**Mutual Funds and Bond Market Liquidity**

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March 15, 2016

We find that bonds held and traded by mutual funds are more liquid both over time and cross-sectionally. Instrumenting with predicted flow-induced trading by mutual funds provides evidence of a causal direction from mutual fund trading to liquidity. The relation is weaker for bonds owned by the most distressed funds. We test several hypotheses explaining this association, and results support the conclusion that mutual funds minimize their trading costs by catering to bond dealers’ inventory management needs, thus enhancing bond liquidity. Mutual fund bond selling more often accommodates dealers’ low inventory positions. These relations remain for bonds owned by the most distressed funds, suggesting that mutual funds would not exacerbate the deterioration of bond liquidity in a crisis.

Preliminary, do not quote.

We would like to thank seminar participants at the University of Notre Dame for their helpful suggestions.

1. **Introduction**

The growing proportion of corporate bonds owned by mutual funds raises concerns from regulators and practitioners that these funds could adversely affect bond market liquidity. There is a superficial resemblance between bond mutual funds and banks: like banks, mutual funds’ liabilities are short-term, but the corporate bonds that they hold as assets may be illiquid. This suggests that mutual funds may also be subject to runs, in which investors, worried that there is insufficient liquidity for the financial intermediaries’ assets, race to consume whatever liquidity exists.

The Office of Financial Research expresses these reservations in their report *Asset Management and Financial Stability*. They suggest that large scale investor redemptions of bond mutual funds could quickly exhaust liquidity in the corporate bond markets. Dealers could refuse to buy bonds except at steeply discounted prices or they could refuse to take new bonds into inventory. If bond market liquidity dried up as a result of a run on mutual funds, this would of course affect all corporate bond investors.

If individual investors held all corporate bonds, a run would still be conceivable if investors feared that others would liquidate their bond holdings and leave bonds at depressed prices. There are, however, two reasons why bond mutual funds may increase the likelihood of runs. First, investors who redeem mutual fund shares at net asset values (NAVs) may not bear the costs of selling bonds. Bond trades made to cover redemptions may take place several days later and NAVs will not reflect trading costs until after the trade is completed. Investors who did not sell may bear the costs of trading. Second, evaluation of fund managers on the basis of performance could lead managers to race to sell underperforming assets before their peers. Feroli, Kashyap, Schoenholtz, and Shin (2014), (henceforth FKSS) model mutual funds that do not face redemptions but are run by fund managers who are evaluated relative to their peers. Mutual funds, even without the possibility of investor redemption, can contribute to financial instability by trying to sell underperforming assets before other managers.

Goldstein, Jiang, and Ng (2015) provide evidence that bond fund investors fear runs. They find a concave relation between bond fund abnormal returns (alphas) and fund flows: a positive alpha has little impact but a negative alpha can mean large outflows from bond funds. Furthermore, concavity is greater if the fund holds less cash or has more atomistic investors, suggesting that the investors who are withdrawing their cash are concerned about runs. While Goldstein, Jiang, and Ng (2015) look at how fund abnormal returns, or alpha, affect individual fund flows, a greater concern is whether a widespread drop in prices of corporate bonds will bring about withdrawals from the corporate bond fund sector and thereby create a liquidity crisis in the bond market.

Others believe it is unlikely that runs on mutual funds could exhaust bond market liquidity. The International Monetary Fund (2015) (IMF) observes that early redemption options can create run risks, but asset managers can cover redemptions by using cash buffers first and selling their most liquid assets next. Relatively large outflows may be required before bond funds need to sell illiquid bonds. In addition, they observe that if funds sell bonds on the same day that redemptions are received, mutual fund investors may fully bear the costs of lowered NAVs from their redemptions and first mover advantages will disappear. The idea that mutual fund withdrawals are a potential source of market instability is also disputed by Richard Prager, head of global trading and liquidity strategies at BlackRock (Nathan (2015a)). He states that “… there is no evidence that ‘mass redemptions’ of non-money market mutual funds have ever occurred historically.”

Some authors claim that mutual fund holding may actually make bonds more rather than less liquid. Mahanti, Nashikkar, Subrahmanyam, Chacko, and Mallik (2007) (henceforth MNSCM) define a bond’s latent liquidity as the weighted average turnover of investors who hold the bond. Using data from State Street Corporation, a large custody bank, they estimate latent liquidity for U.S. corporate bonds from 1994 through June, 2006. They demonstrate that greater latent liquidity is associated with lower trading costs and a smaller Amihud illiquidity measure. The idea behind latent liquidity is that bond dealers rely on being able to access clients’ holdings to buy or sell bonds. If these clients trade frequently, it is easier for dealers to find bonds or to unload inventory. Mutual funds are likely to trade bonds more frequently than pension funds or insurance companies, and therefore bonds held by mutual funds are likely to be more liquid.

The impact of mutual funds on corporate bond markets is an especially important issue today, as many believe bond market liquidity is drying up. The 2015 Financial Stability Report from the Office of Financial Research suggests that bond market dealers are now far less willing to provide liquidity than in the past. They note that 2014 dealer bond holdings, measured either as a percentage of total bonds outstanding or as a percentage of trading volume, are less than half of what they were over 2005-2007. Ramsden (2015) claims that the top U.S. banks reduced the amount of capital committed to trading fixed income by over 20%, or more than $300 billion, from 2010 to 2014. Udland (2015) reports that total dealer inventories of investment grade bonds fell sharply in 2015 to negative levels. They had been between $10 and $15 billion in 2014. The Financial Stability Report goes on to say that, “…it is now more difficult to execute large trades that require a dealer to take principal risk.”

Other observers point to a decline in bond market turnover as a symptom of declining liquidity. Total bond market volume is little changed since the crisis, but there are far more bonds outstanding, and hence turnover is lower. Strongin (2015) asserts that turnover has declined by over 20% for high yield credit and by more than 40% for investment grade credit from 2006 through 2014. Blackrock (2016), however, suggests that this decline in turnover could be a result of the increasing share of bonds held in ETFs. Between 2008 and 2015, assets under management by U.S. fixed income ETFs grew from $58 billion to $343 billion, while assets in all bond funds rose from $1,268 billion to $3,145 billion. When investors trade bond ETFs, they are, in effect, trading baskets of bonds, but these trades are not counted as bond trading volume. Trading volume in ETFs is five times the volume involved in their creation and redemption activity, so trades of the bond ETFs do not have much effect on bond volume. When these ETF trades are considered, it is not clear that turnover has declined.

The 2015 Financial Stability Report proposes several possible reasons for declining bond market liquidity. One is regulatory reform. Higher capital requirements have increased the capital costs of trading by making it more expensive to hold inventory. Strongin (2015) notes that higher capital requirements make it “more difficult for banks to warehouse risk in a cost-effective manner.” He goes on to say that “Dealers are in the moving business, not the storage business.” Udland (2015) points to another reason for declining liquidity: it’s becoming harder for dealers to hedge inventory. Single name credit default swaps are much less liquid, and hedges also carry higher capital charges.

Declining bond market liquidity is one reason for the current concern about how mutual fund bond holdings affect liquidity. Another is that mutual funds own a much larger proportion of corporate bonds now than in the past. Wigglesworth (2015) observes that since 2009, the amount of outstanding U.S. nonfinancial bonds has increased by over $5 trillion. Mutual funds’ ownership share of corporate bonds has increased from 10% to 20%. Strongin (2015) claims that by 2015, open-end mutual funds owned 24% of corporate bonds. The Office of Financial Research’s report Asset Management and Financial Stability notes that over $1.5 trillion flowed into fixed income funds over July, 2008 through June, 2013.

In this paper, we study whether mutual fund holdings of bonds affects their liquidity. We use several measure of liquidity that have been used in other studies of the bond market, including bid-ask spreads, the Amihud illiquidity measure, and the standard deviation and coefficient of variation of daily bond prices. We also introduce new measures of bond market liquidity like the proportion of trades that are prearranged and the proportion of trades that are agency rather than principal trades.

We find that the larger the proportion of a bond that is held by mutual funds at the beginning of a month, the more liquid the bond is during the month. This holds for almost all measures of liquidity. Our regressions include fixed effects for each bond, so our findings indicate that an individual bond’s liquidity is higher during months when funds own a large proportion of the bond issue. We argue that with our control variables, it is unlikely that funds are trading bonds in anticipation of changes in liquidity. It is possible that mutual fund holdings of a bond may make it more liquid, as in MNSCM. It is also possible, though, that mutual fund holding is associated with increased measured liquidity because mutual funds trade bonds more skillfully than other market participants. In this case, measured liquidity will increase with fund holdings, but market participants other than mutual funds will not benefit from it.

We also find that predictable cash flows into funds are associated with increased liquidity for bonds held by the funds. Fund redemptions and cash flows out of funds are associated with decreased liquidity for bonds held by the funds. Funds are likely to use cash inflows to increase the size of their existing positions, but this still gives them numerous bonds from which to choose. They can also take their time to purchase the additional bonds. Under these circumstances, funds may execute their trades by providing, rather than taking liquidity. On the other hand, firms faced with outflows can sell only the bonds they hold, and may have to sell them quickly. Under these circumstances, funds are likely to consume liquidity, and thereby make the market less liquid.

A particular concern is the impact of fund holdings on market liquidity when the bond market is under stress. To examine this, we look at the impact of mutual fund bond holdings on liquidity for two months when bond yields rose sharply: October, 2008, and June 2013. October, 2008 was during the height of the financial crisis while June, 2013 was in the middle of the “taper tantrum.” We find that mutual fund holdings of bonds just before these months are associated with more liquidity. This suggests that mutual funds do not threaten market liquidity during periods of market stress.

Two very recent papers examine the relation between bond mutual fund flows and bond prices. Choi and Shin (2016) study the impact of flows into and out of mutual funds on prices of bonds held by the funds. They find almost no evidence that fund flows affect the returns of the bonds held by mutual funds, and suggest two reasons for their findings. One is that corporate bond mutual funds hold large amounts of cash and cash-like securities; 14.17% of total net assets on average. The second is that funds tend to trade their most liquid securities in response to cash flows. Choi and Shin find that bond funds liquidate only 60 to 78 basis points of corporate bond holdings in response to a 1% outflow. Similarly, they expand current holdings by 48 to 53 basis points in response to a 1% inflow. They may instead park new capital in liquid assets and slowly add to their corporate bond holdings.

Hoseinzade (2015) examines the impact of bond fund redemptions and resulting sales of bonds on bond yields. He shows that bond funds’ quarterly flows are positively related to fund flows the previous three quarters, a finding that indicates to him that investors react to the trading of others and that bond funds are therefore subject to runs. Despite this, Hoseinzade finds no evidence that bond funds destabilize the corporate bond market by moving prices and yields away from fundamental values. He suggests that this is because bond funds hold large amounts of cash and liquid securities and sell their most liquid assets to meet redemptions.

Our paper is different from these in that we look at how holdings by bond mutual funds, and cash flows into and out of bond funds affect the liquidity of the bond market, and examine the mechanisms behind these effects. We believe our measures of liquidity are better able to measure the short-term impact of fund holdings and fund flows than quarterly bond price changes. In a recent paper Sultan (2015) examines the impact of ETF and mutual fund holdings of bonds on bond liquidity. For the most part, he uses different measures of liquidity than we do, but also finds that bond fund holdings are associated with greater liquidity.

The causality between mutual measures of funds holding and trading and measures of bond liquidity could run in either direction. We predict fund flows for individual bond funds using flows and returns from the four prior months. We use the predicted flows as an instrument for bond trades. We find that predicted flows using only prior month data are also associated with bond liquidity measures in the current month, suggesting a direction of causality from mutual fund activity to bond liquidity. We find that these results are partially reversed in periods of market distress and for bonds whose weighted average ownership experiences the lowest decile of investor flows in a given month.

We then seek to understand the mechanism behind the increase in bond liquidity associated with ownership and trading by mutual funds. One possibility is that bond dealers anticipate and prepare for mutual funds’ trading needs, which are predictable from their flows. However, we find no evidence that dealer net transactions in one quarter anticipate the predictable part of mutual funds’ net transactions in the following quarter. We then consider possibility that bond funds act as dealers and provide additional liquidity using their inventory, but find that mutual fund bond trades are not positively related to dealer trades.

Third, we consider the possibility that bond funds accommodate dealers’ inventory needs. This means that when bond funds need to buy, they buy bonds that are plentiful in bond dealers’ inventories. When bond funds need to sell, they tend to sell bonds that dealers need to complete trades with other parties. We find significant and economically strong evidence for this hypothesis. Mutual funds tend to buy bonds that dealers have in positive or zero net supply at the start of the quarter. When dealers’ inventories of a bond are negative, mutual funds subsequently sell more than enough to replenish these inventories, suggesting that they also accommodate pent-up demand fro the bond from third parties. These effects do not significantly diminish for bonds owned by the most distressed funds. This suggests that, even in distressed times, bond funds can provide liquidity to the market.

1. **Data**

We obtain, from FINRA, all corporate bond trades by FINRA member dealers from 2006 through 2014. This data includes virtually all U.S. bond trades. The data set we use contains the same information as the TRACE data and also has masked dealer identities for each trade, allowing us to reconstruct inventories for each dealer. The record for each trade includes the date and time of each transaction, the price and par value of the bonds exchanged, codes for whether the dealer is buying or selling the bond, codes for reversals, corrected trades, and cancelled trades. We eliminate cancelled trades and reversed trades and eliminate the original trade when a trade is corrected. There are interdealer trades, particularly in the early part of the sample period, that are reported by both dealers. In cases where there are identical interdealer trade records, we eliminate one of the trades. Over 2006-2014, there are a total of 1,775,110 bond-month observations, or an average of 16,285 per month. To be included as one of these observations, a bond must trade at least once during a month.

We obtain mutual fund bond holdings from CRSP for 2001 – 2014 for every fund that held at least one corporate bond in Mergent at any time during that period. Funds report their holdings to CRSP on a roughly quarterly basis, but some funds update their holdings monthly and some funds have gaps in reporting. We create a data set of monthly holdings as follows. For each month and for each fund, we look back to the most recent disclosure date that is at most six months old, and use those holdings for that fund-month. The CRSP fund holding database uses portfolio number identifiers, but these can sometimes change for a given fund – for example, many portfolio numbers changed in the third quarter of 2010. To avoid gaps in our data we use CRSP class group identifiers and map them to the corresponding CRSP portfolio number on each date. Results are similar if we use portfolio numbers only and assume that the fund is a new fund if its portfolio number changes. There is a large increase in the number of bond funds in the CRSP holdings data in the fourth quarter of 2007, so we begin our analysis then.

Fund holdings are matched with bond liquidity measures by 8-digit CUSIP. After merging the bond trade information with the mutual fund holding data, we can place bonds into three categories: those that appear in fund holdings but do not trade, those that appear in fund holdings and do trade, and bonds that are traded but do not appear in the holdings of any funds. Characteristics of each of these groups are given in Table 1. Bonds that are held by mutual funds but not traded are relatively uncommon. There are only 1,411 bonds that appear in a total of 32,262 bond-months. In contract, there are 24,188 bonds that are held by funds and traded in a total of 1,049,892 bond-months. There are 30,920 bonds that are traded but not held by mutual funds for a total of 837,897 bond months.

Bonds that appear in our trades but are not held by mutual funds are much less likely to be 144A bonds. The average offering amount of bonds that are not held by mutual funds is only $36 million. In contrast, the average offering amount is $482 million for bonds that are held but not traded, and almost $520 million for bonds that are held by funds and are traded. The traded bonds that are not held by mutual funds are much more likely to be rated AA (Aa) or AAA (Aaa) than bonds that mutual funds hold. Over 33% of the bonds that are held by mutual funds and not traded are 144A bonds. In contrast, only 21.4% of the bonds that are held by funds and traded are 144A bonds.

Table 2 provides summary statistics for bond holdings by funds by year. The number of fund months is only 420 for 2007 because our sample begins in the last quarter. Prior to this, the sample of bond funds was smaller, suggesting that data quality improved in 9/2007. From 2008 on, fund months increase steadily, reflecting both an increase in outstanding corporate bonds and an increase in the proportion of bonds held by mutual funds. The average number of different bonds held by a fund has also increased steadily, from 98 in 2008 to 196 in 2014. Table 2 also shows that the proportion of funds’ portfolios invested in bonds rated AA or higher has declined significantly since 2011. The proportion invested in 144A bonds has increased from 15.9% in 2008 to 25.4% in 2014.

A description of these and other variables used in this paper can be found in table A1 in the appendix.

1. **Measures of Corporate Bond Liquidity**

Our concern in this paper is how mutual fund participation in the bond market affects bond market liquidity. A number of recent studies attempt to measure bond liquidity using a variety of approaches. Perhaps the most common measure of bond liquidity is round-trip trading costs. One approach to measuring trading costs is to use differences between prices for customer purchases from dealers and customer sales to dealers. This is easily done using signed trades from the publicly available TRACE data. There are potential problems with this approach, however. Many bonds go days or weeks without trading. If a researcher uses only bonds with both purchases and sales over a period of time, he will only be able to estimate trading costs for the bonds that trade frequently, or, in other words, the most liquid bonds. Another difficulty with this approach is that trading costs may differ significantly by trade size. Several studies, including Schultz (2001), Bessembinder, Maxwell, and Venkataraman (2006), and Edwards, Harris, and Piwowar (2007) find that corporate bond trading costs decrease with trade size. If the researcher uses the difference between buy and sell prices for different size trades, the estimate of trading costs is likely to be more accurate for trades of an intermediate size.

A second approach to estimating trading costs is to regress changes in successive trade prices on a signed dummy variable for changes from buy to sell (and sell to buy) trades. This dummy can be interacted with trade size and other variables thought to affect trading costs. Fixed income index returns can also be included to adjust for changes in bond values when the trades take place days or weeks apart.

Estimating bid-ask spreads without signed trades presents additional challenges. Dick-Nielsen, Feldhütter, and Lando (2012), and Feldhütter (2012) measure bid-ask spreads using Imputed Round-trip Trades. If two or three trades of the same size occur in a specific bond on a given day, and no other trades of that size occur in that bond that day, the estimate of the bid-ask spread is the difference between the maximum and minimum trade price of the bond divided by the maximum price. This measure is based on the sensible assumption that the trades are part of a round-trip transaction, with, perhaps, an interdealer trade. Of course, this measure presents problems if the two sides of the trade occur days apart or if the bond trades very actively and there are multiple trades of the same size on the same day.

Ederington, Guan, and Yadav (2014) take a more sophisticated approach and decompose bond market dealer spreads into components from dealers’ role as market makers and their role as agents for customers. Market making spreads are strongly related to volatility and other factors that contribute to costs of holding inventory. Both the agent and market maker spreads are inversely correlated with trading volume. For agent-related costs, lower volume implies lower liquidity and greater search costs to find the counterparty to a trade.

Trades in our data are signed – we know whether a trade is a dealer purchase from a customer, a dealer sale to a customer, or an interdealer trade. This allows us to estimate bid-ask spreads more directly than many other studies. In this paper, we estimate the average bid-ask spread for each bond each month using consecutive trades that occurred on the same day. If one trade is a dealer purchase from a customer and the next trade is a dealer sale to a customer, the price of the later trade minus the price of the earlier trade divided by the earlier trade price is one spread observation. Similarly, if one trade is a dealer sale to a customer and the next trade is a dealer purchase from a customer, the price of the earlier trade minus the price of the later trade divided by the earlier trade price is one spread observation. If one of the two consecutive trades is an interdealer trade, we assume the trade takes place at the midpoint of the bid-ask and multiply the difference in prices by two to produce a spread observation. If two consecutive trades are interdealer trades, we do not incorporate the differences in those two prices in the spread estimate.

This method of calculating spreads has the virtue of being simple and intuitive. It has limitations, however. The least liquid bonds may go days between trades and therefore it may not be possible to estimate spreads for these bonds. In addition, we do not differentiate between trade sizes in calculating spreads.

Figure 1 shows the median bid-ask spread across bonds each month. We would expect that a useful liquidity measure would reveal poor liquidity during the financial crisis and toward the end of our sample period. The loss of liquidity during the financial crisis is clearly visible. Median spreads rise from about 0.6% in 2006-2007 to about 1.3% during the financial crisis. We do not, however, see a decrease in liquidity in recent years. Spreads declined following the financial crisis and, since the beginning of 2012, have been lower than they were in 2006. In 2014, monthly median spreads were between 0.3% and 0.4%. One reason for this decline in spreads is increased transparency in the corporate bond market from mandatory TRACE reporting. Some observers have pointed to this decline in spreads as evidence that liquidity has not been a problem in the corporate bond market since the crisis.

Greater price dispersion around Markit end-of-day prices is used as a measure of illiquidity in Jankowitsch, Nashikkar, and Subrahmanyam (2011). Friewald, Jankowitsch, and Subrahmanyam (2012) use dispersion of trade prices as a liquidity estimator. We also estimate price dispersion, but measure dispersion around the mean trade price during the day, not an end-of-day quote. For each bond each month, we calculate the standard deviation of trade prices using all trades between a dealer and customer. The coefficient of variation of prices is then calculated for each bond each month by dividing the standard deviation of prices by the average price.

The monthly average coefficient of variation across all bonds each calendar month is shown in Figure 2. The loss of liquidity during the financial crisis again stands out. The coefficient of variation of prices is several times higher in late 2008 and early 2009 than it had been before. Following the crisis, the mean coefficient of variation declines and is similar to pre-crisis levels. The mean coefficient of variation gives no indication that liquidity has declined recently.

The Amihud illiquidity measure is used by Dick-Nielsen, Feldhütter, and Lando (2012), and by Friewald, Jankowitsch, and Subrahmanyam (2012). The Amihud measure is motivated by the λ measure of price impact in Kyle (1985). It can be estimated daily from individual transactions as

where Nt is the number of trades on day t, rj is the return from trade j, and Dj is the dollar value of the bonds traded. Dick-Nielsen et al estimate the Amihud measure daily, and then use the median of the daily measures for a quarterly measure. The Amihud illiquidity measure is a very intuitive liquidity measure. If investors can trade large quantities of bonds with little impact on price, the Amihud measure will be small. If small trades move prices, the Amihud measure will be large.

There are complications in using the version of the Amihud measure that is based on individual trades. Numerous studies show that trading costs are larger for small bond trades than for larger ones. There is a large fixed cost component to bond trading. Hence differences across bonds and across time in the Amihud measure are driven by the presence of small trades. As an alternative, rather than using the average of the returns and dollar volumes of each trade, we use the absolute value of the return from the first to the last trade of the month, divided by the total dollar volume of trades during the month.

The median Amihud measure across all bonds during a month for each month over 2006-2014 is shown in Figure 3. It closely tracks the mean coefficient of variation shown in Figure 2. It is high during the crisis, several times as large as median values before and after. Like the coefficient of variation, it reveals a small decline in liquidity during the second half of 2011. By 2014, the Amihud measure is much lower than it was before the crisis. By this measure, bond market liquidity has increased rather than decreased.

All of these measures of liquidity, the coefficient of variation of prices, the bid-ask spread, and the Amihud measure, clearly show a decline in liquidity during the financial crisis. None of them, however, shows a decline in liquidity in 2013-2014. Bid-ask spreads and the Amihud illiquidity measure instead suggest that bond market liquidity is better than before the crisis. This may seem curious because both regulators and practitioners have been warning that bond market liquidity is drying up. As Strongin (2015) observes, “documenting the decline in market liquidity is surprisingly difficult…” He claims that although volatility has declined and bid-ask spreads have narrowed, it now takes a lot longer to get trades executed.

A limitation of all of the liquidity measures that we have used thus far is that they are estimated using trades.[[1]](#footnote-1) They may not capture changes in liquidity if trades are not taking place because dealers are reluctant to hold inventory. Illiquidity might be better measured by the difficulty of arranging trades than by the costs of trades that are made.

With this in mind, we calculate three new measures of liquidity that use trades, but reflect the difficulty of getting trades executed. The first is the proportion of daily signed volumes that are a continuation of the previous days’ signed volume. Each day within a month for each bond, we add the volume from all customer buy orders and subtract the volume from all customer sell orders to produce a net buy volume. If a day with a positive (negative) buy volume is followed by a day with a positive (negative) buy volume, we classify it as a continuation. If a day with a positive (negative) buy volume is followed by a day with a negative (positive) buy volume, we classify it as a reversal. If a day has a zero net volume, typically because the bond didn’t trade that day, we look to the day before to see if the latter day is a continuation or a reversal. We then calculate the percentage of two-day sequences that are continuations rather than reversals for each bond-month.

The idea behind the continuations measure is that if a large trade is difficult to execute, it may be broken up into several trades that are executed over several days. Similarly, if investors attempt to execute a number of buy (or sell) orders on the same day, it may be difficult to complete them all. Some of the trades may only be executed on the following day. Either way, poor liquidity should be reflected in a continuation of positive or negative net volume.

Figure 4 shows the average, across bonds, of the proportion of consecutive day volumes that are continuations. Recall that continuations are when net customer buy volume is followed by positive net customer buy volume and net customer sell volume is followed by net customer sell volume. Figure 4 reveals a sharp increase in continuations during the financial crisis. Investors who wanted to buy or sell bonds during the crisis may have had to execute their trades across several days. As the crisis came to an end in 2009, the percentage of continuations declined to pre-crisis levels. It then increased from late 2009 through 2011 to levels seen in the crisis. This is the one liquidity measure that shows both a decline in liquidity during the crisis and a decline in the post-crisis period.

A second measure that reflects the difficulty of getting trades executed is the percentage of trades that are prearranged. If dealers are reluctant to hold inventory, they may find a buyer (seller) for bonds before executing a customer sell (buy) order. These are also referred to as riskless principal trades. We identify them in our data as customer sell (buy) trades that are reversed with a customer buy (sell) trade within 60 seconds. A high percentage of prearranged trades indicates a lack of liquidity for a particular bond in a particular month.

Figure 5 shows the average, across bonds, of the proportion of trades that were prearranged. This is a liquidity measure that should reveal dealer reluctance to hold inventory. From 2006 through 2009, the proportion of trades that are prearranged remains steady at 2.5% to 3%. It is interesting that the financial crisis seems to have had little impact on the proportion of trades that were prearranged. After 2010, however, the proportion of trades that are prearranged increases steadily, and reaches about 4.5% at the beginning of 2014. There is then an abrupt increase in the proportion of prearranged trades to about 6%.

These results appear to validate concerns that bond market liquidity is disappearing. We can infer from the increasing proportion of prearranged trades that it now takes longer for bond holders to liquidate a position. Unfortunately, we cannot observe how long bondholders wait between contacting a dealer to sell bonds, and selling them. Nor can we observe how often bond holders maintain positions rather than trying to sell them.

The last measure of liquidity is the percentage of trades for a bond-month that are executed as agency trades. Dealers can execute trades as principals, who take bonds into inventory or sell them from inventory, or as agents who work to locate the other side of the trade but do not commit capital. Each trade in our sample is designated as an agency or principal trade. These are not the same as prearranged trades. In fact, very few of the prearranged trades are designated as agency trades. A higher proportion of agency trades for a bond-month indicates that dealers are less willing to commit capital to trade the bond and it is therefore less liquid.

Figure 6 shows the proportion of trades between dealers and customers that are denoted as agency trades. This proportion is first calculated for each bond each month, and then averaged across all bonds each month. Figure 6 shows that the proportion of trades in which the dealer acted as an agent rather than as a dealer has increased from about 8% in 2006 to 14% at the end of 2014. This can be interpreted as decline in bond market liquidity over time, but there has been little change in the proportion of agency trades since 2011.

Table 3 provides summary statistics on trades and liquidity measures. Over 2006-2014, there are a total of 1,775,110 bond-month observations, or an average of 16,285 per month. To be included as one of these observations, a bond must trade at least once during a month. The mean number of trades, conditional on trading at all during a month is 52.7, while the median is 13. These data contain both trades between dealers and customers and interdealer trades. On average, 36.67% of the trades during a bond-month are interdealer trades.

If a trade is followed by an offsetting trade of the same size within 60 seconds, the first trade is defined as a prearranged trade. On average, 3.49% of trades are prearranged, but for most bond months there are no prearranged trades. Agency trades are designated as such, and are trades in which the dealer only acts as an agent for the buyer or seller of the bond and does not risk capital. On average, 6.43% of trades are designated as agency trades, but most bond months have none.

The last six rows of Table 3 describe the distribution across bond-month of six liquidity measures: the percentage of trades that are prearranged, the percentage that are agency trades, the bid-ask spread, the Amihud illiquidity measure, the standard deviation of prices, and the coefficient of variation of prices. It is interesting that the mean of each of these measures exceeds its median. Measures of illiquidity are right-skewed.

1. **Fund Flows**

In the mutual fund run scenario feared by regulators, poor returns on bonds lead investors to redeem fund shares, which then forces mutual funds to sell additional bonds, which in turn reduces bond prices even more. This will be important in practice only if mutual fund investors redeem shares in sufficient quantity in response to poor bond returns. To date, researchers have not studied the impact of returns on fund flows for funds that hold bonds.

The impact of fund flows on holdings has been studied for equity mutual funds. Coval and Stafford (2007) find that over their 1980-2004 sample period, equity funds in the 5th through 10th quarterly fund flow deciles experience net outflows. They find that in response to outflows, funds reduce holdings across a large number of stocks. Equity mutual funds in the 8th, 9th, and 10th flow deciles, reduce 31%, 33% and 37% of their stock positions respectively. They eliminate entirely an additional 14%, 17% and 17% of their positions. Coval and Stafford show further that widespread selling from funds facing outflows leads to temporarily depressed prices for the stocks.

Researchers have not yet examined the impact of fund flows on bond prices. There is, however, evidence that regulation-induced selling by insurance companies can have a significant but temporary impact on corporate bond prices. Ellul, Jotikasthira, and Lundblad (2011) examine insurance company sales of bonds that are downgraded from investment grade (BBB or higher) to high-yield (BB or lower). They find that the downgraded bonds have significant negative abnormal returns before and during the week they are downgraded. It takes several months for the bond prices to fully recover.

We examine the relation between fund flows and returns using total net assets (TNA) and return aggregated over share classes by CRSP’s identifier. We retain only portfolios that at one point in the sample hold a corporate bond that is in Mergent. Flows for fund *i* during month *t* are computed as:

*Flowi,t = [TNAi,t – TNAi,t-1(1+Ri,t) ]/[TNAi,t-1(1+Ri,t)]* (1)

Where *Ri,t* is the net-of-fee return on the fund during month *t* and *TNAi,t* is the total net assets of fund *i* at the end of month *t*, from CRSP.

Flows are predicted out-of-sample using four lags of flows and fund returns, and the predicted monthly percentage flow is the fitted value of this regression using the coefficients computed for that month and four lags of the fund’s prior flows and returns. More precisely, each month *m* we run the following regression on all flow and return data in our sample prior to month *m,* i.e for all *t<m*:

*Flowi,t = A0,m + A1,mFlowi,t-1 + A2,mFlowt-2 + A3,mFlowt-3 + A4,mFlowt-4 + A5,mRett-1 + A6,mRett-2 + A7,mRett-3 + A8,mRett-4 + εm,t* (2)

We use the coefficients from this regression to compute the predicted flow for month *m*:

*Predicted Flowi,m = A0,m + A1,mFlowi,m-1 + A2,mFlowi,m-2 + A3,mFlowi,m-3 + A4,mFlowi,m-4 + A5,mReti,m-1 + A6,mReti,m-2 + A7,mRetm-3 + A8,mReti,m-4*(3)

Thus, *Predicted Flowm* uses only data from the four prior months.

1. **Fund holdings and bond market liquidity**

Our concern is whether mutual fund participation in the corporate bond market makes the market more or less liquid. We approach this by examining cross-sectional differences in fund holdings of individual bonds, and seeing if these differences are associated with differences in liquidity. Panel A of Table 4 reports results from panel regressions of monthly individual bond liquidity measures on the percentage of the bonds held by mutual funds at the beginning of the month. A concern, of course, is that funds may choose to hold bonds that are more liquid (or less liquid for that matter) than average. So, we include fixed effects for the CUSIP or bond in each regression. This should control for the inherent liquidity of the bond. Ratings may change over time so we also include a ratings fixed effect. The effect of a bond’s age is nonlinear so we also include age fixed effects. Time fixed effects are included to make sure our results are not driven by mutual funds increasing holdings for months when the bond market is especially liquid. Time to maturity and amount outstanding also change over time for a given bond, so we include these as control variables. After inclusion of these variables, the coefficients on the percentage of the bond held by funds should reflect the association between fund holdings and bond liquidity after adjusting for the bonds’ average liquidity and changes in liquidity from changes in ratings, amount outstanding, age, and time to maturity.

The first column reports results when the bid-ask spread is the dependent variable liquidity measure. The coefficient is negative, suggesting that spreads decline with fund holdings, but the *p*-value in parentheses beneath it shows it is significant only at the 5% level. The second column reports the results when the Amihud illiquidity measure is the dependent variable. The coefficient is negative and significant at the 1% level. Greater fund holdings are associated with more liquidity as measured by the Amihud measure.

The next two columns present results when the measure of liquidity is the standard deviation of trade prices and when it is the coefficient of variation of trade prices. The coefficient of variation is obtained by dividing the standard deviation by the mean price, so these two measures are closely related. The coefficients on percentage of bonds owned by funds are negative in both cases, indicating that by these measures, greater holdings by mutual funds are associated with greater liquidity. The coefficient on the percentage of bonds owned by funds is statistically significant at the 1% level for both liquidity measures.

The percentage of trades that are prearranged is a liquidity measure that seems to be particularly good at capturing recent changes in liquidity that have arisen as dealers have become less willing to hold inventory. When this measure is regressed on the percentage of the bond held by funds, the coefficient is negative and highly significant. When a bond is held by mutual funds, fewer trades are prearranged. This may be because dealers are confident that they will be able cover a short position or layoff inventory by trading with a mutual fund that already holds the bond. Mutual funds may be sources of latent liquidity.

The penultimate column of the table reports regression results when the percentage of trades that are agency trades is regressed on the proportion of bonds that are held by mutual funds. The last column shows the regression results when the liquidity variable is the proportion of times when the sign of the volume is a continuation of the previous volume sign. Neither of these liquidity measures has a statistically significant association with the percentage of the bond held by funds.

In Panel B we regress four measures of trading frequency or trading volume on mutual fund ownership. The measures: turnover, the log of the par value of trades, the number of trades, and the number of dealers trading with customers, can be calculated for all bonds each month, not just those with trades. As before, we include fixed effects for the bond, month, age and rating. We also include the bond’s time to maturity and the log of the current amount outstanding as control variables.

A larger percentage of bonds owned by mutual funds is associated with larger par value of trades, a greater number of trades, and a larger number of dealers trading. In each of these regressions, the percentage of the bonds owned at the beginning of the month is highly significant. Results in Panel B, like results in Panel A suggest that greater ownership by mutual funds is associated with greater liquidity. These regressions do not, however, indicate why mutual fund ownership of bonds is associated with greater liquidity.

One possibility is that mutual funds choose to buy and hold bonds that they expect will be innately more liquid. Recall that we include fixed effects for each bond, so the results in Table 4 indicate that increases in fund holdings of a particular bond across months are associated with subsequent improvements in the bond’s liquidity. In this light, if mutual funds buy and hold more liquid bonds, it must be the case that they are increasing their holdings of specific bonds in anticipation of improved liquidity and decreasing their holdings of these bonds in anticipation of decreased liquidity. This alone, however, cannot explain the relation between mutual fund holdings and liquidity that we find. We include fixed effects for ratings and calendar months and age and also include time to maturity, and current amount outstanding as control variables. If greater mutual fund holdings do not make bonds more liquid but merely reflect greater anticipated liquidity, it must be that funds purchase bonds before liquidity improves, sell them before liquidity deteriorates, and must anticipate liquidity changes that are not explained by intertemporal changes in overall bond market liquidity or by ratings changes, or by changes in the amount of bonds outstanding.

Even if mutual funds could accurately predict liquidity changes – a big if – it is not clear that they would trade on these predictions. Trading bonds is expensive. It would be very costly for funds to capture intertemporal liquidity changes.

It is also possible that increased holding of a bond by mutual funds makes the bond more liquid. Mutual funds could be a source of latent liquidity as in Mahanti, Nashikkar, Subrahmanyam, Chacko, and Mallik (2007) by selling needed bonds to dealers and buying extra inventory from them. Dealers, knowing that funds would be willing to provide liquidity, would be more willing to go short and more willing to buy large numbers of bonds and take them into inventory. Mutual fund holdings of a bond may make the bond more liquid for all investors.

It is also possible that measured liquidity is better when mutual funds hold more of a bond because the bond is being traded by more skillful investors. Pension funds, insurance companies and other bond investors trade less frequently than mutual funds. They may therefore lack the knowledge or skill to trade well. Because they trade less often, they may not contact dealers as frequently and may not have much knowledge of market conditions. They may not know, for example, the best dealer to contact to trade a particular bond. In this case, increased holdings of bonds by mutual funds imply that more of the trades are executed skillfully. Other investors, who do not have the trading expertise of mutual funds will not see an improvement in liquidity.

In Table 5, we examine the impact of mutual funds’ predicted fund flows on the liquidity of the bonds that they hold. There is no reason why inflows and outflow would have the same impact on liquidity, so we use separate variables for positive flows (inflows) and negative flows (outflows). As before, we include bond fixed effects, month fixed effects, rating and age fixed effects, and control variables consisting of the time to maturity, and the log of the amount outstanding in each regression.

Table 5 reports results for regressions with liquidity measures that need trades for estimation as dependent variables. The coefficient on predicted inflows is negative in each case, and highly significant for all liquidity measures except the percentage of agency trades. Inflows into a fund are associated with greater liquidity of the bonds that the fund owns. The coefficients on outflows are also negative, and statistically significant at the 1% level when the dependent variable is the Amihud measure or the coefficient of variation of trade prices. Outflows are negative, so the product of the coefficients and outflows are positive, indicating that outflows of funds holding a bond are associated with reduced liquidity.

Predicted inflows are associated with increased liquidity and outflows with diminished liquidity. It is possible that when faced with an inflow of funds, fund managers can take their time to purchase additional bonds, and can choose between purchasing more of the bonds they already hold or purchasing other bonds. In this situation, funds can trade patiently and act as providers of liquidity. This would make the market more liquid for all investors. On the other hand, funds that are faced with large outflows may not have the luxury of providing liquidity. They may instead consume liquidity by selling quickly. Other investors who are competing for liquidity may not be able to find it.

Table 6 reports regressions of liquidity measures on the holdings at the beginning of the month of bonds that are in the lowest decile of predicted weighted-average flows across the funds that hold them. These are funds with outflows, and often large outflows. Here we see that greater holdings by funds in the lowest flow decile are associated with wider bid-ask spreads, a higher standard deviation and coefficient of variation of trade prices and a higher proportion of volume continuations. This would suggest that bonds that are held heavily by funds that have large outflows experience decreases in liquidity. That is partly contradicted though by our finding that greater holdings by funds in the lowest flow decile are associated with lower Amihud illiquidity measures.

1. **Fund holdings and liquidity during periods of stress**

Mutual fund holding of bonds seems to increase liquidity in general. A concern though, is whether mutual fund holdings of bonds will impede liquidity during periods when the bond market is under stress. Our results thus far suggest that mutual funds consume liquidity when faced with outflows. A fear is that losses in bond mutual funds following an increase in interest rates will lead to redemptions by funds holders which will, in an illiquid market, exacerbate the decline in prices.

We identify two months in our sample period in which rising bond yields (and falling bond prices) could have been expected to place stress on corporate bond markets. June, 2013, saw bond yields increase sharply during the “taper tantrum.” Over this month, yields on BBB bonds increased 46 basis points while yields on AAA bonds increased by 38 basis points. The month in our sample period when the bond market was arguably under the most stress was October, 2008, during the height of the financial crisis. Yields on BBB bonds increased by 157 basis points while AAA corporate yields increased by 63 basis points.

We run cross-sectional regressions of liquidity measures on the percentage of bonds owned by funds at the start of each month for each of the two stress months. We again include fixed effects for the bond ratings and the age of the bond, time to maturity, and number of bonds outstanding as control variables. Panel A of Table 7 reports results for October, 2008, while Panel B reports results for June, 2013. For October, 2008, results are mixed. A greater proportion of fund ownership is associated with a smaller Amihud illiquidity measure and a smaller proportion of trades that are prearranged. On the other hand, a larger proportion of bonds held by funds is also associated with a higher standard deviation of trade prices and a higher proportion of volume continuation. Results are less ambiguous for June, 2013. The bid-ask spread, Amihud liquidity measure, coefficient of variation of trade prices and percentage of agency trades all decrease with mutual fund holdings. All in all, it appears that bonds that are heavily owned by mutual funds have greater liquidity during months with market stress.

1. **Explaining the association between mutual fund activity and bond liquidity**

We now consider how mutual fund ownership and trading might add to the liquidity of the underlying bonds. Since we examine actual mutual fund trades and some funds report only quarterly, the remaining analysis is performed quarterly. Also, we would like to capture only funds that have discretion over what bonds to trade. Thus, we drop both exchange-traded funds (CRSP et\_flag = “F”) and index funds (any non-missing value in CRSP’s index\_fund\_flag). Table 3, Panel C reports summary statistics on quarterly variables included in this analysis.

We consider several hypotheses that could explain the association between enhanced liquidity and mutual fund activity.

**Hypothesis 1: Dealers are able to predict and plan for mutual fund flow-induced trading, and this facilitates their role as liquidity providers.**

Mutual fund flows are predictable using past data. (See, for example, Lou 2012). Thus, the increased liquidity that we find would be attributable to dealers’ ability to anticipate and plan for flow-driven mutual fund trades. This hypothesis predicts that mutual fund net buying of a bond in the current quarter, MFNetBuyi,q,especially the portion of this buying that is predictable using past flows, is positively related to DealerNetBuyi,q-1, dealer net buying in the prior quarter.

**Hypotheis 2: Mutual funds themselves act as shadow dealers, with their holdings as their inventory, and absorb some of the trading imbalances in bonds alongside dealers.**

In this case, we would expect net mutual fund trades, MFNetBuyi,q, to be positively related to DealerNetBuyi,q, net dealer trades of a bond in the same time period. When dealers buy, we would expect mutual funds to buy alongside them. We expect this for both the positive and negative parts of DealerNetBuyi,q.When dealers sell, we would expect mutual funds to sell alongside them.

**Hypothesis 3: Mutual fund managers attempt to minimize their funds’ trading costs by accommodating dealers’ needs.**

This hypothesis predicts that when mutual funds buy bonds, they will prefer to choose from a dealer’s existing bond inventory. Thus, unlike in the second hypothesis, we would expect net mutual fund net buying to be contemporaneously related with dealer net selling of the same bond, to their levels of inventory, or both. When mutual funds sell bonds, if they would like to minimize transaction costs by accommodating dealers, they should be open to selling the bonds that the dealer has negative inventory for or can find buyers for within the quarter. Thus, we expect an unambiguously negative relation between mutual fund buying behavior and dealer selling behavior, but the relation between mutual fund net selling and dealer net buying may be blurred by the fact that dealers may pass the bond along to another buyer within the same quarter.

We proceed to test these hypotheses in our bond and liquidity data by examining quarterly net buying by mutual funds and by dealers. First, in untabulated regressions, we find no evidence that either actual dealer trades or dealer trades predicted from fund flows are related to mutual fund trades in the subsequent quarter. Thus, there is no support for the first hypothesis that dealers anticipate mutual funds’ predictable need for bonds and trade on these anticipated needs one quarter ahead.

In Table 8, we proceed to test for evidence of the second and third hypotheses. In this table, the dependent variable is quarterly aggregate dealer net purchases of a bond, scaled by the amount outstanding. The independent variables are the positive and negative parts of aggregate mutual fund net buys. MFNetBuy+i,q is the aggregate mutual fund change in position in quarter q, scaled by amount outstanding, if it is positive, and zero otherwise. Similarly, MFNetBuy-i,q is the aggregate mutual fund change in position scaled by amount outstanding if this is negative, and zero otherwise. Dependent and independent variables are winsorized at the 1% level to minimize the effect of outliers. We also include bond and time-period fixed effects. Standard errors are clustered by time and by bond.

In Table 8, the coefficient on MFNetBuy+I,q is negative and highly significant. When mutual funds are net buyers of a bond, dealers are net sellers. This suggests that mutual funds do not compete as shadow dealers when purchasing bonds. On the other hand, the coefficient on MFNetBuy-i,q is positive, significant and much smaller in magnitude. MFNetBuy-i,q takes on only negative values, so selling by mutual funds is associated with selling by dealers. This is consistent with the hypothesis of Mahanti, Nashikkar, Subrahmanyam, Chacko, and Mallik (2007) that dealers use mutual funds as sources of bonds. Dealers like to maintain a low inventory, but they are particularly averse to going short. It is difficult to cover short positions in specific bonds that trade infrequently and which may be owned by just a handful of investors. It is therefore not surprising that dealers would obtain specific bonds from mutual funds rather than sell them short. Thus, we find support for the second hypothesis when mutual funds buy, and for the third hypothesis when mutual funds sell.

The second column reports regressions with net dealer buys as a dependent variable, but now includes an interaction between a dummy variable, Distressedi,q, for bonds whose holders are in the lowest decile of fund flows during the quarter. The coefficient on the interaction between distressed and MFNetBuy+i,q is positive. This implies that distressed bonds that are purchased by funds are associated with a lower amount of net selling by dealers. It seems likely that the dealers are able to buy them from funds that are in distress.

Panel B of Table 8 reports separate regressions of dealer net buys on mutual fund net buys and sells for each year from 2008 – 2014. The coefficient on MFNetBuy+i,q is negative in each of the years 2008-2014 and is significantly negative in all years except for 2008. The coefficient tends to become stronger over time as dealer inventories begin to tighten, and the most negative value of this coefficient is in the later years. On the other hand, the coefficient on MFNetBuy-i,q is positive but small, and not significant in most annual subsets.

Panel C of Table 8 breaks the results down by bond age. The first column examines bond ages of up to one year (without bond age fixed effects). The second column presents bonds between 1-3 years old, and the last column presents bonds older than 3 years old. This panel shows that the relation between DealerNetBuyi,q and MFNetBuy+i,q declines significantly with bond age – roughly 10 times from the first to the second column, and by two thirds from the second to the third column. This is consistent with dealers selling newly issued bonds to mutual funds in the first year. The relation between MFNetBuy-i,q and DealerNetBuyi,q is present only in the first two columns. This is consistent with dealers placing newly issued bonds with mutual funds, and then slowly finding more permanent homes for them over 3 years after issuance.

Another implication of the hypothesis that mutual funds accommodate dealers’ inventory needs is that mutual funds should buy the bonds that dealers have in inventory at the beginning of the quarter, and/or sell the bonds for which dealers have negative inventory. Using TRACE, we can examine this question. We reconstruct dealer inventory from each dealer’s transactions since 2007. Goldstein and Hotchkiss (2012) show that only secondary market trades, not the primary offering, are reported to TRACE. Thus, some dealers are allocated inventory that is not accounted for in their TRACE trades. Plotting hypothetical dealer inventory against time reveals that it takes approximately a year after issuance for dealer inventories to reach a steady state around zero. Thus, we exclude the first year after issuance in computing inventories. We construct an indicator variable for whether, at the bond level, dealer inventory is in the bottom tercile (Dealer inventory lowi,q) or top tercile (Dealer inventory highi,q) of its time-series distribution. We also interact these variables with an indicator for whether the bond is held by the bottom decile of distressed funds.

In Table 9 shows that the coefficient of mutual fund net buying on on the aggregate dealer low inventory indicator is negative. This suggests that mutual funds sell to replenish dealer inventories and perhaps to meet additional third party demand. The positive coefficient is consistent with mutual funds buying when dealer inventory is high, but the coefficient is not significant. Recall that dealer inventory does not reflect primary bond trades, and so we would not catch evidence of mutual funds buying newly issued bonds directly from dealers, as we do in Table 8, Panel C. Along with Figure 7 which shows net disinvestment by funds after the first year, these results suggest that, the primary function of mutual funds after the first year of bond life is to provide bonds when dealer inventories are low. The second column of Table 9 shows that when CUSIPs are in the lowest decile of holdings-weighted mutual fund flows, these results do not reverse (although clearly mutual fund net flows into the bond are negative). Thus, there is no evidence that distressed funds would not cause a liquidity crisis on their own.

1. **Conclusions**

It is an open question whether mutual fund ownership of corporate bonds increases or decreases liquidity in the market for corporate bonds. Fund investors can redeem their shares daily. Funds may be forced to consume bond market liquidity by selling illiquid corporate bonds to meet customer demand for redemption. Some authors suggest that the bank-like short-term liabilities and illiquid assets of bond mutual funds may lead to runs. Even if the bonds held by a fund are sound, fear that others may redeem fund shares may give fund investors an incentive to redeem first before the fund exhausts liquidity for its bonds.

Others suggest bond mutual funds add to the liquidity of the market. Funds hold buffers of cash and can provide liquidity to their investors without having to sell illiquid bonds. In addition, they can choose to sell more liquid bonds and hold on to less liquid bonds when faced with redemptions. Finally, mutual funds can contribute to the liquidity of the bond market by offering latent liquidity. They can do this by providing a source of bonds for dealers who need to cover shorts and an outlet for bonds when dealers need to lay off inventory.

There are two reasons why the question of whether mutual funds consume bond market liquidity or add to it is especially important now. The first is that many market participants and regulators believe that there is far less liquidity in the corporate bond market now than there was before the financial crisis. This is not reflected in many of the traditional liquidity measures, like bid-ask spreads, but is seen in lower dealer inventories and reduced willingness to trade. The second is that mutual funds hold a much larger proportion of outstanding corporate bonds now than they did before the crisis.

Using several measures of liquidity, we find that larger proportions of a bond held by mutual funds are associated with greater bond liquidity. It seems highly unlikely that funds are simply picking more liquid bonds to hold. We include fixed effects for each bond in our regression, so in effect we are finding that large mutual fund holdings of a specific bond are high when that bond’s liquidity is greater than its average. Furthermore, we include fixed effects for ratings and month and control variables for bond characteristics that change over time: time to maturity, amount outstanding, and age. So, our results indicate that if funds are just picking more liquid bonds, they are buying the bonds before increases in liquidity and selling them before liquidity decreases, and furthermore that these liquidity changes are not explained by changes in rating, age, or date. If funds could indeed predict liquidity changes that well, would they bear the trading costs to shift to more liquid bonds? It is doubtful.

So, another explanation for our results is that mutual funds make bond market more liquid. They could do this by providing latent liquidity or trading passively. Alternatively, it may be that liquidity appears to be greater in bonds that are held by funds because the funds are more skillful traders. If this is true, liquidity for other investors will not be improved by mutual fund holdings.

We find that predicted cash inflows into mutual funds are associated with greater liquidity during the month. Funds that receive inflows often increase holdings of bonds they already hold. Faced with inflows, funds can trade patiently and provide liquidity to bond sellers. We find that predicted cash outflows are associated with lower liquidity in the bonds held by the fund. With outflows, funds may not have the luxury to trade patiently and may be forced to consume liquidity.

A chief concern of regulators is how mutual funds will affect the liquidity of bonds during times of market stress. We have two months in our sample in which bond yields rose sharply. One, October, 2008 was in the middle of the financial crisis while the other, June, 2013 was during the “taper tantrum.” Bonds that were owned more by mutual funds were clearly more liquid during June, 2013. Results are mixed for October, 2008. The greater the proportion of a bond issue held by mutual funds, the greater the standard deviation of prices, but the lower the Amihud liquidity measure.

We present three hypotheses to explain why mutual fund ownership is associated with greater bond liquidity. We find strong evidence in favor of one: mutual funds enhance market liquidity by accommodating bond dealers’ inventory needs, and this behavior is only partially reduced when funds are under stress. It would appear then that mutual fund ownership of corporate bonds is not a threat to bond market liquidity. If anything, mutual fund participation enhances bond market liquidity.

Table 1

Characteristics of bonds held by mutual funds and bonds that traded over 2007-2014.

Mutual fund holdings of bonds are obtained from the CRSP Mutual Fund Database. Trades are from FINRA and include every trade between dealers and customers as well as every interdealer trade. FINRA trades are matched with CRSP mutual fund holdings using CUSIPs. Bonds that are held but not traded are in the CRSP mutual fund holdings but never show up in FINRA trades. Bonds that are held and traded are in the CRSP mutual fund holdings and also have trades in the FINRA data. Bonds that are traded but not held have trades in the FINRA data but are not held y any mutual funds. Bond characteristics and ratings are from Mergent/FISD.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Held, never traded | Held and traded | Traded, not held |
| Offering amount | 482,051 | 517,326 | 35,649 |
| Percent 144A | 0.331 | 0.214 | 0.026 |
| Percent convertible | 0.041 | 0.056 | 0.010 |
| AAA & Aaa | 0.032 | 0.015 | 0.021 |
| AA & Aa | 0.057 | 0.073 | 0.201 |
| A | 0.188 | 0.236 | 0.338 |
| BBB & Baa | 0.215 | 0.274 | 0.130 |
| BB & Ba | 0.132 | 0.095 | 0.025 |
| B | 0.056 | 0.093 | 0.020 |
| C | 0.044 | 0.049 | 0.013 |
| D | 0.001 | 0.002 | 0.001 |
| No or Missing Rating | 0.275 | 0.163 | 0.251 |
| CUSIP-months | 31,262 | 1,049,892 | 837,897 |
| CUSIPs | 1,411 | 24,188 | 30,920 |

Table 2

Characteristics of bonds held by mutual funds by year

Data on bond characteristics and ratings are from Mergent/FISD

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| Number of Bonds | 70 | 98 | 112 | 143 | 160 | 171 | 189 | 196 |
| Proportion 144A | 0.180 | 0.159 | 0.149 | 0.190 | 0.228 | 0.236 | 0.254 | 0.254 |
| Proportion Convertible | 0.043 | 0.111 | 0.121 | 0.106 | 0.093 | 0.082 | 0.074 | 0.061 |
|  | Proportion with Different Ratings | | | | | | | |
| AAA & Aaa | 0.018 | 0.024 | 0.049 | 0.055 | 0.030 | 0.008 | 0.008 | 0.005 |
| AA & Aa | 0.120 | 0.082 | 0.064 | 0.069 | 0.079 | 0.055 | 0.042 | 0.038 |
| A | 0.150 | 0.207 | 0.215 | 0.196 | 0.195 | 0.204 | 0.190 | 0.186 |
| BBB & Baa | 0.231 | 0.250 | 0.274 | 0.261 | 0.260 | 0.287 | 0.297 | 0.275 |
| BB & Ba | 0.152 | 0.129 | 0.115 | 0.127 | 0.134 | 0.134 | 0.129 | 0.145 |
| B | 0.204 | 0.133 | 0.090 | 0.118 | 0.115 | 0.111 | 0.121 | 0.101 |
| C | 0.064 | 0.061 | 0.072 | 0.052 | 0.048 | 0.048 | 0.047 | 0.041 |
| D | 0.001 | 0.003 | 0.006 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 |
| No or Missing Rating | 0.059 | 0.111 | 0.115 | 0.121 | 0.138 | 0.152 | 0.165 | 0.208 |
|  | Proportion with Different Maturities | | | | | | | |
| < 2 Years | 0.136 | 0.146 | 0.148 | 0.162 | 0.1699 | 0.179 | 0.174 | 0.170 |
| 2 – 5 Years | 0.264 | 0.274 | 0.346 | 0.346 | 0.3172 | 0.295 | 0.298 | 0.308 |
| 5 – 10 Years | 0.389 | 0.372 | 0.322 | 0.338 | 0.3673 | 0.388 | 0.400 | 0.389 |
| ≥ 10 Years | 0.181 | 0.196 | 0.176 | 0.148 | 0.1394 | 0.134 | 0.124 | 0.126 |
| Fund Months | 420 | 8,544 | 12,898 | 16,859 | 22,577 | 23,417 | 23,661 | 24,184 |

Table 3

Panel A presents summary statistics for liquidity measures by bond month. Panel B presents summary statistics for the monthly analysis. Panel C presents summary statistics for the quarterly analysis.

Panel A

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Month-Bond Observations | Mean | 25th Percentile | Median | 75th Percentile |
| Number Trades | 1,775,110 | 52.7 | 5 | 13 | 42 |
| % Interdealer | 1,775,110 | 0.3667 | 0.1429 | 0.4151 | 0.5556 |
| % Prearranged | 1,775,110 | 0.0349 | 0.0000 | 0.0000 | 0.0142 |
| % Agency | 1,775,110 | 0.0643 | 0.0000 | 0.0000 | 0.0833 |
| Bid-Ask Spread | 1,476,374 | 0.0097 | 0.0022 | 0.0061 | 0.0141 |
| Amihud Illiquidity | 1,471,038 | 0.0086 | 0.0002 | 0.0031 | 0.0109 |
| Std. Dev. Of Prices | 1,554,651 | 1.2131 | 0.4390 | 0.9460 | 1.6578 |
| Coef. Var. Prices | 1,554,598 | 0.0135 | 0.0043 | 0.0094 | 0.0170 |

Panel B

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | SD | p25 | p50 | p75 | CUSIP months |
| Spread | 0.009 | 0.009 | 0.002 | 0.005 | 0.012 | 730,526 |
| Amihud | 0.00004 | 0.0002 | 1.0e-7 | 7.0e-7 | 5.20e-6 | 804,329 |
| SD\_prices | 1.292 | 1.241 | 0.481 | 0.957 | 1.663 | 784,760 |
| CVAR\_prices | 0.015 | 0.019 | 0.005 | 0.009 | 0.017 | 784,748 |
| Turnover | 0.519 | 1.244 | 0.003 | 0.129 | 0.513 | 972,817 |
| Log par trades | 8.58 | 5.01 | 5.99 | 10.55 | 12.42 | 972,841 |
| Number of trades | 35.44 | 97.87 | 1 | 9 | 31 | 972,841 |
| Number of dealers | 8.078 | 9.92 | 1 | 5 | 12 | 972,841 |
| Prearranged | 0.046 | 0.1 | 0 | 0 | 0.049 | 826,580 |
| Agency | 0.12 | 0.17 | 0.00 | 0.06 | 0.18 | 826,580 |
| Prop continuations vol | 0.564 | 0.300 | 0.4 | 0.571 | 0.778 | 643,916 |
| Ownership | 0.119 | 0.134 | 0.022 | 0.073 | 0.170 | 869,829 |
| Predicted | 0.0012 | 0.0317 | 1.37e-6 | 0.0002 | 0.0009 | 860,788 |
| Distressed | 0.099 | 0.299 | 0 | 0 | 0 | 860,788 |

Panel C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | SD | p25 | p50 | p75 | CUSIP Quarters |
| Dealer net buy | -0.0002 | 0.0013 | -0.0001 | 0 | 0.0001 | 278,141 |
| Mutual fund net buy | 0.0032 | 0.0558 | -0.0065 | 0 | 0.0081 | 277,469 |
| Mutual fund net buy + | 0.0148 | 0.0406 | 0 | 0 | 0.0096 | 277,469 |
| Mutual fund net buy - | -0.0117 | 0.0334 | -0.0065 | 0 | 0 | 277,469 |
| Prearranged | 0.0502 | 0.0857 | 0 | 0.1562 | 0.0600 | 281,464 |
| Agency | 0.1189 | 0.1492 | 0 | 0.0769 | 0.1707 | 281,464 |
| Net dealer inventory | -0.0001 | 0.0007 | -0.0016 | 0 | 0.0001 | 255,136 |

Table 4

Regressions of monthly bond liquidity measures on the proportion of the bonds owned by mutual funds at the beginning of the month.

The bid-ask spread is the average of bid-ask price differences calculated using all pairs of trades in a bond that occur on the same day within the month. The Amihud illiquidity measure is the difference between the first and last trade price of the month divided by the dollar volume of trade during the month. The standard deviation is calculated using all trade prices during the month. The coefficient of variation of prices is the standard deviation divided by the mean price. The standard deviation and coefficient of variation are winsorized at the 1% level on the upside. The percentage of prearranged trades is the proportion of dealer buy (sell) trades during a month that are followed by an offsetting sell (buy) trade within sixty seconds. The percentage of agency trades is the proportion designated by FINRA as agency trades. The proportion of volume that is a continuation is obtained for each bond each month by calculating the proportion of days within the month with positive net customer buy (sell) volume that are followed by days with positive net customer buy (sell) volume. Control variables are time to maturity and natural log of the par value of the bonds outstanding. Turnover is the trading volume divided by the quantity of the bond outstanding. Number of dealers trading is the total number of dealers who trade the bond with a customer during the month.

Panel A. Liquidity measures that require trades to calculate.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bid-Ask Spread | Amihud Illiquidity | Std.Dev. of Trade Prices | Coef Var.of Trade Prices | % Trades Prearranged | % Trades Agency | Prop. Vol. Cont. |
| % Bond Owned by Funds  Start of Month | -0.000676  (0.05) | **-1.59e-5**  **(0.00)** | **-0.218**  **(0.00)** | **-0.00354**  **(0.00)** | **-0.0115**  **(0.00)** | -0.00513  (0.32) | 0.00171  (0.05) |
| Obs. | 623,665 | 684,108 | 671,770 | 671,764 | 700,524 | 700,524 | 572,703 |
| R-squared | 0.480 | 0.228 | 0.521 | 0.554 | 0.411 | 0.323 | 0.147 |
| Control Variables | YES | YES | YES | YES | YES | YES | YES |
| Time Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Bond Age Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Rating Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| CUSIP Fixed Effects | YES | YES | YES | YES | YES | YES | YES |

Table 4 (continued)

Panel B. Liquidity measures that do not require trades.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Turnover | Log Par Value Trades | Number of Trades | Number of Dealers Trading |
| % Bond Owned by Funds  Start of Month | **0.126**  **(0.01)** | **3.185**  **(0.00)** | **17.23**  **(0.00)** | **4.851**  **(0.00)** |
| Obs. | 785,466 | 785,466 | 785,466 | 785,466 |
| R-squared | 0.360 | 0.684 | 0.533 | 0.785 |
| Control Variables | YES | YES | YES | YES |
| Time Fixed Effects | YES | YES | YES | YES |
| Bond Age Fixed Effects | YES | YES | YES | YES |
| Rating Fixed Effects | YES | YES | YES | YES |
| CUSIP Fixed Effects | YES | YES | YES | YES |

Table 5

Regressions of monthly bond liquidity measures on predicted fund flows of funds holding the bond. Detailed variable definitions appear in the Appendix. Standard errors are clustered by month and CUSIP and p-values appear in parentheses.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bid-Ask Spread | Amihud Illiquidity | Std.Dev. of Trade Prices | Coef Var.of Trade Prices | % Trades Prearranged | % Trades Agency | Prop. Vol. Cont. |
| Predicted fund flows for funds holding the bond (+) | **-0.0979**  **(0.00)** | **-0.00038**  **(0.00)** | **-15.07**  **(0.00)** | **-0.2796**  **(0.00)** | **-0.4417**  **(0.00)** | -0.0485  (0.86) | **-1.5308**  **(0.00)** |
| Predicted fund flows for funds holding the bond (-) | **-0.104**  **(0.01)** | **0.00215**  **(0.00)** | **-53.18**  **(0.00)** | **-1.299**  **(0.00)** | **-1.100**  **(0.00)** | -0.8587  (0.32) | -1.0178  (0.71) |
| Obs. | 622,864 | 683,175 | 670,882 | 670,876 | 699,526 | 699,526 | 562,186 |
| R-squared | 0.480 | 0.228 | 0.523 | 0.553 | 0.412 | 0.325 | 0.147 |
| Control Variables | YES | YES | YES | YES | YES | YES | YES |
| Time Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Bond Age Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Rating Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| CUSIP Fixed Effects | YES | YES | YES | YES | YES | YES | YES |

Table 6

Regressions of monthly bond liquidity measures on an indicator variable for whether the bond is in the lowest predicted weighted mutual fund flow decile. Control variables include bond age, time to maturity, and natural log of the par value of the bonds outstanding. Detailed variable definitions appear in the Appendix. Standard errors are clustered by month and CUSIP and p-values appear in parentheses.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bid-Ask Spread | Amihud Illiquidity | Std.Dev. of Trade Prices | Coef Var.of Trade Prices | % Trades Prearranged | % Trades Agency | Prop. Vol. Cont. |
| Distressedi,m | **0.00021 (0.00)** | **-2.32e-6**  **(0.00)** | **0.05148**  **(0.00)** | **0.00084**  **(0.00)** | **0.00170**  **(0.00)** | -0.00053  (0.74) | **0.004077**  **(0.01)** |
| Obs. | 622,864 | 683,175 | 670,876 | 670,876 | 699,526 | 699,526 | 562,186 |
| R-squared | 0.474 | 0.222 | 0.518 | 0.548 | 0.408 | 0.321 | 0.146 |
| Control Variables | YES | YES | YES | YES | YES | YES | YES |
| Time Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Bond Age Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Rating Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| CUSIP Fixed Effects | YES | YES | YES | YES | YES | YES | YES |

Table 7

Regressions of bond liquidity measures during months of severe market stress on the proportion bonds held by mutual funds. Detailed variable definitions appear in the Appendix. Standard errors are clustered by month and CUSIP and p-values appear in parentheses.

Panel A. October, 2008

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bid-Ask Spread | Amihud Illiquidity | Std.Dev. of Trade Prices | Coef Var.of Trade Prices | % Trades Prearranged | % Trades Agency | Prop. Vol. Cont. |
| % Owned by Fundsi,m-1 | **-0.000696**  **(0.00)** | **-0.000102**  **(0.00)** | **1.221**  **(0.00)** | **0.000158**  **(0.00)** | **-0.0465**  **(0.00)** | **-0.0378**  **(0.00)** | **0.0114**  **(0.00)** |
| Obs. | 5,190 | 5,791 | 5,633 | 5,633 | 6,037 | 6,037 | 4,309 |
| R-squared | 0.083 | 0.141 | 0.151 | 0.258 | 0.124 | 0.068 | 0.032 |
| Control Variables | YES | YES | YES | YES | YES | YES | YES |
| Age Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Rating Fixed Effects | YES | YES | YES | YES | YES | YES | YES |

Panel B. June, 2013.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bid-Ask Spread | Amihud Illiquidity | Std.Dev. of Trade Prices | Coef Var.of Trade Prices | % Trades Prearranged | % Trades Agency | Prop. Vol. Cont. |
| % Owned by Fundsi,m-1 | **-0.00320**  **(0.00)** | **-5.74e-6**  **(0.00)** | **-0.390**  **(0.00)** | **-0.00686**  **(0.00)** | **0.00179**  **(0.00)** | **-0.0457**  **(0.00)** | 0.00380  (0.00) |
| Obs. | 8,821 | 9,669 | 9,527 | 9,527 | 9,974 | 9,814 | 8,084 |
| R-squared | 0.158 | 0.072 | 0.300 | 0.262 | 0.070 | 0.046 | 0.019 |
| Control Variables | YES | YES | YES | YES | YES | YES | YES |
| Age Fixed Effects | YES | YES | YES | YES | YES | YES | YES |
| Rating Fixed Effects | YES | YES | YES | YES | YES | YES | YES |

Table 8

Regressions of Dealer net buying activity on mutual fund net buying activity. MFNetBuy+i,q is the aggregate mutual fund change in position in quarter q, scaled by amount outstanding, if it is positive, and zero otherwise. Similarly, MFNetBuy-i,q is the aggregate mutual fund change in position scaled by amount outstanding if this is negative, and zero otherwise. One observation is one CUSIP-quarter. Panel A presents full sample regression and a regression term with interaction terms with *Distressed*. Panel B presents year-by-year regressions. Panel C presents results by bond age. Control variables are, time to maturity, and natural log of the par value of the bonds outstanding. Standard errors are clustered by CUSIP and by time and p-values are in parentheses. Detailed variable definitions appear in the Appendix.

Panel A

|  |  |  |
| --- | --- | --- |
|  | DealerNetBuyi,q  Full Sample | DealerNetBuyi,q  Full Sample |
| MFNetBuy+I,q | **-0.0126** | **-0.0132** |
|  | **(0.00)** | **(0.00)** |
| MFNetBuy-I,q | **0.0026** | **0.00253** |
|  | **(0.00)** | **(0.00)** |
| MFNetBuy+I,q\*Distressedi,q |  | **0.00551** |
|  |  | **(0.00)** |
| MFNetBuy-I,q\*Distressedi,q |  | 0.00023 |
|  |  | (0.39) |
| Distressedi,q |  | **-8.72e-5** |
|  |  | **(0.00)** |
| Obs. | 274,036 | 274,036 |
| R-squared | 0.395 | 0.397 |
| Control Variables | YES | YES |
| Time Fixed Effects | YES | YES |
| Bond Age Fixed Effects | YES | YES |
| Rating Fixed Effects | YES | YES |
| Bond Fixed Effects | YES | YES |

Panel B

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | DealerNetBuyi,q  2008 | DealerNetBuyi,q  2009 | DealerNetBuyi,q  2010 | DealerNetBuyi,q  2011 | DealerNetBuyi,q  2012 | DealerNetBuyi,q  2013 | DealerNetBuyi,q  2014 |
| MFNetBuy+i,q | -0.00018 | **-0.000581** | **-0.00254** | **-0.0181** | **-0.0239** | **-0.0232** | **-0.0196** |
|  | (0.09) | **(0.00)** | **(0.00)** | **(0.00)** | **(0.00)** | **(0.00)** | **(0.00)** |
| MFNetBuy-I,q | 0.00029 | 2.76e-5 | 0.00105 | 0.00234 | 0.00199 | 0.00320 | **0.00371** |
|  | (0.42) | (0.91) | (0.11) | (0.04) | (0.03) | (0.02) | **(0.00)** |
| Obs. | 29,920 | 32,587 | 36,082 | 41,045 | 42,290 | 45,048 | 45,268 |
| R-squared | 0.296 | 0.284 | 0.623 | 0.638 | 0.691 | 0.666 | 0.640 |
| Control Variables | YES | YES | YES | YES | YES | YES | YES |
| Time FE | YES | YES | YES | YES | YES | YES | YES |
| Bond Age FE | YES | YES | YES | YES | YES | YES | YES |
| Rating FE | YES | YES | YES | YES | YES | YES | YES |
| Bond FE | YES | YES | YES | YES | YES | YES | YES |

Panel C

|  |  |  |  |
| --- | --- | --- | --- |
|  | DealerNetBuyi,q  0-1 year | DealerNetBuyi,q  1-3 years | DealerNetBuyi,q  3+ years |
| MFNetBuy+i,q | **-0.0183** | **-0.00178** | **-0.000625** |
|  | **(0.00)** | **(0.00)** | **(0.00)** |
| MFNetBuy-I,q | **0.00494** | **0.00073** | 0.000334 |
|  | **(0.00)** | **(0.00)** | (0.03) |
| Obs. | 50,702 | 70,076 | 144,189 |
| R-squared | 0.565 | 0.225 | 0.131 |
| Control Variables | YES | YES | YES |
| Time FE | YES | YES | YES |
| Bond Age FE | NO | NO | NO |
| Rating FE | YES | YES | YES |
| Bond FE | YES | YES | YES |

Table 9

Regressions of mutual fund net buying on positive and negative dealer lagged inventories. Control variables are time to maturity, and natural log of the par value of the bonds outstanding. Standard errors are clustered by bond and by time and *p*-values are in parentheses. Detailed variable definitions appear in the Appendix.

Panel B

|  |  |  |
| --- | --- | --- |
|  | MFNetBuyiq | MFNetBuyiq |
| Dealer inventory lowi,q-1 | **-0.00181** | **-0.00189** |
|  | **(0.00)** | **(0.00)** |
| Dealer inventory highi,q-1 | **1.84e-5** | **2.84e-5** |
|  | **(0.94)** | **(0.90)** |
| Dealer inventory low+iq-1\*Distressediq |  | 0.0007 |
|  |  | (0.54) |
| Dealer inventory highiq-1\*Distressediq |  | 0.0005 |
|  |  | (0.62) |
| Distressed |  | **-.00379** |
|  |  | **(-0.00)** |
| Observations | 213,766 | 213,766 |
| R-squared | 0.160 | 0.160 |
| Control variables | YES | YES |
| Time FE | YES | YES |
| Age FE | YES | YES |
| Rating FE | YES | YES |
| Bond FE | YES | YES |
|  |  |  |

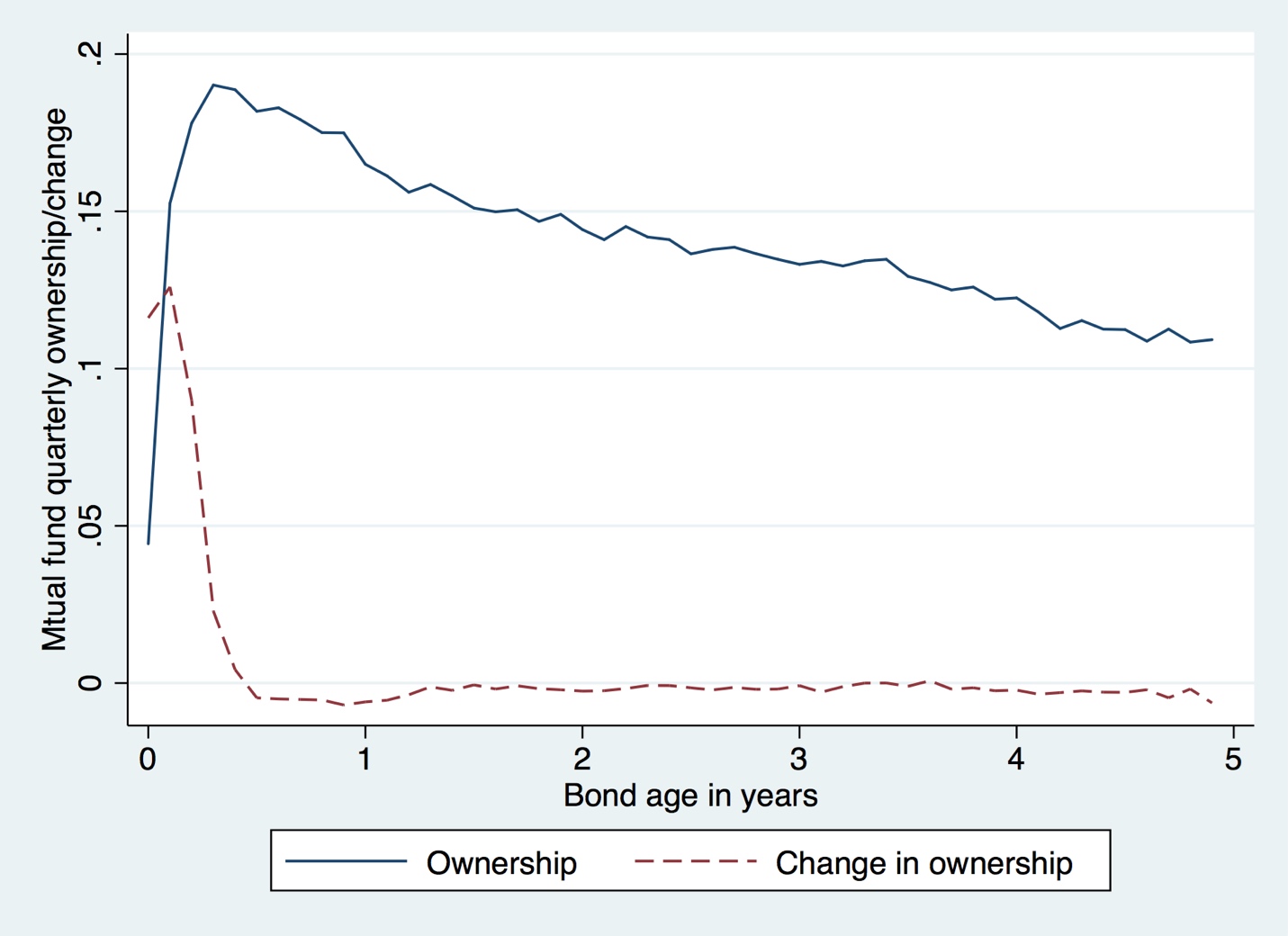
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Figure 7: Mutual fund ownership and change in mutual fund ownership over a bond’s life.

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**Appendix**

Table A1.

Variable descriptions

Panel A. Bond market quality measures

|  |  |  |
| --- | --- | --- |
| **Variable** | **Description** | **Source** |
| Agencyi,m | The percentage of trades for a bond-month that are executed as agency trades. Each trade in our sample is designated as an agency or principal trade. | TRACE |
| Amihudi,m | The Amihud illiquidity measure. | TRACE |
| CVAR\_pricesi,m | The coefficient of variation of prices is calculated for each bond each month by dividing the standard deviation of prices by the average price. | TRACE |
| Days traded*i,m* | The number of days in the month m that bond *i* is traded. | TRACE |
| Number of tradesi,m | The number of trades of bond *i* in month *m*. | TRACE |
| Prearrangedi,m | The percentage of trades of bond *i* that are prearranged during month *m*. We identify them in our data as customer sell (buy) trades that are reversed with a customer buy (sell) trade within 60 seconds. | TRACE |
| Prop continuationsi,m | The proportion of daily signed volumes that are a continuation of the previous days’ signed volume. Each day within a month for each bond, we add the volume from all customer buy orders and subtract the volume from all customer sell orders to produce a net buy volume. If a day with a positive (negative) buy volume is followed by a day with a positive (negative) buy volume, we classify it as a continuation. If a day with a positive (negative) buy volume is followed by a day with a negative (positive) buy volume, we classify it as a reversal. If a day has a zero net volume, typically because the bond didn’t trade that day, we look to the day before to see if the latter day is a continuation or a reversal. We then calculate the percentage of two-day sequences that are continuations rather than reversals for each bond-month. | TRACE |
| SD\_pricesi,m | We measure dispersion around the mean trade price during the day, not an end-of-day quote. For each bond each month, we calculate the standard deviation of trade prices using all trades between a dealer and customer. | TRACE |
| Spreadi,m | We estimate the average spread for each bond each month using consecutive trades on the same day. If one trade is a dealer purchase from a customer and the next trade is a dealer sale to a customer, the price of the later trade minus the price of the earlier trade divided by the earlier trade price is one spread observation. If one trade is a dealer sale to a customer and the next trade is a dealer purchase from a customer, the price of the earlier trade minus the price of the later trade divided by the earlier trade price is one spread observation. If one of the two consecutive trades is an interdealer trade, we assume the trade takes place at the midpoint of the bid-ask and multiply the difference in prices by two to produce a spread observation. If two consecutive trades are interdealer trades, we do not incorporate the differences in those two prices in the spread estimate. | TRACE |

Table A1 (continued)

Panel B. Bond characteristics.

|  |  |  |
| --- | --- | --- |
| **Variable** | **Description** | **Source** |
| 144Ai | Bond can only be traded between Qualified Institutional Buyers. | TRACE |
| Agei,m | Years since the bond *i*’s issuance, as of month *m.* | Mergent |
| Bonds outstandingi,m | Par value of the bond issue of CUSIP *i* as of month *m*. | Mergent |
| Bond typei | Type of bond as defined by Mergent variable *bond\_type* | Mergent |
| Distressedi,m | Bond *i* is in the lowest decile of mutual-fund-holdings-weighted flows in month *m* or in quarter *q*. |  |
| Ownership | Proportion of outstanding bond *i* held by mutual funds in aggregate as of month *m*. | CRSP, Mergent |
| Ratingi,m | Average of most recent Moody’s, S&P, and Fitch ratings for bond *i* in month *m* | Mergent |
| Time to maturityi,m | Years from month *m* until the bond *i*’s maturity. | Mergent |

**Trading by dealers and mutual funds**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Description** | **Source** |
| MFNetBuyi,q | Change in mutual funds aggregate position in a bond of CUSIP *i* in quarter *q.* Trading is measured quarterly as not all funds report monthly. | CRSP |
| MFNetBuy+i,q | Positive part of the change in mutual funds’ aggregate position in a bond of CUSIP *i* in quarter *q* | CRSP |
| MFNetBuy-i,q | Negative part of the change in mutual funds’ aggregate position in the bond of CUSIP *i* in quarter *q* | CRSP |
|  |  |  |

1. The Roll spread estimator is The Roll spread estimate comes from the insight that if trades alternate randomly between purchases at the ask price and sales at the lower bid price, bid-ask bounce will produce a negative autocorrelation in returns. The Roll estimator has been used as a measure of corporate bond liquidity in Friewald, Jankowitsch, and Subrahmanyam (2012), and Jankowitsch, Nashikkar, and Subrahmanyam (2011). Bao, Pan and Wang (2011) use -1 times the covariance of successive returns as a measure of liquidity. This is obviously very similar to the Roll measure. We do not use the Roll estimator in this paper. The Roll estimator was originally used as a way to estimate bid-ask spreads, Since we have signed trades, we believe that our more direct measure of bid-ask spreads is preferable to the Roll estimator. [↑](#footnote-ref-1)