrip spreads do not vary with liquidity, it is unlikely that roundtrip spreads would be priced into yield spreads. The mitigating techniques of the dealers to reduce their risk by reducing holding period by searching for customers should result in an optimal and relatively constant cost, which should result in a relatively constant roundtrip spread, as we find here. If the spread therefore does not change with liquidity, it would not make a good proxy for liquidity risk and therefore should not be priced in yield spreads.

VII. Conclusion

Corporate bond dealers frequently trade highly illiquid bonds. Many corporate bonds trade rarely, if at all. For many bonds, one or two trades over the past 30 days is not unusual, and that is market-wide activity across all dealers in the marketplace. For a given dealer, trading is even less frequent. For most bonds trading is infrequent, and for most dealers, it is even more so.

However, not much is known about dealer behavior in assets that trade rarely. Standard market microstructure models, which model dealers as passive order takers waiting for customers to arrive in a Poisson-process like manner, suggest that for very infrequently traded assets dealers would have to hold the asset in inventory for a long time, absorbing the price risk associated with long holdings, and charging a large bid-ask spread to compensate them for this risk.

Using a unique dataset, in this paper we analyze dealer behavior in these highly illiquid risky assets. We match an initial dealer institutional size purchase of 100 bonds or more from a customer with the dealer's subsequent sales to other customers. In contrast to the expectations of the standard models, we find that dealer roundtrip spreads for initial purchases of institutional size illiquid bonds are less than those of much more frequently traded bonds, despite vast differences in liquidity. Further examination indicates that for a given credit rating, the average dealer holding period does not vary substantially. The average dealer holding period for a AAA bond that has only traded once to ten times in the previous 30 days is about 6.5 days, while it is 7 days for bonds that traded as much as once to twice a day in the previous 30 days. However, average dealer holding periods are notably shorter (almost half) for lower rated, more risky bonds; in contrast to the AAA bonds, the average dealer holding period for CC bonds is only 2 to 3 days. Despite the decreased liquidity, dealers appear to sell more of their initial purchase of illiquid bonds to other customers on the same day that the dealers purchased the bonds than they do for more liquid bonds, and overall they are more able to sell their purchase of illiquid bonds to other customers than their purchases of liquid bonds.

Collectively, these results suggest that dealers are actively managing their inventory risk in illiquid assets in such a way so as to keep their overall inventory risk relatively constant regardless of the natural liquidity of the bond. These results seem consistent with dealers actively searching for counterparties to manage their inventory risk, similar to that suggested in Duffie, Garleanu, and Pedersen (2005). These activities appear to intensify for lower rated, more risky assets, resulting in lower holding periods. Overall, dealer activity in managing their holding period regardless of natural liquidity is such that they are able to offer relatively constant spreads to customers, and, in fact, in contrast to standard microstructure models, seem to be offering slightly lower spreads on *more* illiquid assets, perhaps as an inducement to customers to take these highly illiquid bonds off of dealers' hands.

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Table 1
Summary Statistics

This table presents summary statistics on the bonds in this sample by rating. Rating for each bond is the rating of the bond at the time a customer-dealer-customer (CDC) chain was created by the dealer purchasing an institutional size amount (100+) bonds from a customer; the rating then averaged across all CDCs for that bond. Panel A shows the number of bonds, the percent of bonds that are 144a, and the mean number of CDCs per bond for that rating. Issue size, Time to Maturity, and Age of the bond are first averaged across CDCs for a bond, then averaged across all cusips with that rating. Panels B and C show the number of bonds whose median number of trades (or volume) falls in the respective liquidity categories

	Investment Grade				High-Yield				
	AAA	AA	A	BBB	BB	B	CCC	CC	C
A. Average Summary Statistics by bond									
Number of Bonds	446	892	3318	4174	1588	2539	1386	331	75
144a	12%	12%	9%	11%	18%	29%	25%	4%	11%
# of CDCs per bond	109	141	109	95	113	84	94	57	25
Issue size	288,207	794,391	424,443	391,216	356,916	311,048	270,017	323,678	319,445
Time to Maturity	13.0	7.5	9.9	10.2	9.0	6.8	6.3	6.0	5.7
Age of bond	6.7	4.7	5.5	4.5	4.2	3.0	3.8	5.6	5.6
B. Number of bonds by rating based on median number of trades per month									
3 to 10 days	251	345	1,443	2,324	703	1,219	680	222	54
2-3 days	66	113	492	708	250	433	201	27	12
about 1 day	47	127	552	496	264	412	177	31	4
1 -2 per day	29	60	211	167	114	145	85	13	3
2-3 per day	24	48	186	136	97	94	78	8	1
3-5 per day	18	58	161	130	70	77	55	14	1
30 per day	10	134	244	157	52	55	52	16	0
C. Number of bonds by rating based on median volume per month									
150 or less	208	144	719	1,037	317	508	317	140	33
150 - 500	71	38	192	291	63	62	34	14	1
501 - 1500	47	67	289	357	61	108	53	20	2
1501 - 2500	11	29	175	201	81	104	46	14	3
2501 - 3500	10	21	157	140	54	82	48	6	3
3501 - 5500	19	55	227	215	94	173	77	22	4
more than 5500	79	531	1,530	1,877	880	1,398	753	115	29

Table 2

Summary Statistics for Dealer Purchases from a customer and then sold to (multiple) customer(s) -- CDCs

Number of Dealer Purchase Groups and Average Number of Customer Sales per Dealer Purchase Group by Rating

This table presents summary statistics on customer-dealer-customer (CDC) round trip groupings for a single initial purchase of more than 100 bonds from a customer by an individual dealer that is later sold to one or more other customers. Although the individual dealer bought the bonds in a single transaction with a single customer, the dealer may then turn around and sell the bonds over multiple trades to multiple customers, so that each purchase may or may not have multiple sales. Each purchase is then catagorized by the size of the intial purchase, the credit rating of the bond at the time of purchase and a liquidity bucket for that bond over the previous 30 days. Num is the number of observations of a customer-dealer-customer purchase/sale combination per retail/institutional, credit rating, and liqudity category. Avg is the average number of sales to a customer that was matched to a dealer purchase per observation in that size, liqudity, and rating group. Panel A shows the data for liquidity buckets based on the trading frequency (number of trades in the past 30 days, so one trade every 3 to 10 days, etc.); Panel B shows liquidity buckets based on volume in the past 30 days.

Liquidity	Investment Grade								High-Yield									
Group	AAA		AA		A		BBB		BB		B		CCC		CC		C	
	Num	avg	Num	avg	Num	avg	Num	avg	Num	avg	Num	avg	Num	avg	Num	avg	Num	avg
A. Trading Frequency (number of trades over the previous 30 days)																		
3 to 10 days	1,736	1.40	4,648	1.37	16,909	1.41	27,761	1.35	11,747	1.24	22,114	1.16	10,598	1.15	1,528	1.14	493	1.11
2-3 days	974	1.44	3,679	1.46	14,119	1.55	21,508	1.44	12,084	1.28	22,630	1.20	9,387	1.18	920	1.15	419	1.15
about 1 day	1,122	1.75	5,304	1.59	22,319	1.64	28,488	1.51	19,663	1.30	33,751	1.25	14,834	1.20	1,580	1.17	604	1.19
1 -2 per day	814	2.10	3,909	1.81	14,310	1.79	15,951	1.62	12,875	1.37	21,203	1.30	9,773	1.23	1,400	1.23	507	1.17
2-3 per day	952	2.08	4,462	1.92	15,714	1.84	15,502	1.69	12,192	1.46	18,905	1.34	10,564	1.27	1,836	1.27	573	1.38
3-5 per day	1,164	2.69	7,592	2.01	21,857	1.87	18,319	1.82	12,174	1.63	18,711	1.40	13,452	1.36	2,979	1.27	875	1.28
30 per day	2,264	2.51	30,345	2.06	57,305	2.15	69,706	2.76	25,008	2.03	36,983	1.73	29,486	1.52	9,081	1.31	3,286	1.27
B. Cumulative Volume (previous 30 days)																		
150 or less	1,039	1.95	2,170	1.59	9,913	1.71	10,538	1.52	3,189	1.37	4,253	1.25	2,473	1.21	529	1.14	136	1.07
150 - 500	925	1.99	3,521	1.75	13,157	1.85	8,534	1.81	3,339	1.57	4,722	1.33	1,389	1.35	247	1.19	97	1.23
501 - 1500	1,550	2.13	7,974	1.91	26,252	1.81	19,783	1.79	12,470	1.51	21,969	1.29	6,244	1.30	857	1.22	286	1.22
1501 - 2500	1,077	1.96	6,553	1.90	19,153	1.86	17,084	1.74	13,683	1.49	24,822	1.32	9,427	1.33	1,170	1.26	324	1.60
2501 - 3500	774	2.05	5,938	1.90	14,721	1.81	14,685	1.82	12,040	1.45	21,782	1.35	10,029	1.33	1,175	1.29	309	1.18
3501 - 5500	1,009	1.99	9,196	1.93	21,676	1.87	23,647	1.77	17,330	1.48	30,699	1.38	18,161	1.31	2,443	1.27	741	1.22
more than 5500	2,652	2.06	24,587	1.93	57,661	1.90	102,964	2.18	43,692	1.60	66,050	1.42	50,371	1.33	12,903	1.27	4,864	1.24

Table 3

Mean Weighted Average Holding Period for Dealer Purchases from a customer and then sold to (multiple) customer(s) -- CDCs

This table presents the weighted average number of days that a dealer holds in inventory an initial purchase of more than 100 bonds from a customer that is later sold to other customers (CDCs). Although the dealer bought the bonds in a single transaction with a single customer, the dealer may then turn around and sell the bonds over multiple trades to multiple customers, so that each purchase may or may not have multiple sales. Each purchase has a weighted average holding period, where the weights are the holding period for that specific sale weighted by the number of bonds sold divided by the total number of bonds sold to customers across all sales associated with that purchase. Each purchase is then catagorized by the size of the intial purchase, the credit rating of the bond at the time of purchase and a liquidity bucket for that bond based on the number of trades (Panel A) or volume (Panel B) in that bond over the previous 30 days. Then a simple average is taken of the weighted average holding periods per retail/institutional, credit rating, and liqudity category.

Liquidity	Investment Grade				High-Yield				
Group	AAA	AA	A	BBB	BB	B	CCC	CC	C
A. Trading Frequency (number of trades over the previous 30 days)									
3 to 10 days	6.57	8.94	8.58	8.89	4.87	3.62	2.99	2.10	2.46
2-3 days	7.59	8.48	9.11	9.48	5.68	4.42	3.74	2.29	2.71
about 1 day	7.82	8.05	8.84	9.00	6.02	4.94	4.18	2.79	3.24
1 -2 per day	7.00	8.45	8.50	8.13	5.97	4.84	3.84	2.98	2.62
2-3 per day	6.23	7.60	7.59	7.35	5.46	4.47	3.68	3.27	2.68
3-5 per day	7.09	7.49	7.07	6.58	4.73	3.89	3.35	3.17	2.94
30 per day	4.01	5.10	5.38	3.40	3.07	2.66	2.46	2.35	2.26
B. Cumulative Volume (previous 30 days)									
150 or less	5.64	7.96	7.96	8.11	4.10	3.02	2.48	2.12	2.31
150 - 500	7.12	7.50	8.50	8.57	5.19	3.97	3.26	2.49	3.20
501 - 1500	7.22	7.62	8.19	8.38	5.30	4.53	3.84	2.74	3.41
1501 - 2500	6.08	7.17	7.95	8.42	5.69	4.66	4.02	2.49	2.65
2501 - 3500	7.62	6.91	7.83	8.19	5.60	4.75	4.09	2.68	3.84
3501 - 5500	7.19	6.41	7.24	8.01	5.71	4.48	3.84	3.07	2.71
more than 5500	4.98	5.79	5.97	5.15	4.15	3.29	2.78	2.56	2.37

Table 3a - zero day Holding periods
Percentage of Dealer Purchases from a customer and then sold to (multiple) customer(s) completed on the SAME day -- CDCs

This table presents the percentage of observations where the dealer bought more than 100 bonds from a customer and then sold it off to multiple customers on the same day. Specifically, this table shows the percentage of observations where the weighted average number of days that a dealer holds in inventory an initial purchase of bonds from a customer that is later sold to other customers (CDCs) was zero. Although the dealer bought the bonds in a single transaction with a single customer, the dealer may then turn around and sell the bonds over multiple trades to multiple customers, so that each purchase may or may not have multiple sales. Each purchase has a weighted average holding period, where the weights are the holding period for that specific sale weighted by the number of bonds sold divided by the total number of bonds sold to customers across all sales associated with that purchase. Each purchase is then catagorized by the size of the intial purchase, the credit rating of the bond at the time of purchase and a liquidity bucket for that bond based on the number of trades in that bond over the previous 30 days.

Liquidity	Investment Grade				High-Yield				
Group	AAA	AA	A	BBB	BB	B	CCC	CC	C
A. Trading Frequency (number of trades over the previous 30 days)									
3 to 10 days	49%	37%	40%	42%	63%	69%	74%	84%	81%
2-3 days	40%	33%	34%	37%	56%	62%	67%	81%	76%
about 1 day	39%	32%	31%	36%	50%	56%	61%	75%	73%
1 -2 per day	35%	28%	30%	35%	47%	53%	59%	68%	76%
2-3 per day	34%	29%	30%	36%	46%	53%	60%	65%	70%
3-5 per day	27%	28%	31%	37%	48%	52%	59%	61%	63%
30 per day	36%	32%	33%	44%	52%	57%	62%	64%	63%
B. Cumulative Volume (previous 30 days)									
150 or less	51%	36%	37%	43%	67%	74%	80%	86%	82%
150 - 500	36%	31%	29%	37%	59%	66%	72%	81%	74%
501 - 1500	32%	29%	30%	36%	54%	60%	64%	78%	73%
1501 - 2500	38%	29%	30%	36%	51%	57%	62%	74%	75%
2501 - 3500	33%	29%	31%	36%	50%	55%	61%	73%	70%
3501 - 5500	36%	31%	32%	37%	48%	55%	61%	69%	72%
more than 5500	39%	34%	36%	42%	51%	57%	62%	64%	65%

Table 4
Difference between Expected and Actual Weighted Average Holding Periods -- CDCs

This table presents regressions on the difference between the weighted average holding period of a dealer's initial purchase of bonds from a customer that is later sold to other customers (CDCs) and the expected holding period. Holding period is defined and classified as in Table 3. The expected holding period is calculated based on the number of trades (volume) for that particular bond in the 30 days prior to the day of the intial purchase by the customer that starts the CDC chain. In Panel A, dummy variables for liquidity groups based on the number of trades in the previous 30 days are as follows: d1 (0-9), d2 (10-19), d3 (20-40); d4 (41-60), d5 (61-90), d6 (91-150). (Observations with 150+ trades are not dummied and are captured by the intercept.) In Panel B, dummy variables for cumulative volume is as shown (observations with cumulative volume in excess of 5500 bonds are not dummied and are captured by the intercept.) Lsize is the natural log of the dealer's initial purchase of bonds. Trend is a time variable by quarter. Dtc144a is a dummy variable that is 1 if the bond is subject to Rule 144a and 0 otherwise. Ttm is time to maturity in days. Age is time since maturity in days. Offering Amount is the face value of the original issue of the bonds. Dissem is a dummy variable that is 1 if the bond is disseminated through TRACE, and 0 otherwise.

	Investment Grade				High-Yield				
	AAA	AA	A	BBB	BB	B	CCC	CC	C
Panel A:	Trading Frequency (number of trades over the previous 30 days)								
Intercept	6.82 ***	5.77 ***	6.68 ***	7.64 ***	8.29 ***	7.56 ***	8.55 ***	7.65 ***	6.79 ***
3 to 10 days	-13.08 ***	-9.02 ***	-9.23 ***	-7.90 ***	-9.58 ***	-9.58 ***	-11.16 ***	-13.72 ***	-12.95 ***
2-3 days	-0.31	1.41 ***	1.28 ***	2.99 ***	-0.02	-0.41 ***	-0.64 ***	-1.81 ***	-1.62 ***
about 1 day	1.62 ***	2.05 ***	2.09 ***	3.69 ***	1.40 ***	1.15 ***	0.83 ***	-0.34 *	-0.15
1 -2 per day	1.51 ***	2.60 ***	2.26 ***	3.48 ***	1.81 ***	1.55 ***	1.05 ***	0.32	-0.30
2-3 per day	1.07 **	1.75 ***	1.73 ***	3.02 ***	1.60 ***	1.50 ***	1.07 ***	0.76 ***	-0.01
3-5 per day	1.75 ***	1.72 ***	1.35 ***	2.47 ***	1.21 ***	1.16 ***	0.86 ***	0.74 ***	0.37
lsize	-0.42 ***	-0.33 ***	-0.49 ***	-0.65 ***	-0.82 ***	-0.92 ***	-0.97 ***	-0.82 ***	-0.64 ***
trend	-0.24 ***	0.26 ***	0.11 ***	0.07 ***	0.15 ***	0.16 ***	0.06 ***	0.03	-0.03
dtc144a	4.28 ***	0.71 **	-1.65 ***	-2.45 ***	-1.35 ***	-0.63 ***	-0.97 ***	-0.54 **	0.27
ttm	-0.22 ***	0.19 ***	0.13 ***	0.02 ***	0.06 ***	0.09 ***	0.16 ***	0.11 ***	-0.06 **
age	-0.30 ***	-0.90 ***	-0.62 ***	-0.37 ***	-0.35 ***	-0.06 ***	-0.36 ***	-0.24 ***	-0.09
Offering Amt	-37.26 ***	-62.33 ***	-85.27 ***	-71.75 ***	-54.27 ***	5.99	13.39 **	28.70 **	-6.65
dissem	2.51 ***	1.61 ***	2.50 ***	1.08 ***	0.62 ***	0.41 ***	0.20 ***	0.00	0.52
Adj R^2	24.1%	11.5%	13.5%	15.4%	16.1%	18.2%	22.0%	27.5%	22.9%
N	9,007	59,091	160,524	196,289	105,470	174,183	98,052	19,314	6,743
Panel B:	Cumulative Volume (over the past 30 days)								
Intercept	630.72 ***	421.58	1045.83 ***	419.59 ***	242.33 ***	189.29 ***	551.49 ***	279.86 ***	97.64 ***
150 or less	-858.20 ***	-2115.87 ***	-2124.17 ***	-2012.55 ***	-1185.62 ***	-1127.18 ***	-1408.00 ***	-931.78 ***	-290.50 ***
150 - 500	-312.17 ***	-231.95	-267.79 **	-305.04 ***	-207.56 ***	-182.76 ***	-216.95	-237.75 ***	-168.15 ***
501 - 1500	-130.61 ***	-103.28	-106.31	-99.63 ***	-64.91 ***	-56.93 ***	-61.26	-80.89 ***	-58.32 ***
1501 - 2500	-77.86	-73.79	-60.62	-46.24 **	-32.35 ***	-27.99 *	-30.43	-41.33 **	-31.76 ***
2501 - 3500	-48.48	-54.06	-37.56	-28.81	-19.82 **	-16.75	-17.95	-28.80	-18.40 **
3501 - 5500	-43.05	-34.87	-27.03	-18.84	-13.48 *	-8.67	-8.64	-18.26	-11.73 **
lsize	-90.26 ***	-28.20	-133.07 ***	-61.93 ***	-34.47 ***	-28.86 ***	-68.91 ***	-37.41 ***	-13.42 ***
trend	4.57	45.41 *	-28.46	4.15	1.25	3.94	8.78	-8.48 **	2.57
dtc144a	92.08 *	-94.57	415.69 **	254.41 ***	75.06 ***	30.69	13.11	43.73 *	5.39
ttm	1.89	6.46	-21.35 **	0.86	-0.74	0.71	-18.07 *	-2.25	0.14
age	-12.75	-68.27	-21.79	-22.28 ***	-12.34 ***	2.99	-28.16	2.14	-6.20 ***
Offering Amt	-2611.33 **	-5314.18	-2837.50	-1812.23 ***	260.71	277.04	1426.07	-1891.75 *	5.65
dissem	-33.75	-288.18	-24.69	4.06	-6.91	-32.51 **	-59.49	34.56 ***	-3.27
Adj R^2	6.1%	0.1%	0.2%	4.9%	7.7%	0.7%	0.2%	7.1%	12.8%
N	9,007	59,091	160,524	196,289	105,470	174,183	98,052	19,314	6,743

Table 5
Mean Cumulative Sell Ratio for Dealer Purchases from a customer and then sold to (multiple) customer(s)

This table presents the average percentage of an initial purchase of more than 100 bonds by a dealer from a customer that is later sold to other customers. Although the dealer bought the bonds in a single transaction with a single customer, the dealer may then turn around and sell the bonds over multiple trades to multiple customers, so that each purchase may or may not have multiple sales. Each purchase has a cumulative sell ratio, which is the sum of all of the bonds subsequently sold to customers divided by the total size of the intitial purchase of bonds associated with those sales. Each purchase is then catagorized by the size of the intial purchase, the credit rating of the bond at the time of purchase and a liquidity bucket for that bond based on the trading frequency (Panel A) or cumulative volume (Panel B) for that bond over the previous 30 days prior to the initial purchase. Then a simple average is taken of the cumulative sell ratios per retail/institutional, credit rating, and liqudity category.

Liquidity	Investment Grade				High-Yield				
Group	AAA	AA	A	BBB	BB	B	CCC	CC	C
A. Trading Frequency (number of trades over the previous 30 days)									
3 to 10 days	88%	84%	83%	82%	86%	86%	88%	94%	91%
2-3 days	82%	79%	75%	74%	80%	82%	84%	91%	89%
about 1 day	77%	73%	72%	69%	75%	77%	81%	87%	88%
1 -2 per day	73%	66%	67%	65%	70%	75%	79%	84%	89%
2-3 per day	66%	63%	64%	63%	69%	74%	79%	82%	85%
3-5 per day	58%	58%	60%	60%	68%	72%	76%	79%	82%
30 per day	48%	52%	54%	54%	63%	68%	73%	76%	76%
B. Cumulative Volume (previous 30 days)									
150 or less	86%	81%	81%	84%	89%	89%	92%	94%	91%
150 - 500	72%	72%	72%	76%	79%	83%	85%	91%	88%
501 - 1500	69%	65%	68%	71%	76%	80%	82%	88%	86%
1501 - 2500	69%	60%	65%	68%	74%	77%	80%	86%	89%
2501 - 3500	69%	58%	63%	67%	73%	76%	79%	84%	86%
3501 - 5500	69%	57%	62%	65%	71%	76%	79%	83%	87%
more than 5500	59%	57%	59%	59%	68%	72%	77%	78%	80%

Table 6

Sell Ratio CENSORED Regressions -- CDCs

This table presents regressions on the cumulative sell ratio of an initial purchase of more than 100 bonds by a dealer from a customer that is later sold to other customers (CDCs). Cumulative sell ratio is defined and classified as in Table 5. In Panel A, dummy variables for liquidity groups based on the number of trades in the previous 30 days are as follows: d1 (0-9), d2 (10-19), d3 (20-40); d4 (41-60), d5 (61-90), d6 (91-150). (Bond with 150+ trades are not dummied and are captured by the intercept.) In Panel B, dummy variables for cumulative volume is as shown (observations with cumulative volume in excess of 5500 bonds are not dummied and are captured by the intercept.) Lsize is the natural log of the dealer's initial purchase of bonds. Trend is a time variable by quarter. Dtc144a is a dummy variable that is 1 if the bond is subject to Rule 144a and 0 otherwise. Ttm is time to maturity in days. Age is time since maturity in days. Offering Amount is the face value of the original issue of the bonds. Dissem is a dummy variable that is 1 if the bond is disseminated through TRACE, and 0 otherwise. As the sell ratio cannot be less than zero or larger than 1, censored regresssions were run with a lower bound of zero and an upper bound of 1.

	Investment Grade				High-Yield				
	AAA	AA	A	BBB	BB	B	CCC	CC	C
Panel A:	Trading Frequency (number of trades over the previous 30 days)								
Intercept	-0.19 ***	-0.15 ***	-0.16 ***	-0.21 ***	-0.28 ***	-0.25 ***	-0.38 ***	-0.30 ***	-0.10 *
3 to 10 days	0.41 ***	0.20 ***	0.24 ***	0.23 ***	0.27 ***	0.24 ***	0.20 ***	0.33 ***	0.25 ***
2-3 days	0.25 ***	0.12 ***	0.14 ***	0.12 ***	0.16 ***	0.15 ***	0.08 ***	0.27 ***	0.16 ***
about 1 day	0.17 ***	0.11 ***	0.10 ***	0.06 ***	0.08 ***	0.06 ***	0.03 ***	0.15 ***	0.19 ***
1 -2 per day	0.11 ***	0.07 ***	0.06 ***	0.02 ***	0.03 ***	0.02 ***	0.00	0.06 ***	0.23 ***
2-3 per day	0.09 ***	0.06 ***	0.04 ***	0.00	0.01	0.01 **	0.00	0.04 **	0.16 ***
3-5 per day	0.03	0.03 ***	0.02 ***	-0.01	0.00	0.00	-0.01	-0.01	0.07 ***
lsize	0.16 ***	0.16 ***	0.16 ***	0.16 ***	0.18 ***	0.19 ***	0.21 ***	0.20 ***	0.19 ***
trend	-0.03 ***	-0.04 ***	-0.03 ***	0.00 **	-0.01 ***	-0.01 ***	-0.02 ***	0.00	-0.03 ***
dtc144a	-0.19 ***	0.02	0.05 ***	-0.01	0.04 ***	-0.01 **	0.05 ***	0.02	-0.01
ttm	-0.01 ***	-0.02 ***	-0.02 ***	-0.01 ***	-0.01 ***	-0.01 ***	-0.01 ***	-0.01 ***	0.00
age	0.06 ***	0.09 ***	0.08 ***	0.05 ***	0.05 ***	0.03 ***	0.04 ***	0.06 ***	0.03 ***
Offering Amt	-2.09 ***	-2.74 ***	-4.00 ***	-2.97 ***	-5.45 ***	-10.64 ***	-14.95 ***	-15.70 ***	-23.89 ***
dissem	-0.04 **	-0.06 ***	-0.09 ***	-0.09 ***	-0.03 ***	0.00	0.02 ***	0.01	0.00
Sigma	0.464 ***	0.43 ***	0.45 ***	0.46 ***	0.49 ***	0.50 ***	0.49 ***	0.51 ***	0.54 ***
Panel B:	Cumulative Volume (over the past 30 days)								
Intercept	-0.16 ***	-0.13 ***	-0.16 ***	-0.22 ***	-0.33 ***	-0.26 ***	-0.39 ***	-0.39 ***	-0.07
150 or less	0.29 ***	0.10 ***	0.17 ***	0.30 ***	0.37 ***	0.32 ***	0.33 ***	0.38 ***	0.23 ***
150 - 500	0.07 ***	0.07 ***	0.08 ***	0.20 ***	0.24 ***	0.23 ***	0.21 ***	0.38 ***	0.20 ***
501 - 1500	0.03 *	0.03 ***	0.06 ***	0.12 ***	0.16 ***	0.14 ***	0.10 ***	0.30 ***	0.14 ***
1501 - 2500	0.05 **	0.02 ***	0.03 ***	0.08 ***	0.12 ***	0.08 ***	0.05 ***	0.21 ***	0.29 ***
2501 - 3500	0.01	0.01	0.03 ***	0.05 ***	0.08 ***	0.05 ***	0.03 ***	0.14 ***	0.12 ***
3501 - 5500	0.01	0.01	0.02 ***	0.03 ***	0.04 ***	0.02 ***	0.01	0.10 ***	0.12 ***
lsize	0.18 ***	0.17 ***	0.17 ***	0.16 ***	0.18 ***	0.19 ***	0.22 ***	0.21 ***	0.19 ***
trend	-0.03 ***	-0.04 ***	-0.02 ***	0.00	-0.01 ***	0.00 ***	-0.01 ***	0.00	-0.02 **
dtc144a	-0.01	0.11 ***	0.13 ***	0.05 ***	0.08 ***	0.00	0.05 ***	0.07 ***	-0.02
ttm	0.00 ***	-0.02 ***	-0.01 ***	-0.01 ***	-0.01 ***	-0.01 ***	-0.01 ***	0.00	9.93
age	0.06 ***	0.09 ***	0.08 ***	0.04 ***	0.04 ***	0.02 ***	0.03 ***	0.05 ***	0.02 *
Offering Amt	-3.83 ***	-4.22 ***	-5.79 ***	-3.42 ***	-5.72 ***	-11.94 ***	-16.02 ***	-15.87 ***	-28.11 ***
dissem	-0.04 **	-0.07 ***	-0.10 ***	-0.09 ***	-0.04 ***	-0.01 ***	0.01 **	0.01	-0.07 **
Sigma	0.468 ***	0.43 ***	0.46 ***	0.46 ***	0.49 ***	0.50 ***	0.49 ***	0.51 ***	0.54 ***

Table 7
Weighted Average Spread for Dealer Purchases from a customer and then sold to (multiple) customer(s)

This table presents the weighted average spread between the transaction price on an initial purchase of more than 100 bonds by a dealer from a customer and the price paid when the dealer later sells that same bond to other customers. Although the dealer bought the bonds in a single transaction with a single customer, the dealer may then turn around and sell the bonds over multiple trades to multiple customers, so that each purchase may or may not have multiple sales. Each purchase has a weighted average spread, where the weights are the spread (difference between the purchase price and the sale price) for that specific sale weighted by the number of bonds sold divided by the total number of bonds sold to customers across all sales associated with that purchase. Observations were winsorized at the 1% level so that weighted average spreads of less than -2.75 or more than 6 were removed. Each purchase is then catagorized by the credit rating of the bond at the time of purchase and a liquidity bucket for that bond based on the trading frequency (Panel A) or cumulative volume (Panel B) for that bond over the previous 30 days prior to the initial purchase. Then a simple average is taken of the cumulative sell ratios per credit rating and liqudity category.

Liquidity	Investment Grade				High-Yield				
Group	AAA	AA	A	BBB	BB	B	CCC	CC	C
A. Trading Frequency (number of trades over the previous 30 days)									
3 to 10 days	0.35	0.26	0.39	0.43	0.47	0.46	0.59	0.67	0.62
2-3 days	0.31	0.23	0.34	0.38	0.42	0.40	0.50	0.62	0.53
about 1 day	0.42	0.25	0.34	0.36	0.39	0.40	0.48	0.63	0.65
1 -2 per day	0.41	0.27	0.37	0.37	0.42	0.40	0.46	0.68	0.59
2-3 per day	0.41	0.30	0.35	0.38	0.44	0.43	0.48	0.63	0.65
3-5 per day	0.44	0.29	0.34	0.42	0.49	0.48	0.53	0.57	0.63
30 per day	0.58	0.33	0.41	0.76	0.65	0.61	0.57	0.63	0.48
B. Cumulative Volume (previous 30 days)									
150 or less	0.64	0.38	0.50	0.54	0.59	0.55	0.73	0.77	0.65
150 - 500	0.53	0.29	0.43	0.48	0.58	0.49	0.68	0.76	0.66
501 - 1500	0.37	0.34	0.36	0.46	0.50	0.44	0.57	0.69	0.59
1501 - 2500	0.36	0.33	0.34	0.44	0.47	0.46	0.55	0.73	0.74
2501 - 3500	0.40	0.30	0.35	0.45	0.46	0.46	0.56	0.66	0.61
3501 - 5500	0.44	0.28	0.34	0.45	0.47	0.46	0.54	0.63	0.63
nore than 5500	0.40	0.28	0.37	0.57	0.48	0.47	0.49	0.60	0.51

Table 8
Weighted Average Spread Regressions -- CDCs

This table presents regressions on the weighted average spread of an initial purchase of more than 100 bonds by a dealer from a customer that is later sold to other customers. The weighted average spread is defined and classified as in Table 7. In Panel A, dummy variables for liquidity groups based on the number of trades in the previous 30 days are as follows: d1 (0-9), d2 (10-19), d3 (20-40); d4 (41-60), d5 (61-90), d6 (91-150). (Bond with 150+ trades are not dummied and are captured by the intercept.) In Panel B, dummy variables for cumulative volume is as shown (observations with cumulative volume in excess of 5500 bonds are not dummied and are captured by the intercept.) Lsize is the natural log of the dealer's initial purchase of bonds. Trend is a time variable by quarter. Dtc144a is a dummy variable that is 1 if the bond is subject to Rule 144a and 0 otherwise. Ttm is time to maturity in days. Age is time since maturity in days. Offering Amount is the face value of the original issue of the bonds. Dissem is a dummy variable that is 1 if the bond is disseminated through TRACE, and 0 otherwise.

	Investment Grade				High-Yield				
	AAA	AA	A	BBB	BB	B	CCC	CC	C
Panel A:	Trading Frequency (number of trades over the previous 30 days)								
Intercept	1.42 ***	1.01 ***	1.33 ***	1.85 ***	1.81 ***	1.70 ***	2.10 ***	2.09 ***	1.75 ***
3 to 10 days	-0.24 ***	0.01	-0.09 ***	-0.22 ***	-0.26 ***	-0.22 ***	0.00	0.08 **	-0.01
2-3 days	-0.26 ***	-0.03 **	-0.13 ***	-0.30 ***	-0.31 ***	-0.25 ***	-0.07 ***	0.01	-0.10
about 1 day	-0.25 ***	-0.07 ***	-0.14 ***	-0.33 ***	-0.32 ***	-0.24 ***	-0.09 ***	0.00	0.01
1 -2 per day	-0.24 ***	-0.07 ***	-0.11 ***	-0.34 ***	-0.29 ***	-0.23 ***	-0.09 ***	0.06 *	-0.04
2-3 per day	-0.22 ***	-0.04 ***	-0.11 ***	-0.32 ***	-0.26 ***	-0.19 ***	-0.06 ***	0.00	0.05
3-5 per day	-0.18 ***	-0.03 ***	-0.09 ***	-0.28 ***	-0.21 ***	-0.13 ***	-0.02 **	-0.05 **	0.08 *
lsize	-0.10 ***	-0.09 ***	-0.11 ***	-0.16 ***	-0.14 ***	-0.13 ***	-0.18 ***	-0.18 ***	-0.13 ***
trend	-0.03 ***	0.02 ***	0.00	-0.05 ***	-0.03 ***	-0.04 ***	-0.04 ***	-0.05 ***	0.01
dtc144a	-0.28 ***	-0.36 ***	-0.36 ***	-0.12 ***	-0.12 ***	-0.07 ***	-0.12 ***	-0.03	-0.19 **
ttm	0.06 ***	0.07 ***	0.06 ***	0.05 ***	0.03 ***	0.03 ***	0.01 ***	0.01 *	-0.01 *
age	0.04 ***	-0.01 **	0.01 ***	0.03 ***	0.04 ***	0.06 ***	0.04 ***	0.01	0.00
Offering Amt	-3.04 ***	-0.35	-5.70 ***	-3.41 ***	-9.83 ***	-10.11 ***	-6.93 ***	-3.94 **	-8.71 *
dissem	-0.29 ***	-0.35 ***	-0.34 ***	-0.21 ***	-0.18 ***	-0.16 ***	-0.21 ***	-0.08 ***	-0.29 ***
Adj R^2	13.8%	11.8%	10.2%	12.9%	9.5%	8.0%	8.7%	5.3%	3.3%
N	8,940	58,770	158,543	192,332	103,463	170,650	95,276	18,601	6,370
Panel B:	Cumulative Volume (over the past 30 days)								
Intercept	1.23 ***	0.93 ***	1.26 ***	1.69 ***	1.68 ***	1.61 ***	2.07 ***	2.07 ***	1.75 ***
150 or less	0.15 ***	0.12 ***	0.10 ***	0.09 ***	0.01	-0.04 ***	0.13 ***	0.17 ***	0.01
150 - 500	0.07 *	0.05 ***	0.06 ***	-0.02 *	-0.09 ***	-0.12 ***	0.02	0.03	-0.03
501 - 1500	-0.04	0.08 ***	0.00	-0.05 ***	-0.12 ***	-0.13 ***	-0.04 ***	-0.02	-0.08
1501 - 2500	-0.06 *	0.05 ***	-0.02 **	-0.06 ***	-0.12 ***	-0.10 ***	-0.03 ***	0.06 *	0.04
2501 - 3500	0.03	0.03 **	-0.01	-0.06 ***	-0.10 ***	-0.08 ***	-0.01	0.01	-0.04
3501 - 5500	0.05	0.01	-0.02 ***	-0.07 ***	-0.07 ***	-0.05 ***	0.00	0.01	0.01
lsize	-0.11 ***	-0.09 ***	-0.11 ***	-0.16 ***	-0.15 ***	-0.14 ***	-0.18 ***	-0.18 ***	-0.13 ***
trend	-0.03 ***	0.02 ***	0.00 **	-0.07 ***	-0.04 ***	-0.05 ***	-0.05 ***	-0.06 ***	0.01
dtc144a	-0.33 ***	-0.33 ***	-0.38 ***	-0.13 ***	-0.17 ***	-0.09 ***	-0.12 ***	-0.02	-0.21 **
ttm	0.05 ***	0.07 ***	0.06 ***	0.05 ***	0.03 ***	0.02 ***	0.00 ***	0.01 **	-0.01 **
age	0.03 ***	-0.02 ***	-0.01 ***	0.03 ***	0.04 ***	0.07 ***	0.05 ***	0.01	0.00
Offering Amt	1.95 **	2.85 ***	-1.46 ***	3.42 ***	-3.44 ***	-5.23 ***	-4.88 ***	-3.88 **	-8.62 *
dissem	-0.30 ***	-0.34 ***	-0.33 ***	-0.17 ***	-0.15 ***	-0.14 ***	-0.20 ***	-0.07 ***	-0.29 ***
Adj R^2	13.8%	11.8%	10.1%	11.9%	8.6%	7.5%	8.7%	5.3%	3.2%
N	8,940	58,770	158,543	192,332	103,463	170,650	95,276	18,601	6,370

Figure 1:
Median Number of Trades per Month