Cross Trading in the Corporate Bond Market*

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Abstract

We examine cross trading by mutual funds in corporate bonds. We find that cross trading is relatively common in the 2008 to 2023 sample period, with substantial variation across fund families and greater activity for illiquid and hard-to-obtain bonds. Cross trading is particularly elevated around maturity cutoffs, credit rating changes, and periods of extreme fund flows, suggesting that it can be beneficial in times of stress. High-fee funds tend to cross with lower-fee funds, but we find no evidence that crossing transfers performance from low- to high-value funds. We document large transaction cost savings, although these savings have diminished following a regulatory change that significantly limits cross trading.

JEL Classification: G10, G23

Keywords: mutual funds, corporate bonds, cross trading, transaction costs

1 Introduction

Rule 17a-7 permits funds within the same fund family to internally match buy and sell orders for the same security—a practice known as "cross trading." A key benefit of cross trading is that it allows both parties to avoid market transaction costs. However, because these trades occur off-market and are not reported to any regulatory agency, they also raise concerns about opportunistic pricing and potential conflicts of interest. To date, academic research on cross trading has primarily focused on equity funds and largely emphasized the dark side of these internal transactions.

In this paper, we provide the first evidence on cross trading in corporate bonds. Since corporate bond markets are generally far less liquid and more opaque than equity markets, both the transaction cost and the conflict of interest arguments are particularly important in this setting. For example, according to Morningstar, just over 50% of the traded bonds in 2019 were transacted at least once every three weeks. Similarly, MarketAxess reports that on any given day in 2020, only 17% of the universe of US investment grade bonds traded.[1] At the extreme, some bonds are difficult to acquire in the secondary market because many primary market buyers hold them to maturity. As a result, cross trading in fixed-income securities can offer an additional benefit by allowing families to transfer hard-to-obtain bonds from funds seeking to sell to other in-house funds that may not otherwise have access to them.

Illiquidity is a concern with respect to Rule 17a-7 as well. The rule only permits cross trades in securities for which "market quotations are readily available." Although this is generally not the case for fixed-income assets, the Securities and Exchange Commission (SEC) historically allowed for flexibility in interpreting this standard. New Rule 2a-5 introduced in September 2022 removes the flexibility however. While the new regulation does not affect

[1] `https://www.morningstar.com/content/dam/marketing/shared/research/foundational/Bond_Pricing_2021.pdf` and `https://www.sec.gov/comments/s7-12-20/s71220-8426732-229606.pdf`

in-house transactions in liquid assets, such as stocks or Treasury securities, it significantly limits the cross trading of corporate bonds.

To assess the prevalence and determinants of cross trading in the corporate bond market, we use data on mutual fund holdings disclosures from the CRSP Survival-bias Free Mutual Fund Database for the 2008-2023 time period.[2] We also match these data with the regulatory version of the Financial Industry Regulatory Authority's (FINRA) Trade Reporting and Compliance Engine (TRACE).

Since cross trades are not observable, there are no direct measures that capture these transactions. Previous studies adopt three alternative approaches. First, Chan et al. (2018) and Eisele et al. (2020) use transaction-level data from Ancerno and designate offsetting trades in the same security by two funds in a family that 1) occur at the same time, 2) involve the same quantity, 3) execute at the same price, and 4) do not incur commissions as cross trades. While this is perhaps the most direct approach to flag trades that are internally crossed, the data are limited to a subsample of equity funds. Importantly, similar, transaction-level data are not available for fund trades of corporate bonds.

The other approaches are more indirect. Gaspar et al. (2006a) and Chuprinin et al. (2015) infer equity cross trades from quarterly holdings disclosures by summing across the holdings-implied purchases and sales of funds in a given family. Potential cross trades are then calculated as the minimum of the aggregate family buy and sell transactions in the security. Finally, Casavecchia and Tiwari (2016) and Del Guercio et al. (2018) use fund Form ADV disclosures, filed annually at the adviser's level. Specifically, each investment advisory firm is required to disclose whether they engage in principal or agency cross trades on Item 8 of Form ADV. Therefore, this third approach only provides an indicator variable on whether some trades were internally crossed in the family during the filing year.

[2]ETFs are excluded.

To capture cross trades, we develop two measures. One measure is related to the approaches adopted in previous studies, the other is a new measure that utilizes reported corporate bond trades. The first (new) measure, which we refer to as our 'off-tape' cross trading measure (*Off-Tape Cross*) is a simple indicator of whether mutual fund position changes implied by the holdings disclosures exceed TRACE volume for the bond during the same holding period. As an example, suppose that from the January 31st, 2020 and February 29th, 2020 holdings disclosures of fund A we infer that the fund sold 1000 'shares'—which correspond to the principal amount in bonds—of bond B in February, 2020. If the total TRACE-recorded February sell volume in bond B is smaller than 1000, our *Off-Tape Cross* indicator for fund A's February trade in bond B takes the value of one, and zero otherwise. For each corporate bond in our sample, we repeat this analysis at the fund-disclosure period and family-disclosure period levels.[3] Additionally, we also use a continuous version of *Off-Tape Cross* based on the notional amount traded during these flagged transactions.

Our second measure, which we refer to as 'Fund Offset' crosses (*Fund Offset Cross*) flags near-exact offsetting trades executed within the same family during the same holdings period as cross trades. Consistent with the *Off-Tape Cross* measure, we create both an indicator and a continuous version of the *Fund Offset Cross* metric, also at both the fund-disclosure period and the family-disclosure period levels. The *Fund Offset Cross* measure substantially refines the metrics derived from holdings disclosures in the previous literature. Although it is also based on holdings available at relatively low frequencies—often monthly, but in about 25% of the cases only at the quarterly level—our *Fund Offset Cross* measure is closer in spirit to that developed in Chan et al. (2018) and Eisele et al. (2020) using transaction-level data. This is because, unlike in equities, it is possible to identify offsetting bond trades at these low frequencies due to the lack of liquidity in this market.

[3]We limit our sample to holdings disclosures that occur at the monthly, bi-monthly, or quarterly frequencies. The most frequent disclosure period is a month in our sample, though the SEC only requires funds to disclose their holdings at the quarterly level.

We find that our two measures, although derived from different data sources, exhibit a strong positive correlation of about 83%. It is important to note that, despite the methodological improvements, our measures also have some weaknesses, though the two measures are complementary and help mitigate each other's limitations. For example, the *Off-Tape Cross* measure may miss smaller cross trades or cross trades involving more liquid bonds, whereas the *Fund Offset Cross* measure is not sensitive to bond liquidity or trade size. Conversely, the *Fund Offset Cross* measure only captures internally matched transactions involving two mutual funds. Because fund families often also have funds that are not registered investment companies, such as separate accounts or common investment trusts, some cross trades may occur between a mutual fund and a non-mutual fund affiliate. For these transactions, there are no observable offsetting trades in the mutual fund data, but they can be captured by our *Off-Tape Cross* measure. Despite their complementary strengths, our measures likely underestimate cross trading in corporate bonds.

Mutual fund trading activity in corporate bonds is economically large. The total trading volume inferred from holdings represents approximately 20% of the customer volume reported in TRACE, on average. Importantly, it is not uncommon that trades by mutual funds exceed that reported in TRACE. For example, at the mutual fund industry level, the *Off-Tape Cross* indicator takes the value of one in 11.4% of the bond-quarters in our sample, indicating that total trading by mutual funds frequently exceeds the corresponding TRACE figure. This industry statistic also points to significant additional liquidity in the bond market not captured by TRACE. In terms of total notional amount, the corresponding statistic is 7.9%.[4]

Our *Off-Tape Cross* indicator also identifies an economically significant number of cross trades at more granular levels: at the bond-$fund$-quarter level, for approximately 2.50% of

[4]To compare this figure to those reported for equity funds, Eisele et al. (2020) estimate that roughly 4% of the equity dollar volume traded by mutual funds is internally crossed based on transaction-level data (this finding is significantly lower than the 12% figure inferred from equity holdings, but likely downward biased due to the significant selection bias in Ancerno).

observations, a fund's trade exceeds the total TRACE-reported trade for the bond in the quarter and at the bond-$family$-quarter level, the average proportion of *Off-Tape Cross* trades is 3.30%, while the corresponding figure for *Fund Offset Crosses* is 4.90%.[5]

There is large dispersion in the prevalence of cross trading across bonds and fund families. In cross-sectional analyses, we find that cross trading is more prevalent in illiquid, hard-to-obtain bonds. Not surprisingly, large fund families are more likely to cross trade, presumably because there are more potential counterparties for these internal trades and because large fund families have better access to the technology and compliance systems necessary to facilitate cross trades.

There is also dispersion in the timing of cross trading within bonds and within fund families. We examine the impact of three bond- and fund-specific shocks on cross trading activity: 1) shifts in demand around maturity thresholds (Bretscher et al. (2024)), 2) credit rating changes, and 3) fund families with extreme flows. We find that our cross trading metrics significantly increase around all three events, suggesting that cross trading can be beneficial to families in times of stress, and may even dampen the market impact of these shocks.

Cross trading entails important trade-offs. On the one hand, it can benefit both parties by reducing transaction costs. This is especially relevant in corporate bond markets, where transaction costs tend to be high. Indeed, our results thus far point towards the advantages of cross trading. On the other hand, the lack of transparency raises concerns about conflicts of interest. Fund families may strategically use cross trades to subsidize their high-value funds at the expense of low-value funds (Gaspar et al., 2006b). In the final section of the paper, we explore this trade-off.

[5]One concern is that ETF creation and redemption 'trades' are not reported to TRACE. While we exclude all ETFs and Vanguard funds with substantial ETF share classes from the analyses, non-ETF mutual funds can, in some circumstances, exchange a basket of bonds for ETF shares. We show that this explanation is unlikely to significantly affect our cross trading measures.

We begin by examining potential conflicts within fund families using our *Fund Offset Cross* measure, which allows us to observe the funds on both sides of the cross trade. For every within-family cross, we identify the triggering fund (i.e., the fund initiating the trade) and the counterparty fund(s) (i.e., those taking the opposite side). We find that triggering funds are more likely to experience extreme outflows, while counterparty funds are more likely to experience extreme inflows, suggesting a motive to trade for both parties. We also test whether triggering and counterparty funds differ along dimensions previously linked to funds being high/low value in the family, such as fees, past performance, age, and size. Although we find no systematic differences in most characteristics, triggering funds tend to have higher fees than their counterparties.

Given this result, we examine whether cross trades transfer performance from counterparty to triggering funds by constructing a return spread between the two. We find no difference in returns during the period when the cross trade occurs, or in subsequent quarters, perhaps because both sides benefit from transaction cost savings.

We then turn to assessing the transaction cost savings from cross trading. We compute back-of-the-envelope estimates of realized savings on transaction costs using our two measures of cross trades. In aggregate, we estimate that the mutual fund industry saves at least $20 million each quarter, suggesting they are able to avoid about 8% of transaction costs by trading with other funds or affiliates rather than trading with traditional mechanisms.

Finally, we examine the effect of the September 2022 rule change on cross trading activity, as the new Rule 2a-5 imposes significant constraints on internal transactions of illiquid assets. The results reveal economically large declines in both cross trading measures after the reform for both investment grade and high yield bonds. These reductions may be beneficial in reducing the potential for cross-fund subsidization, but they will also have a non-trivial impact on transaction costs savings generated from cross trading.

To the best of our knowledge, this is the first paper on cross trading in corporate bonds. As such, we contribute to the cross trading literature, which, to date, has largely focused on equity funds.[6] The literature generally raises concerns about conflicts of interest in cross trading activities. Although we find some evidence that high-fee funds may cross strategically with low-fee funds, unlike the equity literature, we do not find that cross trading results in the outperformance of high-value funds at the expense of low-value funds.

We also contribute to several other strands of research. First, our paper is related to studies on bond fund trading. Papers in this literature examine the implications of fund trading on bond fragility (see, for example, Manconi et al. (2012), Goldstein et al. (2017), Cai et al. (2019), Anand et al. (2021), and Jiang et al. (2021)), reaching for yield (Choi and Kronlund (2018)), and trading around news (Huang et al. (2025)). Our paper shows that cross trading can be beneficial around bond and fund family shocks. Second, we also contribute to the literature that documents large trading costs in the corporate bond market.[7] We show that fund families use cross trading as a means to reduce these costs. Third, our paper is related to the literature on corporate bond primary markets (see, for example, Flanagan et al. (2020), Nikolova et al. (2020), Goldstein et al. (2021), Nagler and Ottonello (2022), and Bessembinder et al. (2022)). Our paper suggests that cross trading may be an effective tool to retain hard-to-obtain bonds in-house.

2 Institutional Background

Section 17(a) of the Investment Advisers Act of 1940 generally prohibits trades between affiliated entities, including funds managed by the same investment adviser. Rule 17a-7, adopted in 1966, offers an exemption however, which under certain strict conditions allows

[6]Papers in this literature include Gaspar et al. (2006a), Chuprinin et al. (2015), Eisele et al. (2020), Chan et al. (2018), Casavecchia and Tiwari (2016), and Del Guercio et al. (2018).

[7]See e.g., Schultz (2001), Bessembinder et al. (2006), Edwards and Piwowar (2007), Goldstein et al. (2007), Harris (2016), Dick-Nielsen and Rossi (2019), Goldstein and Hotchkiss (2020), and Choi et al. (2024).

the sale of a security held by one fund directly to another fund in the family. Such 'cross trading' is permitted as long as these trades meet the fiduciary duty of the investment adviser to provide best execution to both sides of the transaction. Additionally, the rule only permits cross trades in securities for which "market quotations are readily available" and prohibits any brokerage commission or fee payments other than transfer fees.

While market quotations are generally not available for many fixed income securities, the Securities and Exchange Commission (SEC) issued several no-action letters in the early 1990s specifically to allow cross trades of municipal bonds. In the no-action relief, the SEC permits cross trading at prices obtained from pricing vendors as long as they are objectively determined, can be independently verified, and are fair to both funds involved in the transaction. While the SEC never formally addressed cross trading in other fixed-income securities, both the Commission and the industry applied the criteria described in the municipal bond relief for the in-house purchase and sale of fixed-income assets in general, including corporate bonds. Moreover, later SEC legislative releases continued to maintain flexibility and ambiguity in whether evaluated prices can be used for these transactions (e.g., the pricing flexibility shows up in the money market rules in 2014 or the 2016 liquidity management rule).

Despite the lack of a formal regulatory treatment, a member survey by the Investment Company Institute (ICI) indicates that cross trades in fixed income securities were quite common in 2020. Specifically, 43% of the 2,266 funds holding fixed-income securities in the ICI's survey report engaging in the practice.

The ICI conducted the member survey because in 2020, the SEC proposed new Rule 2a-5 ('fair value rule') which significantly tightens the interpretation of readily available market quotations. The rule became effective in September 2022. In the final rule, the Commission specifically states that "evaluated prices are not readily available market quotations." It thus removes previous flexibility in the legislative language, significantly limiting cross trading

in fixed income securities. Finally, though the Commission simultaneously began soliciting comments for a potential reform of Rule 17a-7 itself, currently, there are no further updates on this legislative agenda.

3 Data and Measures

3.1 Data Sources

We use various data sources to construct our cross-trade measures. We merge the Mergent Fixed Income Securities Database (FISD), which includes corporate bond-specific information, with Trade Reporting and Compliance Engine (TRACE) data, which includes corporate bond transactions, and with the CRSP Survivor-bias Free Mutual Fund Database, which includes the mutual fund holdings data. Table A2 provides a summary of the data sources.

We first construct our initial sample of corporate bonds using FISD. We select non-puttable or convertible U.S. Corporate Debentures and U.S. Corporate Bank Notes (identified as bond type CDEB or USBN) that have complete issuance information, including offering date, amount, and maturity.[8] This selection results in an initial sample of 59,064 unique bonds.

We merge this sample of bonds with TRACE to obtain corporate bond transaction data. We link the FISD data to TRACE data using the CUSIP identifier, resulting in a sample of 42,942 bonds and 188 million trades. We apply additional filters to the transactions data. We exclude bonds with fewer than five trades over the sample period. Trades are excluded if they are flagged as primary market trades, if their reported size exceeds the bond's offering amount, or if they are reported after the bond's outstanding amount falls to zero. We exclude trades coded as affiliate trades (where a FINRA registered broker dealer transfers a bond to their non-FINRA registered broker dealer affiliates) and trades by a specific dealer that

[8]We exclude the following types of debt: retail notes, foreign government, agency, municipal, pass- through trusts, pay in kind, strips, zeros, Eurobonds/Euronotes, asset and mortgage backed, insured, and guaranteed by letters of credit, medium term notes/zeros, convertible, and foreign currency.

during 2014, reported an immediately offsetting transaction for most of its principal trades with an affiliated offshore entity, both of which result in the double counting of trades.[9] After implementing these filters, the sample is reduced to 183 million secondary market transactions in 41,993 distinct CUSIPs over the January 2002 to June 2023 period. Because the CRSP holdings data are known to become reliable beginning in 2008 (Schwarz and Potter (2016)), we restrict the sample to the January 2008 to June 2023 period, yielding 138.5 million secondary market transactions in 34,371 distinct CUSIPs.

Using this sample of bonds, we next merge with CRSP holdings data. Panel B of Table A2 shows our steps in detail. We start by cleaning the CRSP holdings data at the most granular level: we require that cusips (`cusip`) are available for the constituent securities. Report dates (`report_dt`) are pushed to the last calendar day of the month. Since funds may revise their holdings disclosures over time by filing amendments, for each fund, security, and report date, we take the fund's position (`nbr_shares`) on the most recent effective date (`eff_dt`).

We infer mutual fund trades from changes in their holdings (i.e., changes in the `nbr_shares` variable). We calculate changes in holdings from consecutive holdings disclosures, that is, from position changes between the previous report date and the report date corresponding to each holdings report. To do so, we identify the complete list of fund and report date pairs available in the CRSP fund holdings file. We find that about 70% of the CRSP holdings are reported at the monthly frequency, but some funds only report bi-monthly or quarterly. In a few cases, the gap between reporting dates is longer than a quarter. We exclude these observations. Our final sample includes holdings disclosures that occur at the monthly, bi-monthly, or quarterly frequencies.

We compare the number of shares in each security in each fund's holdings on consecutive report dates and compute changes in holdings, i.e., trades. We then restrict our sample to

[9]This filter is commonly used in the literature (see, e.g., Bessembinder et al. (2018)). In robustness tests, we show our cross trading measure that relies on TRACE trading volume is robust to the inclusion of these trades.

reporting periods in which the fund holds or trades[10] at least one corporate bond using the 59,064 corporate bond cusips described above. This yields 56,238,384 observations in units of fund × cusip × report date. We only keep observations corresponding to non-zero holding changes (i.e., we only retain trades), leading to 17,950,545 observations in units of fund × cusip × report date.

We apply several filters to eliminate observations that may imply spurious holdings changes by a fund. We exclude observations for which a fund's report date is either prior to the bond's offering date or after the bond's maturity date. We delete observations if the gap between the fund's current and previous holdings disclosure is longer than three months, as mentioned above. We delete bond holdings if they mature within a year, or if a fund's trade is larger than the bond's offering amount. In addition, we delete observations that correspond to potential fund reclassification events.[11] To identify fund reclassification events, we use two criteria: 1) a fund experiences greater than 90% of inflows or outflows, and 2) a fund holds more than 5 bonds and trades more than 95% of its bonds. That is, the fund has a large inflow and more than 95% of its bond positions increase during the holding period, or has a large outflow and more than 95% of the bonds are sold. Furthermore, we exclude funds with ETF share classes that are larger than 10% of the fund's total assets. This insures that all ETFs are dropped. Additionally, Vanguard funds with significant ETF share classes are also dropped from our sample. Furthermore, we exclude observations corresponding to bonds that are maturing in the current quarter or are issued in the current quarter.

Finally, for our baseline analyses, we aggregate the data to the quarterly level to accommodate the heterogeneity in reporting frequencies in our sample. At the fund-level, this step leads to 7,114,778 observations in units of fund × cusip × quarter, which will be the basis of our fund-level tests. Similarly, our other baseline aggregation level is at the unit of

[10]The latter is needed for cases where the fund no longer holds the bond at the report date, but had a non-zero position at the previous report date.

[11]We thank the economists at the Investment Company Institute for suggesting this.

the family. For the family-level analyses, we identify fund families using the management name (`mgmt_name`) variable from the CRSP Mutual Fund Database and the methodology proposed in Dannhauser and Spiker III (2023). Unfortunately, some funds in the CRSP holdings database do not have matching family information. The family-level aggregation results in 3,168,230 observations in units of family × cusip × quarter. Finally, in some analyses, we also aggregate our data to the 'industry' level by summing across trades in each bond by all mutual funds. Our industry-level analysis is based on 465,921 observations in units of cusip × quarter.

In Section 5.2, we estimate transaction cost saving from cross-trading. To do so, we obtain monthly bid-ask spread estimates for bonds from the WRDS Bond Returns database.

3.2 Summary Statistics

Our data sample contains all fund trades from the CRSP holdings database that involve corporate bonds (i.e., we retain all non-zero fund report date bond trade observations). Tables 1 and 2 provide summary statistics. Panel A of Table 1 shows that our final merged sample contains 32,564 unique corporate bonds, indicating that mutual funds trade the large majority of the 34,371 corporate bonds we identify from FISD and TRACE. The table also reveals that, consistent with prior literature (Choi and Kronlund (2018), for instance), the number of corporate bonds held by funds has steadily increased in recent years. There are a total of 665 unique fund families in our sample, but the number of fund families each year is 342, at most. Similarly, our sample includes 4,777 unique funds, but the number of funds each year is at most 2,201.

Columns (3)-(4) in Panel B display summary statistics at the family level based on mutual fund holdings. Column (3) shows that a family holds an average of 5.8 million shares in a bond during the average quarter. Column (4) reports that when more than two funds within a family hold a bond simultaneously, their aggregate position is significantly larger,

11.3 million shares on average. Columns (5)-(8) are based on mutual funds with non-zero changes in their holdings. Columns (5) and (6) show that on average 2.16 funds within a family change their positions, with an average change of about 3 million shares each quarter.

Table 2 compares funds' total changes in holdings to the reported trading volume on TRACE. Column (3) shows that the aggregate position changes of mutual funds are about 20% of the total reported trading volume on TRACE (Column (7)).

3.3 Cross Trading Measures

3.3.1 Measure One: Off-Tape Cross Trading

Our first measure, *Off-Tape Cross*, compares mutual fund trades with the trading volume reported on TRACE. As described above, we measure fund f's trade in bond i in quarter q by the corresponding holdings change, $\Delta Holdings_{i,f,q}$ identified from CRSP. We also aggregate these trades—separately for buys (positive changes) and sells (negative changes)—to the family and industry levels. Fund-level and, similarly, aggregate positive (or negative) changes in the holdings are then compared with customer buy (or sell) volume reported on TRACE.

For example, the *Off-tape Cross* indicator at the industry level is a dichotomous variable defined for each bond i and quarter q as follows:

$$\textit{Off-tape Cross Indicator}_{i,q} = \begin{cases} 1 & \text{if } \sum_f (\Delta Holdings_{i,f,q})^+ > Customer\ Buy\ Volume_{i,q} \\ & \text{or } \sum_f (\Delta Holdings_{i,f,q})^- > Customer\ Sell\ Volume_{i,q} \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

where the superscripted quantities are defined as

$$(\Delta Holdings_{i,f,q})^+ = \begin{cases} \Delta Holdings_{i,f,q} & \text{if } \Delta Holdings_{i,f,q} \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

$$(\Delta Holdings_{i,f,q})^- = \begin{cases} -\Delta Holdings_{i,f,q} & \text{if } \Delta Holdings_{i,f,q} \leq 0 \\ 0 & \text{otherwise} \end{cases}$$

and $Customer\ Buy\ Volume_{i,q}$ and $Customer\ Sell\ Volume_{i,q}$ refer to the total customer-initiated buy and sell volumes, respectively, in bond i during quarter q reported on TRACE.

In order to gauge the magnitude of off-tape crossing in terms of notional amounts at the industry level, we define a companion continuous variable using the volume quantities for each bond i and quarter q:

$$\begin{aligned} \textit{Off-tape Cross}_{i,q} = & \frac{Max\left[0, \left(\sum_f \Delta Holdings_{i,f,q}\right)^{+} - Customer\ Buy\ Volume_{i,q}\right]}{Change\,in\,total\,holdings_{i,q}} \\ & + \frac{Max\left[0, \left(\sum_f \Delta Holdings_{i,f,q}\right)^{-} - Customer\ Sell\ Volume_{i,q}\right]}{Change\,in\,total\,holdings_{i,q}} \end{aligned} \quad (2)$$

The corresponding *Off-tape Cross* indicators and the *Off-tape Cross* measures at the fund or family levels are denoted by an additional subscript. For example, the off-tape cross indicator variable at the family level is denoted by $\textit{Off-tape Cross Indicator}_{i,F,q}$ for each bond i, family F, and quarter q. Its counterpart continuous measure, $\textit{Off-tape Cross}_{i,F,q}$, is defined as

$$\begin{aligned} \textit{Off-tape Cross}_{i,F,q} = & \frac{Max\left[0, \left(\sum_{f\in F} \Delta Holdings_{i,f,q}\right)^{+} - Customer\ Buy\ Volume_{i,q}\right]}{Change\,in\,total\,holdings_{i,F,q}} \\ & + \frac{Max\left[0, \left(\sum_{f\in F} \Delta Holdings_{i,f,q}\right)^{-} - Customer\ Sell\ Volume_{i,q}\right]}{Change\,in\,total\,holdings_{i,F,q}} \end{aligned} \quad (3)$$

Note that compared to the industry-level definition in Eqn. (2), the change in total fund holdings in the numerator is aggregated to family F and that the change in total holdings in

the denominator is also restricted to family F. The unaggregated fund-level measures are denoted by *Off-tape Cross Indicator*$_{i,f,q}$ and *Off-tape Cross*$_{i,f,q}$.

3.3.2 Measure Two: Cross Trading between Mutual Funds

Our second measure is at the family level. We first define the fund offset cross variable (FOCI), *Fund Offset Cross Indicator*$_{i,F,q}$, for each bond i, family F, and quarter q. *Fund Offset Cross Indicator*$_{i,F,q}$ is a dichotomous variable that takes the value of 1 if total buy trades and total sell trades in bond i, in family F, and quarter q are both non-zero and are within 2% of each other, and zero otherwise. Specifically,

$$\textit{Fund Offset Cross Indicator}_{i,F,q} = \begin{cases} 1 & \text{if } \sum_{f\in S}(\Delta Holdings_{i,f,q})^{+} \approx \sum_{f\in S'}(\Delta Holdings_{i,f,q})^{-} \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

where S and S' indicate non-empty subsets, that is, cases where trades are non-zero.

We also consider a corresponding continuous variable, *Fund Offset Cross*$_{i,F,q}$ (FOC), defined as the ratio of the volume that involves internal cross trades to the total volume of the bond traded within the family during the quarter:

$$\textit{Fund Offset Cross}_{i,F,q} = \begin{cases} \frac{\sum_{f\in S}(\Delta Holdings_{i,f,q})^{+}+\sum_{f\in S'}(\Delta Holdings_{i,f,q})^{-}}{Change\,in\,total\,holdings_{i,F,q}} & \text{if } FOCI_{i,F,q}=1 \\ 0 & \text{otherwise} \end{cases} \tag{5}$$

Note that unlike the *Off-tape Cross* measures in section 3.3.1 above, these cross measures do not reference the reported trading volume on TRACE, but rather attempt to match near-offsetting quarterly buys and sells in a bond within the family.

Some families concentrate their fund lineup in certain investment styles, while others offer a diverse set of options to their clients. This implies that the availability of potential

counterparties and, therefore, the feasibility of internal trades may vary substantially across funds. We therefore also devise conditional measures to take this into account. Specifically, we argue that if a larger number of funds hold similar bonds within the family, they are potentially more likely to cross trade with each other.

To do so, we first sort bonds into 18 categories based on credit ratings (IG or not), size of issuance (small, medium, or large), and time to maturity (short, intermediate, or long). For each category, we count the number of funds that held bonds in that category in any of the prior four quarters. In our conditional analyses, we re-estimate our cross-trading measures by requiring at least 2 funds in each category. We also repeat this analysis by requiring 5 funds in each category.

Furthermore, we perform two additional robustness tests. First, while our main analysis is at the quarterly level, we also re-estimate our measures using information from the subsample of holdings reports that are filed at the monthly frequency. Specifically, if two funds cross trade a bond during *any* of the months in a quarter based on monthly holdings, we replace our quarter-level indicator by one. Second, we combine the CRSP mutual fund holdings data with fund holdings in the eMaxx database. Since the eMaxx database includes funds outside the mutual fund industry, this gives us a larger sample of funds that may engage in cross trading. Unfortunately, we are limited to a small snapshot of the eMaxx data.

4 Cross Trading Patterns

In this section, we examine cross trading patterns. We first assess the prevalence of cross trading. We then then consider whether cross trading frequency varies across bond characteristics, families, and over time, and formally examine the determinants of cross trading. In the third set of tests, we examine cross trading behavior around fund-level and bond-specific shocks. Finally, we conduct robustness tests to ensure the *Off-Tape Cross* measure is not driven by

ETF creation and redemption activity or the trades that are included in the aggregation of TRACE volume.

4.1 Prevalence of Cross Trading

We first examine the prevalence of cross trading in the corporate bond market. In Table 3, we report univariate statistics for our two measures as indicators,[12] and aggregated at the bond-quarter level, the bond-family-quarter level, and the bond-family-quarter level.

Table 3 shows that cross trading in corporate bonds is common. Panel A provides summary statistics using the main sample. Columns (1)-(3) report the percentage of cross trades based on our first measures discussed in subsection 3.3.1 (*Off-tape Cross*). The corresponding figures using the second measures discussed in subsection 3.3.2 (*Fund Offset Cross*) are tabulated in column (4). Finally, to compare our cross trading measures to the traditional holdings-inferred metric used in previous studies (see, e.g., Gaspar et al. (2006a) or Chuprinin et al. (2015)), we also report statistics for the 'maximum available to cross' in column (5). The union of our two measures is presented in Column (6).

Column (1) shows that at the bond-industry level, *Off-tape cross* trades account for 11.4% of trades in the total sample, while column (2) reports that they represent around 3.3% of the observations at the bond, fund family, and quarterly level. The bond, fund, and quarter level estimates in column (3) indicate that cross trades account for around 2.5% of all trades. The corresponding results for *Fund Offset Cross* in columns (4) shows that 4.9% of trades are cross trades between mutual funds. Finally, the results based on the traditional cross trade measure, *Max Avail to Cross*, points to a higher prevalence of cross trades. Column (5) shows 15.3% of trades are crossed based on the maximum available trade measure.

We next re-examine the frequency of cross trades using additional approaches and report the results in Table A3 in the Appendix. First, we use the conditional analyses described

[12]We report univariate statistics for our measures as dollar par values in the Appendix in Table A3.

above, which take into account the availability of counterparties, i.e., the feasibility of internal transactions. In this approach, we place bonds into 18 portfolios based on rating (investment grade, high yield/no rating), issue size (less than $500 million, $500 to $1 billion, $1 billion or greater), and age (3 years or less, 3 to 10 years, greater than ten years). We then restrict our sample to cusip-family-quarter observations for which at least two funds in the family held a bond in the same portfolio in any of the previous four quarters. In our second approach, we re-calculate our cross trade measures by using information from monthly holdings disclosures, when available. Finally, we also combine the two approaches, providing conditional monthly estimates. Not surprisingly, these refinements increase both the percentage of *Off-tape cross* trades and our second measure, *Fund Offset Cross*. For example, at the fund family level, the conditional monthly *Off-tape* measure is about 5.3%. Similarly, the revised quarterly measure, which incorporates the additional information contained in the more frequent filings, increases to 5.7%.

We next show that our two cross trading measures (*Off-Tape Cross* and *Fund Offset Cross*), are correlated despite being constructed using different data. In Panel A of Figure 1, we examine our three indicator measures over time. The averages are taken first across bonds per family and then across families. The average *Off-Tape Cross* indicator is correlated with that of the *Fund Offset Cross* indicator with a correlation coefficient of 0.83. Panel B shows the time series of the averages of their corresponding continuous measures. Panel C shows the temporal series of the averages of the *Off-Tape Cross* indicator and the continuous *Off-Tape Cross* measure at the industry level. In addition, Figure A1 shows that the proportion of *Fund Offset Cross* trades in the group tagged as *Off-Tape Cross* is larger than the one in the non-off-tape cross group. This indicates that the *Off-Tape Cross* at the family level is positively correlated with the *Fund offset Cross* measure.

There is large dispersion in the prevalence of cross trading across bonds and fund families. In the Appendix, Figure A2 Panels B and D show that around 40% of bonds are rarely cross

traded, while around a third of bonds are crossed more than 10% of bond-quarters. Panel A and C show that the *Off-Tape Cross* and *Fund Offset Cross* indicators are widely dispersed across families. In Panel A, almost 20% of families avoid cross trading entirely in a given bond-quarter, while around 15% of families cross more than 10% of bond-quarters. Many families display high cross trading—at around 3-4%—consistent with Table A1.

4.2 Determinants of Cross Trading

Given the large dispersion in the extent of cross trading across bonds and families documented in Figure A2, we next examine the specific characteristics of bonds and families associated with cross trading.

In Table 3, we conduct cross-sectional analyses and report the prevalence of cross trading across various bond characteristics. The results in columns (1)-(4) indicate that *Off-Tape Cross* and *Fund Offset Cross* are more common for the less traded, the less liquid and the smaller issue bonds. For example, for bonds that trade infrequently, 13.0% of bond-family-quarters have a positive *Off-Tape Cross* indicator (column (2)) and 9.4% have a positive *Fund Offset Cross* indicator (column (4)), whereas for the most liquid bonds, less than 1.0% of bond-family-quarters have a positive *Off-Tape Cross* indicator and 3.0% have a positive *Fund Offset Cross* indicator. Overall, the results in Table 3 display a clear relation between bond characteristics associated with illiquidity and the propensity to cross trade.

The results in Table 3 indicate no clear patterns in the relation between cross trading and public versus private status and bond age. While 144A bonds and shorter maturity bonds have higher levels of *Off-Tape Cross*, no such patterns exist for *Fund Offset Cross*, likely because it is more difficult to locate a mutual fund counterparty for private and short maturity bonds which are less likely to be held in many mutual fund portfolios within a family.

We next examine whether some families are more likely to cross trade than others. Intuitively, the extent of cross trading should vary with family size and the presence of multiple funds with overlapping investment styles: in both cases a fund desiring to cross trade can more easily locate a potential counterparty.

Figure 2 verifies this intuition. In each quarter, we consider a family as large (or small) if their total net assets are in the top (or bottom) quartile. We then report the percentage of family-quarters with an average cross trade indicator in the top 25% of the distribution for small, medium, and large families. Panel A shows that for large families, the percentage of family-quarters with an average *Off-Tape Cross* indicator in the top 25% is almost 40% and panel B shows the same percentage for the *Fund Offset Cross* indicator is about 70%.

Table 4 shows the determinants of cross trading in a multivariate framework and reports regressions of cross trade measures on bond and family characteristics. The dependent variables are the *Off-Tape Cross* and *Fund Offset Cross* indicators, measured at the bond-family-quarter level.

Columns (1)-(2) of Table 4 examine the impact of bond characteristics on the propensity to cross trade. These regressions include family x quarter fixed effects to control for time-varying family characteristics that might affect the likelihood of crossing. Standard errors are clustered at the bond level. Consistent with Table 3, Table 4 shows that lack of liquidity is a significant determinant of cross trading by mutual funds—the coefficient on the natural log of the number of trades in the bond in the previous quarter is statistically significant at the 1% level in columns (1) and (2).

Columns (3)-(4) of Table 4 examine the relation between family characteristics and the propensity to cross trade. To control for time-varying bond characteristics that affect cross trading, these regressions include bond x quarter fixed effects. Standard errors are clustered at the family level. Column (3) shows that larger families are more likely to off-tape cross

trade and column (4) shows that families with more funds holding similar bonds are more likely to cross trade with other mutual funds in the family.[13] Not surprisingly, the ability to locate a counterparty (gauged by family size or the incidence of funds with overlapping holdings) is a key determinant of the ability to cross trade.

Comparing the higher adjusted R^2 in column (3) versus column (1) indicates that *Off-tape cross* trading is largely driven by bond-specific factors (such as illiquidity) rather than family-specific factors. Alternatively, the the higher adjusted R^2 in column (2) versus column (4) indicates that *Fund Offset* cross trading is largely driven by family-specific factors (such as the ability to locate a mutual fund counterparty) rather than bond-specific factors.

4.3 Cross Trading Around Shocks

We next examine cross trading around three bond- and fund-specific shocks: 1) shifts in demand around maturity thresholds, 2) credit rating changes, and 3) funds with extreme inflows or outflows.

4.3.1 Cross Trading Around Maturity Thresholds

Passive corporate bond funds track the returns of their underlying benchmark indices. Often, the benchmark index is based on maturity categories and, as a result, funds benchmarked to such indices have strict maturity mandates. There are three primary thresholds: long-term indices, which include bonds with maturities exceeding 10 years; intermediate-term indices, covering bonds with maturities between 5 and 10 years; and short-term indices, which include bonds with maturities between 1 and 5 years or 1 and 3 years. The largest share of passive bond mutual fund assets is benchmarked to short-term indices, with intermediate-term indices attracting significantly fewer assets, and long-term indices being the least popular. As a

[13]The variable '# Similar Funds' is the number of funds in the family holding similar bonds in the previous four quarters. Similar bonds are defined using 18 categories based on credit ratings (investment grade or not), size of issuance (small, medium or large), and time to maturity (short, intermediate, or long).

result, demand from index funds increases sharply as bonds age and shift from the long-term to intermediate-term category, or from intermediate-term to short-term. Bretscher et al. (2024) show that these maturity mandates for passive funds present non-fundamental demand shocks in the bond market.

We investigate whether funds engage in cross trading during these events. As in Bretscher et al. (2024), our analyses are limited to investment grade bonds and use the 10-, 5-, and 3-year maturity cutoffs. We examine cross trading four quarters before and after each threshold. Figure 3 displays our *Off-Tape Cross* measure at the industry level for maturity thresholds of 3, 5, and 10 years. The figure shows that our *Off-Tape Cross* measure increases at the onset of the demand shocks t=0, from 7.8% to 14.0% for the three year threshold and from 6.7% to 13% for the five year threshold. We do not find significant changes around the 10 year threshold.

Panels D to F display our *Off-Tape Cross* measure at the family level, while the corresponding results for the *Fund Offset Cross* measure are shown in Panels G to I. In all cases, we find sharp increases in our measures at the maturity threshold events. Bretscher et al. (2024) document that trading volume in the market significantly increases during the maturity event times. Our results imply that internal fund trades also increase significantly. Therefore, the magnitude of these non-fundamental demand shocks is greater than that captured in Bretscher et al. (2024) using TRACE.

4.3.2 Cross Trading Around Credit Rating Changes

Next, we examine how cross trading activity varies around bond upgrade and downgrade events. Bond rating changes often draw significant investor attention, not only because of the information content, but also due to the potential shift in investor base that follows a change in rating. Investment grade and high yield bonds typically operate in segmented markets, as certain institutional investors—such as insurance companies—face regulatory constraints

that limit their ability to hold high yield bonds (Chernenko and Sunderam (2012); Becker and Ivashina (2015)).

Mutual funds with different investment mandates also hold different types of bonds. For example, high yield corporate bond funds typically allocate the majority of their holdings to high yield bonds. When a bond's rating crosses the investment grade threshold, mutual funds may need to adjust their portfolios by buying or selling the newly rated bonds to follow their investment mandate or maintain their risk profile. Rather than selling the bond on the lit market, mutual funds may opt to exchange it internally with other affiliated funds if they have such options.

We obtain bond credit rating information from Mergent Fixed Income Securities Database (FISD), and identify rating changes based on agency classifications.[14] We define a downgrade event as a transition from investment grade to high yield, and an upgrade as the reverse. We exclude the Covid-19 period from 2020Q1 to 2020Q2, during which the corporate bond market experienced massive downgrades.[15] Over our sample period from 2008 to 2023, 3,294 bonds experienced upgrades from high yield to investment grade and 1,372 bonds experienced downgrades from investment grade to high yield.[16]

Figure 4 shows the dynamics of *Off-Tape Cross* and *Fund Offset Cross* measures over four quarters before and after the rating events. Rating changes occur between quarter 0 and quarter 1. As shown in Panels A and B, when bonds are upgraded from high yield to

[14]Following convention, a bond is classified as high yield if its rating is below BBB– from Standard & Poor's or Fitch's, or below Baa3 from Moody's. Since ratings across the three rating agencies do not always agree, we assign ratings to bonds for each month using a 'pecking order' rule. Specifically, if the rating from Standard & Poor's is below BBB-, we classify the bond as high-yield, and investment grade otherwise. If no rating is available from Standard & Poor's, we designate bonds as investment grade or high yield based on Moody's ratings. Finally, if no ratings are available from these two agencies, we use Fitch's rating to evaluate the bond.

[15]Our results are qualitatively simlar when we include this time period.

[16]Credit rating changes are not necessarily exogenous events. Prior literature has shown that some downgrades are anticipated by the market (Goh and Ederington (1993)). Moreover, because some credit ratings are paid by issuers, potential conflicts of interest may arise (Becker and Milbourn (2011)). Therefore, our analysis focuses on the association between cross trading behaviors and bonds' rating changes rather than drawing causal claims.

investment grade, family-level *Off-Tape Cross* indicators increase significantly. Similarly, *Fund Offset Cross* also increases following upgrades. During downgrades, both the family-level *Off-Tape Cross* and *Fund Offset Cross* measures increase one quarter preceding the rating changes. This is consistent with prior literature which finds that bond downgrades may be anticipated ahead of time (Ellul et al. (2011)). The *Fund Offset Cross* measure declines in the longer term, likely due to a reduced pool of investors willing to trade high yield bonds compared to when the bonds were classified as investment grade.

4.3.3 Cross Trading Around Extreme Fund Flows

We next consider the extent of cross trading around extreme fund withdrawals or deposits. We first motivate this analysis with the high-profile and fund-specific (rather than bond- or market-specific) shock to the PIMCO Total Return Fund.

The PIMCO Total Return Fund was once the largest bond fund with $293 billion in assets under management in April 2013. After the unexpected departure of its founder, Bill Gross, in September 2014, the fund encountered large redemptions for consecutive months. The pace of these outflows was significant: investors withdrew $27.5 billion in October, $9.5 billion in November, and $143.4 billion in December from the Total Return Fund, totaling more than $180 billion in outflows during the fourth quarter of 2014. Theses outflows were more than four times greater than that for the entire year of 2013.

Market participants anticipated that the Total Return Fund would be forced to unload holdings at fire sale prices to meet these record withdrawals. Despite these expectations, the bond market was largely unaffected by this episode. One explanation for the lack of market impact, as described in a Bloomberg article following the event, was that PIMCO "held the fund's clearance sale in-house."[17]

[17] https://www.bloomberg.com/news/articles/2015-06-11/pimco-may-have-averted-fire-sale-after-gross-s-exit

In Figure 5, we report our cross trading measures around the departure of Bill Gross on September 26, 2014. We focus on bonds that were sold by Total Return Fund in Q4 2014 and Q1 2015, and report the prevalence of cross trading by PIMCO at the family-cusip-quarter level. Panel A shows large increases in *Off-Tape Cross*, rising from about 0.25% in Q3 2014 to more than 2% in Q4 2014 and Q1 2015. Likewise, Panel B indicates *Fund Offset Cross* increased more than threefold between Q3 2014 and Q4 2014.

We next examine whether families respond to extreme fund flows with increased cross trading across the full sample. We follow Choi et al. (2020) to identify corporate bond funds with large inflows or outflows. We retain only mutual funds with Lipper objective code A, BBB, HY, SII, SID, or IID or the CRSP objective code starting with IC and exclude exchange-traded funds, exchange-traded notes, and index funds. We retain funds with total net assets (TNA) of at least $1 million, with at least 20% of TNA invested in corporate bonds in the prior quarter, and without extreme changes to TNA (e.g., we require $0.5 \leq \frac{\text{TNA}_t}{\text{TNA}_{t-1}} < 3$).

We construct monthly flows as:

$$\text{flow}_{j,t} = \frac{TNA_{j,t} - TNA_{j,t-1} \cdot (1 + r_{j,t})}{TNA_{j,t-1}} \tag{6}$$

where $TNA_{j,t}$ is total net assets for fund j at the end of month t and $r_{j,t}$ is monthly returns for fund j over month t. Because monthly flows are constructed at the share class level, we construct a value-weighted portfolio flow based on funds' TNA in the previous month. Finally, we sum the monthly flows to the quarterly level. Our sample consists of 1,632 corporate bond funds and 38,717 fund-quarters.

To identify extreme fund flows, for each quarter, we place funds into deciles based on flows and retain funds in the top and bottom decile. We then create an indicator 'Extreme Flow' if the family has any fund in the top or bottom decile in the quarter.

Table 5 reports regressions of the cross trade measures on indicators for families that experience an extreme fund flow in a particular quarter. The dependent variables are the

Off-Tape Cross and *Fund Offset Cross* indicators, measured at the bond-family-quarter level. All regressions include bond x quarter fixed effects, which allows us to compare families trading the same bond in the same quarter. Standard errors are clustered at the family x quarter level.

We find families are more likely to cross trade when experiencing an extreme inflow or outflow. We find a significant relationship between crossing propensity and periods of extreme flows for both *Off-Tape Cross* and *Fund Offset Cross* in Columns 1 and 3. In Columns 2 and 4 of Table 5, we control for family size. We find similar results, although with reduced statistical significance when *Fund Offset Cross* is the dependent variable.

Overall, the results in Figure 5 and in Table 5 indicate that cross trading can be a powerful tool for families facing large client withdrawals or subscriptions.

4.4 Robustness

4.4.1 ETFs and Off-Tape Trades

ETF creation and redemption result in bond position changes in a fund's portfolio holdings. These position changes are not reported on TRACE. A potential concern is that our *Off-Tape Cross* measures may spuriously capture these creation and redemption activities in the ETF primary market and, as a result, may overestimate the true magnitude of internal cross trading.

While we exclude all ETFs and also Vanguard funds with substantial ETF share classes from the analyses, conversations with industry participants also reveal that non-ETF mutual funds can, in some circumstances, exchange a basket of bonds for ETF shares, essentially acting as quasi-APs. However, we believe that this latter activity is unlikely to have a significant effect on our measures.

First, our sample begins in 2008 when ETF activity was quite small. Our time series evidence shows that our measures are rather stable over time. Second, the average holdings changes of mutual funds, when the implied trading exceeds TRACE volumes is $6 million in par value, and the median is around $900,000 in par value. This is much larger than the average bond position exchanged with ETFs in the ETF primary market, as the realized baskets tend to contain a large number of securities (Koont et al. (2025)). Third, if a mutual fund exchanges its bonds for ETF shares, this requires the fund to 'sell' many bonds in the same direction and these bonds would overlap with the ETF basket portfolios. To gauge this possibility in each month of 2016, we construct the realized ETF basket portfolios using the daily ETF portfolio holdings from ETF global. We limit this exercise to 2016 because we have data on announced ETF creation and redemption baskets for this year. We then compare (a) the set of bonds in each mutual fund's portfolio that undergo position changes to (b) the bonds included both in the announced and in the realized ETF basket portfolios corresponding to all bond ETFs during the month. To construct the realized ETF basket, we follow the methodology in Shim and Todorov (2021).

We find that on average, only 1.4% of the bonds funds trades overlap with those in the ETF redemption or creation baskets. Conditional on the overlap, the trading directions and quantities of the two sets of bonds are similar only in 17.5% of the cases on average. Furthermore, we find that larger overlaps coincide with lower *Off-Tape Cross* values. This is not surprising, given the position size argument above. We also find that the results are similar when the announced ETF basket portfolio is used. Therefore, the contribution of ETF creation and redemption to cross trading appears to be negligible.

5 The Trade-Offs of Cross Trading

In this section, we examine the potential costs and benefits of cross trading, namely cross-fund subsidization (conflicts between crossing funds) and transaction cost savings that benefit both funds.

5.1 Cross-Fund Subsidization

Gaspar et al. (2006b) document that fund families often strategically cross-subsidize high value funds with low value funds using cross trading in the equity market. We examine whether cross-fund subsidization using cross trading is prevalent in the corporate bond market. In Section 4.3.3, we document that families with funds experiencing extreme flows are associated with elevated cross trading. In this section, we extend the analysis to a more granular level by identifying which funds within the family are "triggering" (i.e., initiating) the cross trade and which funds serve as the associated counterparty (i.e., offsetting the trade). We first explore whether triggering funds are more likely to be "high value" and counterparty funds to be "low value" as defined in Gaspar et al. (2006b). We then turn to the performance implications of cross trading at the fund level.

5.1.1 High Value Funds and Cross Trading

We identify the particular funds within a family that we can reasonably assume have engaged in cross trading. Our identification strategy looks for two scenarios in which opposite-signed trades occur for the same bond-month-family. The first case occurs when two funds trade in the same bond and period, near exact quantity, but of opposite sign (e.g., a $300,000 sell trade is offset with a single counterparty fund who buys $299,000). We refer to this case as a 1-to-1 cross trade. The second case arises when a fund simultaneously engages with multiple counterparties in the same bond and period, but of opposite sign. We refer to this

as a 1-to-many cross trade (e.g., a $300,000 sell trade is offset with two counterparties: both funds buy $148,000).[18]

Within each cross trade, we classify the fund initiating the cross trade as the *triggering* fund and the funds which support the other side of the trade as *counterparty* funds. In a 1-to-1 cross trade, we assume the triggering fund is the fund selling the bond; since funds can only sell bonds that are already held in their portfolio, but can buy any bond irrespective of prior ownership, it is likely the selling fund has triggered the trade. In a 1-to-many cross trade, we assume the triggering fund is the fund with the single largest trade size, while the counterparty funds are the ones providing the smaller offsetting positions.

We first examine the fund flows of triggering and counterparty funds and whether these funds are associated with characteristics linked with "high value" funds. Following Gaspar et al. (2006b) we classify funds as having a high value to the family if the fund has fees in the top quartile of funds within the family, if the fund has year-to-date returns in its investments style in the top quartile, or if the fund is a young fund with an age in the bottom quartile of funds in the family. We also classify funds as having a high value to the family if the fund size is in the highest quartile among funds in the family since larger funds contribute more to the families' revenues.[19]

Table 6 shows the results. We report measures for triggering funds crossing in the quarter (column 1), counterparty funds crossing in the quarter (column 2), and for funds with no crossing in the quarter (column 3). In columns 4-6 we present pairwise comparisons across the groups to gauge statistical differences. To ensure differences in characteristics across fund types is not driving the results, we report measures for both the full sample and for funds classified as corporate bond funds.

[18]The detailed procedure for identifying cross trades is described in Section A.1 of the Internet Appendix.

[19]Fund families are often compensated based on a certain percentage fee on assets under management (AUM).

In Panel A of Table 6, we report fund flow measures. We find that triggering funds are more likely to experience extreme outflows relative to counterparty funds. When focusing on the corporate bond fund sample, counterparty funds are also significantly more likely to experience extreme inflows compared to the triggering funds. Overall, there is some evidence that triggering funds with extreme outflows match with counterparty funds that desire to acquire more bonds (i.e., funds with extreme inflows). Looking at the bond fund sample, there is no clear evidence that triggering and counterparty funds differ in flow-to-performance.

In Panel B of Table 6, we show that triggering funds are more likely to be classified as high-fee funds relative to counterparty funds in both samples and, for the bond fund sample, are also more likely to be classified as high-fee funds relative to non-crossing funds. The triggering and counterparty funds do not show consistent differences for the other high value measures related to prior performance, size, and age.

Because we find some evidence of higher fees for triggering funds in Table 6, we further examine the association between cross trading and funds' fees using matched fund pairs. For each identified cross trade pair (e.g., each unique trigger-counterparty pair), we construct a control sample of non-cross traded fund pairs. The triggering fund is held fixed, and we pair it with other corporate bond funds in the same family that (i) have not participated in a cross trade in the past, and (ii) have traded corporate bonds within the past two years. This design ensures that the comparison isolates the effect of cross trading from the effect of being members of the same fund family. We aggregate cross trading across bonds using two measures: value-weighting or equal-weighting of the trade size. We estimate the following regression model:

$$Fee\ Spread_{i,j,t} = \beta Cross\ Trade_{i,j,t} + \gamma_{it} + \epsilon_{i,j,t} \tag{7}$$

where $Fee\ Spread_{i,j,t}$ is the value-weighted (equal-weighted) expense ratio difference between triggering fund i and the counterparty fund j in a specific quarter t. For the value-weighted

fee spread, the weights are proportional to the size of the cross trade between triggering fund i and counterparty fund j in quarter t. For the equal-weighted fee spread, each counterparty fund receives equal weight. $Cross\ Trade_{i,j,t}$ is an indicator of whether triggering fund i and counterparty fund j engage in cross trades in quarter t. γ_{it} is the cohort fixed effect, where cohort is defined as the sample of actual cross trade fund pairs with matched control fund pairs for a given triggering fund i in quarter t.

Table 7 reports the results. We find that cross traded fund pairs are more likely to have a larger fee spread compared to the matched fund pairs, in both value-weighted and equal-weighted measures. This indicates that when two funds pair to cross trade bonds within a family, the triggering fund often has higher fees relative to the counterparty funds. To further examine whether families strategically cross-subsidize high-fee funds with low-fee funds, we examine the consequence of the cross trades on funds' performance in the next section.

5.1.2 Consequence of Cross Trades on Performance

We now examine whether the cross trade has performance consequences for the triggering and counterparty funds. We apply a similar fund pair-level methodology as in Eq. (7), but focus on return spreads as the main dependent variable. We construct both a value-weighted return spread and equal-weighted return spread. The value-weighted return spread is calculated as the difference in style-adjusted fund net returns between the triggering fund and its counterparty funds, weighted by each counterparty's share of the absolute trading size relative to the total cross traded size for a given bond and reporting period. These trade-level return spreads are then aggregated to the fund pair at the quarterly level, with weights proportional to the absolute trade size of each bond for the triggering fund. The equal-weighted return spread is the difference in style-adjusted fund net returns between the triggering fund and its counterparty funds, giving each trade equal weight regardless of the trade size.

We report the association between cross trades and return spreads in Table 8. In both value-weighted measures (Panel A) and equal-weighted measures (Panel B), cross trades show no significant association with the return spread in either the concurrent (column 1) and subsequent (columns 2-3) quarters. Although funds that are paired up for cross trades tend to be high- by low-fee pairs, such cross trades do not necessarily benefit more high-fee funds' performance relative to the low-fee funds. One possible explanation is that cross trades may benefit both parties via transaction costs savings, as trading costs are high in the corporate bond market relative to many other markets (e.g., the equity market). We further explore this channel in the next section.

5.2 Transaction Cost Savings

We next compute back-of-the-envelope estimates of realized savings on transaction costs using our two measures of cross trades. For each cusip, we obtain monthly average bid-ask spread estimates from the WRDS Bond Returns database and average to the quarterly level.[20]

Because spread estimates can only be computed for bonds that trade in a particular quarter and, if traded, are often based on a small sample of trades, we compute portfolio-level spread estimates.[21] Analogous to our previous classification, we place bonds into 18 portfolios based on rating (investment grade, high yield/no rating), issue size (less than $500 million, $500 to $1 billion, $1 billion or greater), and age (3 years or less, 3 to 10 years, greater than ten years). Then, for each portfolio, we obtain the median spread for each quarter. Of 3.17 million cusip-family-quarter observations in our sample, 98% have portfolio-level spread estimates. Panel A (Column 2) of Table 9 shows that the average half bid-ask spread

[20]For each cusip-day, WRDS Bond Returns database computes the difference between the trade-weighted ask and bid and scales by the midpoint. Daily spread measures are then averaged to the monthly level.

[21]Of 3.17 million cusip-family-quarter observations in our sample, 64% have cusip-level spread estimates from the WRDS Bond Returns database.

over the sample period is 18 bp, which is consistent with estimates provided in the existing literature.[22]

We first estimate the total spending on transaction costs by fund families assuming that all trades were intermediated via traditional mechanisms (dealer intermediated and reported), thus incurring transaction costs. For each cusip-family-quarter, we aggregate total (unsigned) holdings changes across all funds, then multiply by one-half of the spread estimate (the half-spread). We then aggregate these transaction cost estimates to the family-quarter level (Panel A) and industry-quarter level (Panel B).

To estimate realized savings from off-tape cross trading, for each cusip-family-quarter, we multiple the *Off-Tape Cross* amount by the half-spread, then aggregate to the family-quarter level (Panel A) and industry-quarter level (Panel B). Similarly, to estimate realized savings from cross trading between mutual funds, for each cusip-family-quarter, we multiply the *Fund Offset Cross* amount by the full bid-ask spread estimate (to capture savings on both buy and sell trades), then aggregate to the family-quarter level (Panel A) and industry-quarter level (Panel B).

Finally, we estimate potential savings from *Max Avail to Cross*—savings if all opposite-signed trades by mutual funds in a family for a particular bond were crossed rather than traded via traditional mechanisms. For each cusip-family-quarter, we multiply the *Max Avail to Cross* amount by the bid-ask spread estimate, then aggregate to the family-quarter level (Panel A) and industry-quarter level (Panel B).

The results are reported in Table 9. Families potentially incur large transaction costs each quarter: the average mutual fund family spends almost $1 million (Column 3) each quarter to adjust positions in corporate bond holdings.[23] Families are able to offset some of

[22]For example, Bessembinder et al. (2018) report average one-way trade execution costs of 29 bp for smaller trades, 20 bp for mid-sized trades, and 16 bp for large block trades over the 2014 to 2016 period.

[23]The estimates reported in Table 9 are likely lower bound approximations of dollar transaction costs and savings as the WRDS methodology to estimate bid-ask spreads requires both a buy and sell trade in a bond

these costs via cross trading: on average, families save more than $80,000 (Column 4) each quarter by crossing trades off-tape (representing 8% of total transaction costs) and more than $30,000 (Column 5) by crossing trades with other mutual funds in the family. Mutual fund families appear to cross a large portion of opposite-signed trades between funds: comparing Column 6 versus Column 5, families cross about 44% of opposite-signed trades.

Panel A of Table 9 shows that transaction costs are particularly large for high yield bonds (relative to investment grade bonds) and during times of stress (defined as the financial crisis and COVID periods), indicating that cross trading may be particularly beneficial during these periods.[24] Not surprisingly, transaction cost savings from cross trading are higher for large families, who trade larger quantities of corporate bonds and likely have more opposite-signed trading counterparties.[25]

Panel B of Table 9 aggregates estimates to the industry level. Each quarter, mutual funds in aggregate could spend about $240 million on corporate bond transaction costs (Column 1). They appear to offset $8 to $20 million (Column 4 and 5) of these costs each quarter by cross trading.

5.3 Cross Trading Post-Regulation

Given the potential conflicts associated with cross trading, regulators have limited funds' access to cross trading but have provided various exemptions. The availability and flexibility of these exemptions have varied over the last three decades, but recent regulations have made these exemptions significantly more restrictive.

in a particular day, thus limiting estimates to more liquid bonds, which are associated with lower trading costs. Our estimates also do not reflect trade size and the family's network of dealers, both of which have been shown to impact trading costs (see e.g., Schultz (2001), Bessembinder et al. (2006), Edwards et al. (2007), Goldstein et al. (2007), Di Maggio et al. (2017), O'Hara et al., (2018), Hendershott et al. (2020), Nikolova and Wang (2020), Goldstein et al. (2021), and Jurkatis et al. (2024).

[24]Stress periods include the financial crisis (July 2007 to Apil 2009) and Covid (March 2020 to June 2020).

[25]Large families are families in the top tercile of AUM.

The new rule 2a-5 "fair value rule," which redefines "readily available market quotation" was adopted in December 2020 with an effective date of September 2022. Since few bonds have "readily available market quotations" under the more restrictive definition, few bonds are eligible for cross trading under Rule 17a-7. Dealers are largely unwilling to provide two-sided quotes if they believe the trade will be crossed and they will not be compensated. Evaluated prices from third-party pricing providers and other indications of interest are no longer eligible.

We assess the impact of the regulation on the magnitude of off-tape cross trading and cross trading between mutual funds using a simple event study framework. We consider four quarters before (Q3 2021 to Q2 2022) and four quarters after (Q4 2022 to Q3 2023) the September 2022 effective date.

We illustrate the impact of the regulation graphically in Figure 6 which reports the cross trade indicators at the family-level (cusip-family-quarter level). Panel A shows that *Off-Tape Cross* declines dramatically over the pre- to post-implementation period; off-tape trading is almost halved by the end of the post-regulation period. Panel B and Panel C confirm the decline in off-tape trading for both investment grade and high yield bonds. Panels E and F show no observable decline in *Fund Offset Cross* following the regulation for the full sample and for investment grade bonds, however in Panel F, which reports results for the high yield sample, we observe moderate declines in cross trading between mutual funds.

We evaluate the impact of the regulation using a regression framework, as shown in Table 10, where cross trade indicators are regressed on a post-regulation dummy. The regressions include bond fixed effects, allowing us to track changes in the prevalence of cross trading for the same bond following the implementation of the regulation. We control for the age of the bond and cluster standard errors at the bond x quarter level. We measure off-tape crossing at the industry level (columns 1-3) and family level (columns 4-6), and

crossing between mutual funds at the family level (columns 7-9) for the full sample, and for investment grade and high yield bonds.

Across all columns in Table 10, the coefficient on the post-regulation indicator is negative and significant at the 1% level. The reductions are economically large. For example, in column 4, where *Off-Tape Cross* is the dependent variable, the coefficient on the post-regulation indicator of -0.008 is about 40% of the dependent variable average (0.019). When *Fund Offset Cross* is the dependent variable in column 7, the coefficient on the post-regulation indicator is about 30% of the dependent variable average, and for high yield bonds (column 9), the coefficient is about 75% of the dependent variable average.

Overall, we observe a clear impact of the new regulation on the prevalence of cross trading. These reductions may be beneficial in reducing cross-fund subsidization costs some investors may face, but they will also have a non-trivial impact on transaction cost savings generated by cross trading.

6 Conclusion

Mutual funds may benefit from cross trading with other funds in the family, which allows funds to avoid transaction costs, minimize price impact, or obtain bonds that are hard-to-obtain in the secondary market. Because these cross trades are not reported, little is known about the extent and determinants of cross trading in the corporate bond market.

We construct two measures of cross trading and find that cross trading is relatively common for both definitions. Our first measure compares corporate bond trades by mutual funds to that reported on TRACE. We find that a meaningful portion of fund volume is "off-tape", meaning that trading volume inferred from mutual fund holdings disclosures exceeds reported trading volume. Our second measure identifies near-offsetting trades in the same bond, in the family, over the same period. We find that our two measures, although

derived from different data sources, exhibit a strong positive correlation. There is large dispersion in the prevalence of cross trading across bonds and fund families: cross trading is more prevalent in illiquid, hard-to-obtain bonds and in large fund families.

We examine cross trading around three bond- and fund-specific shocks: 1) shifts in demand around maturity thresholds, 2) credit rating changes, and 3) funds with extreme inflows or outflows. We find elevated cross trading around all three events, suggesting that cross trading can be beneficial to families in times of stress, and may even dampen the market impact of these shocks.

We examine the trade-offs faced by mutual funds when engaging in cross trades. In terms of potential conflicts, we find that the fund triggering the cross trade often has higher fees relative to the counterparty funds. Using other proxies for high- versus low-value funds, we find no other evidence of cross-fund subsidization. We also find no differences in returns in periods when bonds are crossed by particular funds, both in the concurrent and subsequent quarters, indicating that families do not appear to transfer performance from low-to high-value funds. We estimate transaction cost savings from cross trading and document that savings are significant.

Finally, we examine the effect of the September 2022 rule change on cross trading activity, as the new Rule 2a-5 imposes significant constraints on internal transactions of illiquid assets. The results reveal economically large declines in both cross trading measures after the reform for both investment grade and high yield bonds. These reductions may be beneficial in reducing the potential for cross-fund subsidization, but they will also have a non-trivial impact on transaction costs savings generated from cross trading.

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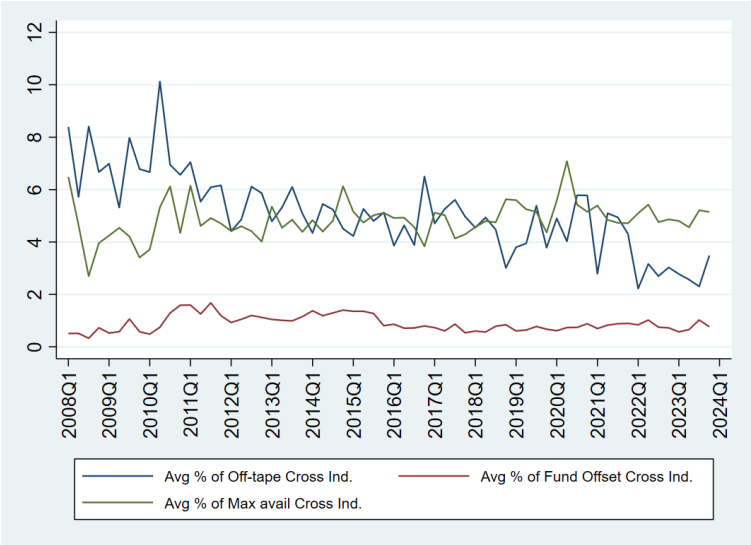
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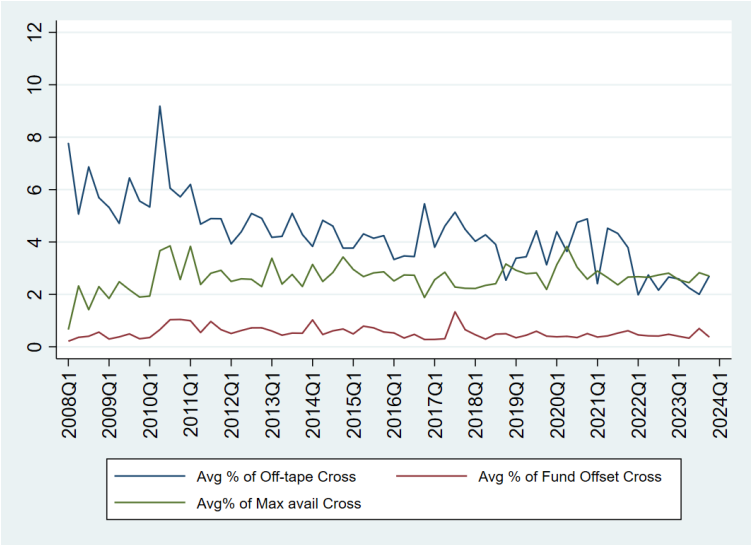
Figure 1: Time Series Cross Trades

This figure displays cross trading activity by quarter from 2008 to 2023. Panel A shows the three indicator measures – *Off-tape Cross Indicator*, *Fund Offset Cross Indicator* and *Max Avail Cross Indicator* – on average by quarter. The *Off-tape Cross Indicator* is shown in blue, the *Fund Offset Cross Indicator* is shown in red, and the *Max Avail Cross Indicator* is shown in green. We start the analysis in units of family, bond, and quarters. We first compute the average of each measure over bonds for each family and quarter, which are then averaged over family by quarter. *Off-tape Cross Indicator* is a dichotomous variable equal to one if positive (negative) changes of total family holdings in a bond exceed the quantity of total customer buys (sells) reported on TRACE. *Fund Offset Cross Indicator* is a binary variable equal to one if buy trades and sell trades are matched in bond i, in family F during quarter q are both non-zero and are within 2% of each other, and zero otherwise. *Max Avail to Cross Indicator* is a binary variable that takes the value of one if the min (positive holdings of total family holdings, negative changes of total family holdings) is non-zero or 0 otherwise. Panel B shows their companion continuous measures on average. *Off-tape Cross* aggregates the total quantity for which *Off-tape Cross Indicator* equals 1, scaled by total holdings changes for a cusip-family-quarter (e.g., positive holdings changes + |negative holdings changes|). *Fund Offset Cross* aggregates the total cross quantity, scaled by total holdings changes for a cusip-family-quarter. *Max available to cross* scales the min(positive changes of total family holdings, |negative changes of total family holdings|) by total holdings changes for each cusip-family-quarter. Panel C reports the *Off-tape Cross Indicator* and *Off-tape Cross* on average at the industry level.

Panel A: Indicator Measure



Panel B: % Holdings Measure



Panel C: Industry Level

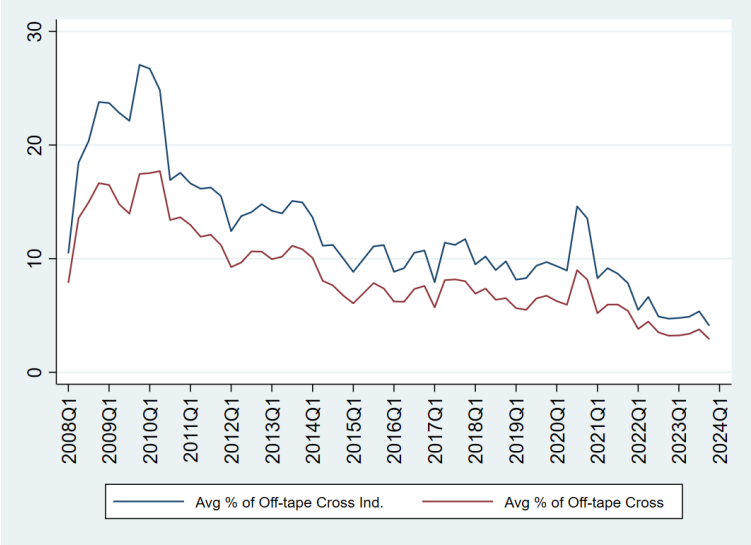
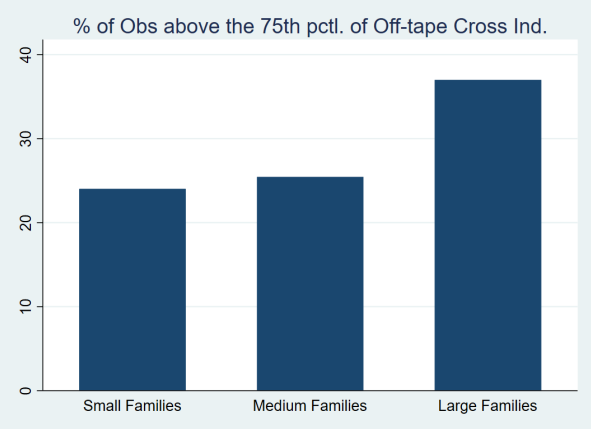


Figure 2: Cross Trading Measures By Family Size

This figures shows the cross trading measures by family size. Panel A uses the *Off-tape Cross Indicator* measure and Panel B uses the *Fund Offset Cross Indicator* measure. For each quarter, we sum TNA over all funds in the family to measure family size. We place, per each quarter, families into three size groups based on their ranking: A family is regarded as 'small' (or 'large') if their TNA are below the bottom 25th percentile (or above the 75th percentile). A family in between the 25th and 75th percentiles is considered to be of a 'medium' size. Using bond-family-quarter level data, we average the *Off-tape Cross Indicator* over bonds at the family-quarter level. In each quarter, we add a flag 'High' when a family's average percentage of *Off-tape Cross Indicator* is in the top quartile of the distribution. Finally, for each family size group, we show the percentage of family-quarters that fall in the 'High' category, i.e., whose average percentage of *Off-tape Cross Indicator* is in the top quartile in each quarter.

Panel A



Panel B

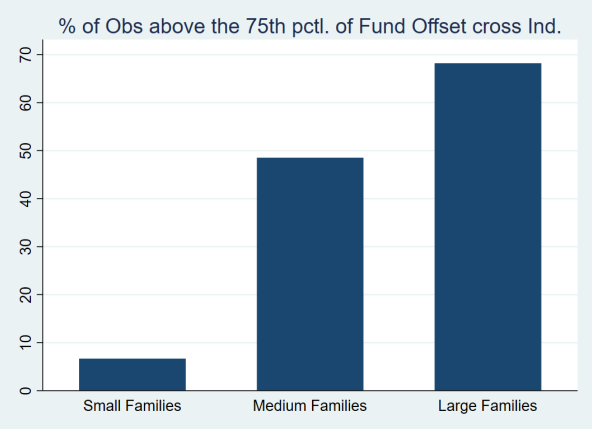
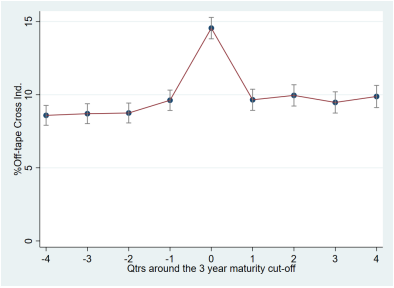


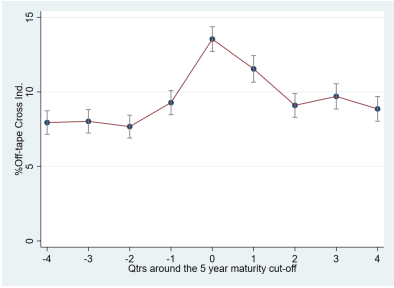
Figure 3: Cross Trading Around Maturity Thresholds

This figure shows our measures - *Off-tape Cross indicator* and *Fund Offset Cross indicator* around bonds' 3-year, 5-year, and 10-year maturity thresholds. Panels A-C show the average percentage of *Off-tape Cross Indicator* at the industry level. Panels D-F show the average percentage of *Off-tape Cross indicator* at the family level. Panels G-I show the average percentage of *Fund Offset Cross indicator* at the family level. The red lines represent the average percentage of *Off-tape Cross Indicator* and *Fund Offset Cross Indicator* in four quarters before and after the bonds' maturity cutoffs. The bars in each figure represent the 95% confidence interval of the estimate. The analysis is focused on investment grade bonds.

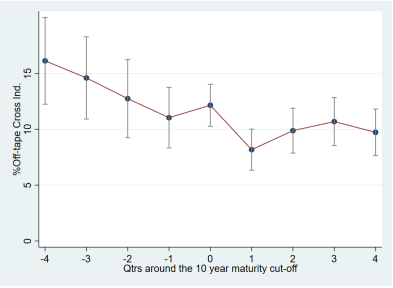
Panel A: Off-tape Cross Indicator, Industry



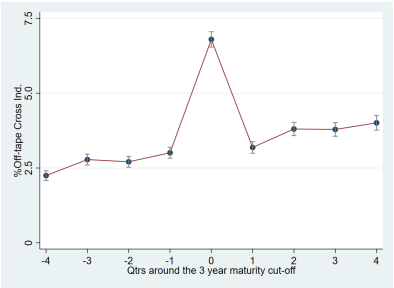
Panel B: Off-tape Cross Indicator, Industry



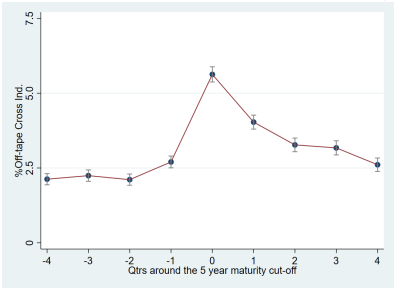
Panel C: Off-tape Cross Indicator, Industry



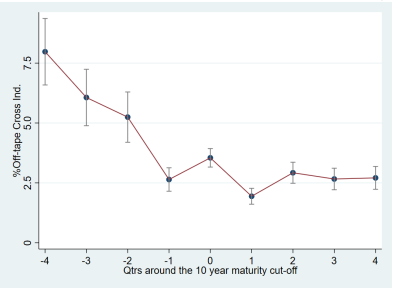
Panel D: Off-tape Cross Indicator, Family



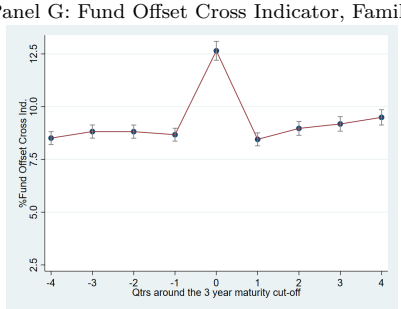
Panel E: Off-tape Cross Indicator, Family



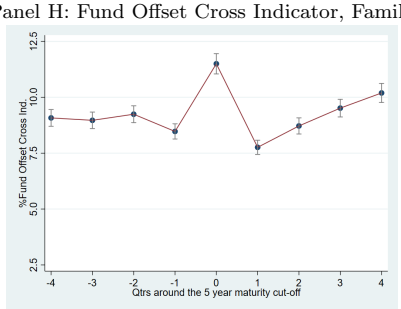
Panel F: Off-tape Cross Indicator, Family



Panel G: Fund Offset Cross Indicator, Family



Panel H: Fund Offset Cross Indicator, Family



Panel I: Fund Offset Cross Indicator, Family

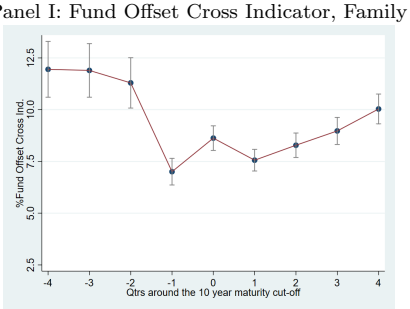
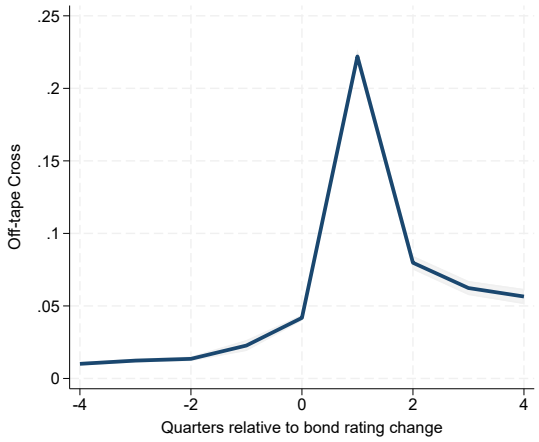


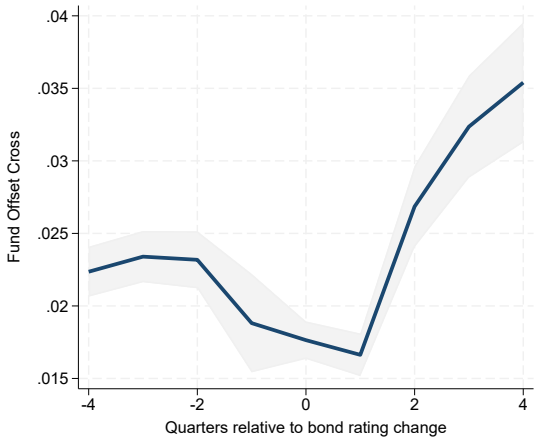
Figure 4: Cross Trading Around Credit Rating Changes

This figure presents the percentage of cross trading measures around bond upgrade and downgrade events. Panels A and B display the levels of *Off-tape Cross Indicator* and *Fund Offset Indicator* at the family level around the time when bonds are upgraded from high-yield (HY) to investment-grade (IG). Panels C and D show the corresponding measures when bonds are downgraded from IG to HY. The solid blue lines represent the sample means for each quarter, and the grey region indicate the 95% confidence intervals.

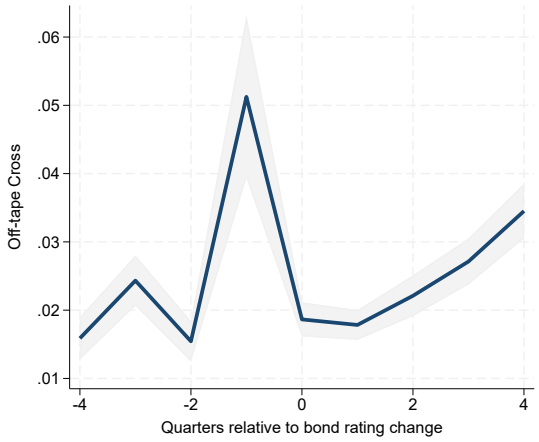
Panel A: Off-tape Cross Trades Around Upgrade



Panel B: Fund Offset Around Upgrade



Panel C: Off-tape Cross Trades Around Downgrade



Panel D: Fund Offset Around Downgrade

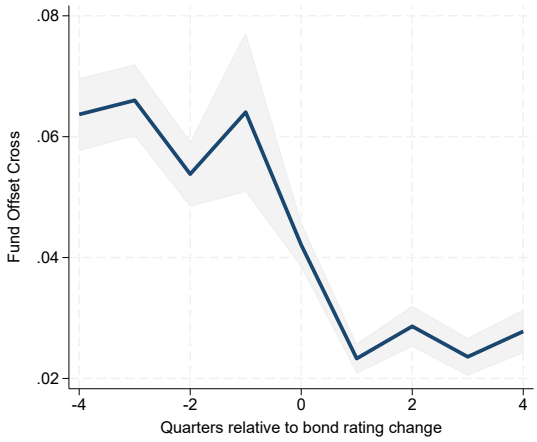
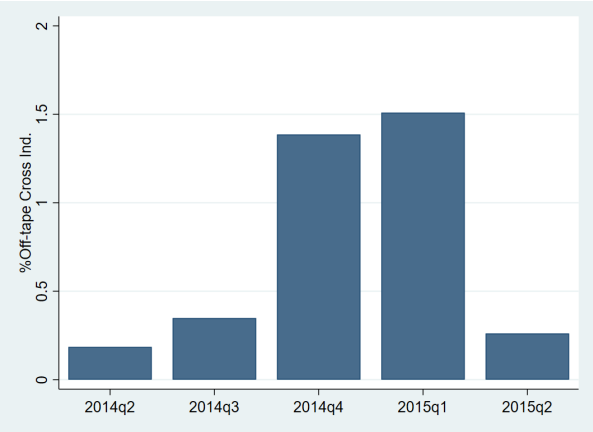


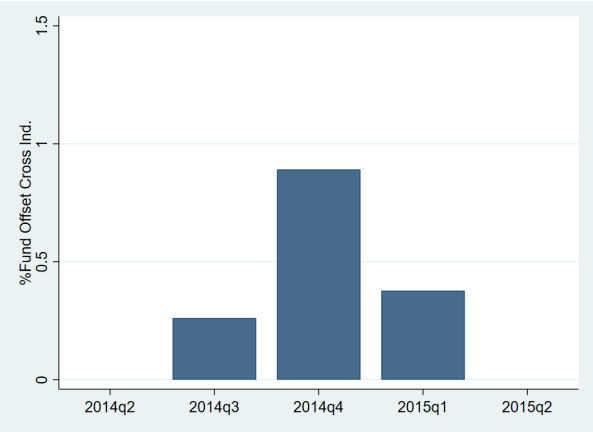
Figure 5: Cross Trading Around PIMCO Shock

This figure shows our cross trading measures around the unexpected departure of the leading fund manager, Bill Gross, from PIMCO on September 26, 2014. We focus on the bonds that are sold by Total Return Fund, which had been managed by Bill Gross at PIMCO. Panel A shows the percentage of the *Off-Tape Cross Indicator* at the family level from 2014Q1 to 2015Q2. Panel B shows the percentage of *Fund Offset Cross Indicator* from 2014Q1 to 2015Q2. Panel C shows the percentage of *Max available to cross Indicator* from 2014Q1 to 2015Q2.

Panel A: Off-tape Cross Indicator, Family



Panel B: Fund Offset Cross Indicator, Family



Panel C: Max Available Cross, Family

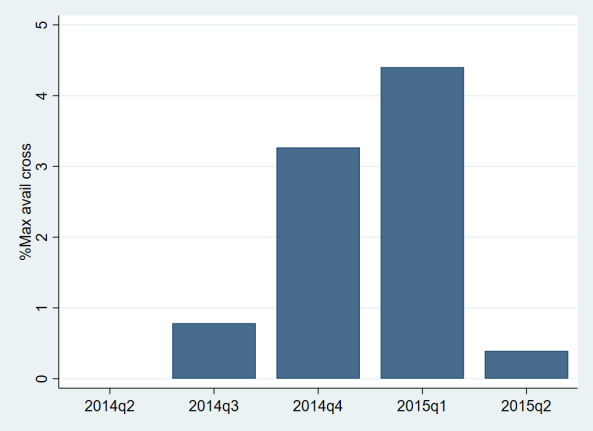


Figure 6: Regulatory Impact on Cross Trading

This figure presents the percentage of cross trading measures around New SEC Rule 2a-5 (also known as "fair value rule"), which become effective in September 2022. The post-regulation period includes 2022 Q4 and 2023 Q1-Q3. The pre-regulation period includes 2021 Q3-Q4 and 2022 Q1-Q2. Families that are not in both the pre- and post-regulation period are excluded. The solid blue lines represent the average of the Off-Tape Cross Indicator (Panels A-D) and Fund Offset Cross Indicator (Panels E-G) in each quarter. The shaded area in each figure represent the 95% confidence interval of the estimate. Panel A-C report Off-tape Cross Averages at the cusip-family-quarter (family) level. Panels D-F report Fund Offset Cross averages.

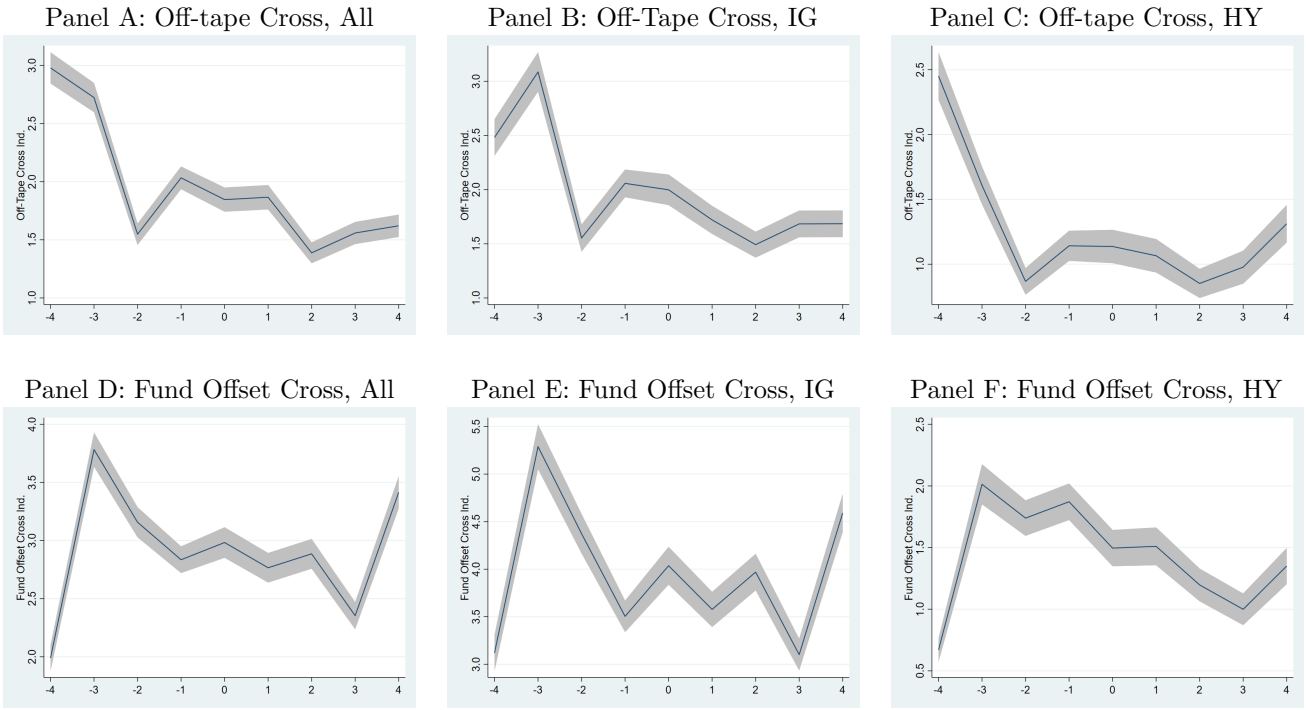


Table 1: Sample Statistics: Funds with Holdings Changes

Panel A reports sample summary statistics for funds that increase or reduce holdings in a particular bond. Our sample is from 2008 to June 2023. We report the number of unique bonds in Column (1), the number of unique families in Column (2), the number of unique funds in Column (3), the number of unique bond-quarter observations in Column (4) which aggregates changes across all mutual funds holding the bond, the number of unique bond-family-quarter observations in Column (5), and the number of unique bond-fund-quarter observations in Column (6). Panel B reports family-level statistics. Column (4) reports the average number of funds within a family with changes in a particular cusip. Column (5) and (6) report for each bond-family-quarter observation, the percent with at least two funds trading in the same or opposite direction. Columns (1)-(6) report par values in units of millions.

Panel A: Number of Observations with Holdings Changes

	(1)	(2)	(3)	(4)	(5)	(6)
Year	# of Bonds	# of Families	# of Funds	# of Bond-Quarter Obs.	# of Bond-Family-Quarter Obs.	# of Bond-Fund-Quarter Obs.
2008	5,019	194	1,219	13,603	39,446	68,322
2009	6,320	224	1,842	18,593	80,973	169,409
2010	7,522	280	2,201	21,227	104,120	223,638
2011	7,842	301	1,752	23,543	152,913	375,336
2012	8,270	317	1,754	25,211	161,442	393,966
2013	9,118	320	1,811	28,037	177,384	445,399
2014	9,235	306	1,764	28,752	171,925	435,503
2015	9,615	326	1,917	30,430	185,954	456,530
2016	9,899	342	2,015	31,556	218,209	482,784
2017	10,357	337	2,086	31,244	218,668	429,358
2018	10,537	323	2,041	32,853	243,341	502,627
2019	10,748	317	2,047	33,889	269,127	591,834
2020	11,499	321	1,974	35,459	308,272	666,894
2021	11,960	341	1,917	36,960	291,397	602,260
2022	11,604	258	1,878	37,454	283,198	523,485
2023	11,249	248	1,767	37,110	261,861	464,651
All Years	32,564	665	4,777	465,921	3,168,230	6,831,996

Panel B: Family-Level Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year	Total Holdings (M)	Ave. Fund Holdings (M)	Ave. Family Holdings (M)	Ave. Overlap Holdings (M)	Holdings w/ Changes (M)	Ave. # Funds w/ Changes	% Same Dir.	% Opp. Dir.
2008	24.66	3.39	5.31	8.40	2.59	1.73	18.01%	12.34%
2009	41.43	3.32	6.32	10.48	3.44	2.09	27.86%	10.60%
2010	51.07	2.79	5.66	10.19	3.38	2.15	29.22%	10.92%
2011	73.98	2.50	5.89	10.85	3.15	2.45	29.59%	12.03%
2012	79.49	2.83	6.06	11.13	3.24	2.44	28.45%	11.65%
2013	74.46	2.36	5.70	10.34	3.27	2.51	27.66%	13.05%
2014	78.28	2.50	5.81	10.79	3.25	2.53	27.38%	12.50%
2015	81.19	2.53	5.86	10.81	3.14	2.46	28.26%	11.88%
2016	83.89	2.51	5.71	10.82	2.96	2.21	27.67%	9.36%
2017	84.31	2.54	5.69	11.09	2.98	1.96	25.73%	10.60%
2018	89.91	2.52	5.64	11.14	2.84	2.07	26.69%	9.27%
2019	92.20	2.59	5.70	11.26	2.72	2.20	26.29%	10.18%
2020	97.65	2.57	5.65	11.22	3.14	2.16	25.25%	10.70%
2021	103.92	2.64	5.87	11.91	2.88	2.07	24.66%	9.52%
2022	103.94	2.74	5.88	12.59	2.57	1.85	22.18%	8.68%
2023	97.72	2.63	5.69	12.39	2.46	1.77	21.92%	8.70%
All Years	83.33	2.64	5.77	11.29	2.96	2.16	25.95%	10.43%

Table 2: Mutual Fund Holdings Changes and TRACE Volume

The table reports summary statistics on mutual fund holdings changes and TRACE volume. The results are based on data organized at the fund-cusip-quarter level. Columns (1)-(3) report the total dollar volume of position changes, averaged over bonds. Column (4) is averaged over all fund-bond-quarters. Columns (5)-(8) report TRACE customer trade volume statistics for the bond-years in our sample, averaged over bonds. Column (8) reports average trade size for the bond-quarters in our sample. All volume numbers are reported in millions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year	Total Vol. for Positive Position Change (M)	Total Vol. for Negative Position Change (M)	Total Vol. for All Position Change (M)	Average Position Change Vol. (M)	TRACE Customer Buy Vol. (M)	TRACE Customer Sell Vol. (M)	TRACE Customer Vol. (M)	Average Customer TRACE Vol. (M)
2008	18.03	18.37	36.40	1.98	134.64	133.49	268.13	84.96
2009	36.87	40.61	77.48	1.96	157.78	157.76	315.54	101.34
2010	25.56	33.68	59.24	1.76	134.86	134.63	269.49	87.21
2011	26.68	34.83	61.52	1.45	134.68	133.86	268.54	84.29
2012	25.48	37.84	63.33	1.38	128.95	131.02	259.97	82.19
2013	24.52	39.08	63.60	1.44	140.36	141.77	282.13	89.36
2014	24.63	35.90	60.53	1.43	144.57	146.11	290.68	90.16
2015	22.90	37.86	60.77	1.44	152.53	154.45	306.98	95.89
2016	26.39	38.82	65.20	1.43	174.85	177.33	352.17	108.50
2017	24.70	38.32	63.02	1.46	166.25	169.56	335.81	103.98
2018	26.23	39.41	65.64	1.45	175.09	174.97	350.06	106.22
2019	27.74	40.51	68.25	1.43	186.54	190.30	376.84	115.52
2020	34.34	49.97	84.30	1.67	191.46	195.37	386.83	125.98
2021	26.34	43.89	70.23	1.58	174.35	175.01	349.36	107.83
2022	24.06	38.74	62.79	1.41	187.09	191.07	378.16	111.70
2023	20.91	36.63	57.53	1.36	190.97	195.86	386.83	110.74
All years	26.01	38.68	64.7	1.51	164.46	166.45	330.92	102.29

Table 3: Prevalence of Cross Trading in Corporate Bonds

This table reports summary statistics of cross trading measures in corporate bonds. Panel A reports the statistics on the prevalance of cross trades based on the CRSP mutual fund data. *Off-tape Cross Indicator* is a dummy variable equal to one if positive (negative) changes of total family holdings in a bond exceed the quantity of total customer buys (sells) reported on TRACE. *Fund Off-set Cross Indicator* is a dummy variable equal to one if (1) total buy trades and sell trades in bond i, in family F during quarter q are both non-zero and (2) partial sum of buy trades match partial sum of sell trades within the family within 2% of each other, and zero otherwise. *Max Avail to Cross Indicator* is a dummy variable that takes the value of one if the min (positive holdings of total family holdings, negative changes of total family holdings) is non-zero or 0 otherwise. Panel B reports cross sectional variations of cross trading measures using the unconditional averages. A bond is regarded as investment grade (or high yield) if it has the credit rating of BBB- or above (or below) according to S&P. If a bond is traded at the frequency higher than the top 25% of the distribution, then it is considered to be highly frequently traded. A bond whose trading volume is in the top 25% of the distribution is regarded as high volume bonds. A bond has large issue if its offering amount is larger than $1 billion. A small issue bond is that with offer size of less than $500 million.

	(1)	(2)	(3)	(4)	(5)	(6)
	% Bond-Qtrs w/ Off-tape Cross Indicators	% Bond-Family-Qtrs w/ Off-tape Cross Indicator	% Bond-Fund-Qtrs w/ Off-tape Cross Indicators	% Bond-Family-Qtrs w/ Fund Offset Cross Indicators	% Bond-Family-Qtrs w/ Max Avail to Cross Indicators	% Bond-Family-Qtrs w/ union of (2) and (4)
Panel A: Full sample						
Unconditional	11.40%	3.30%	2.50%	4.90%	15.31%	7.80%
Panel B: Cross Sectional Analysis						
Investment Grade	8.09%	2.70%	1.90%	7.60%	17.40%	9.90%
High Yield	16.24%	3.20%	2.60%	2.20%	14.40%	5.10%
High # Trades Bonds	3.53%	0.70%	0.50%	4.00%	16.40%	4.70%
Medium # Trades Bonds	8.02%	3.30%	2.20%	5.70%	14.80%	8.70%
Low # Trades Bonds	29.01%	17.20%	12.90%	9.40%	16.40%	24.10%
High Volume Bonds	1.64%	0.00%	0.00%	3.00%	18.30%	3.00%
Medium Volume Bonds	3.08%	0.20%	0.10%	4.10%	14.60%	4.30%
Low Volume Bonds	20.16%	13.00%	9.10%	9.40%	16.20%	21.00%
Large Issues	8.07%	1.90%	1.60%	4.60%	17.40%	6.30%
Medium Issues	9.27%	2.80%	2.00%	5.00%	15.20%	7.50%
Small Issues	15.80%	6.30%	4.60%	6.20%	14.60%	11.80%
Public	7.24%	1.90%	1.40%	6.30%	16.80%	8.00%
144A	24.01%	6.10%	5.10%	2.50%	14.00%	8.00%
$\leq$ 3 year to Maturity	13.68%	4.90%	3.80%	5.90%	14.20%	10.30%
3-5 years to Maturity	14.01%	3.80%	2.90%	4.70%	14.90%	8.00%
5-10 years to Maturity	11.31%	2.80%	2.10%	4.20%	15.90%	6.70%
10+ years to Maturity	7.14%	2.30%	1.70%	7.20%	18.60%	9.10%

Table 4: Determinants of Cross Trading

This table reports regressions of cross trade measures on bond and family characteristics. The dependent variables are the Off-Tape Cross and Fund Offset Cross indicators, measured at the cusip-family-quarter level. Columns (1)-(2) examine the impact of bond characteristics on the propensity to cross trade. These regressions include family x quarter fixed effects and standard errors clustered at the cusip level. Columns (3)-(4) examine the impact of family characteristics on the propensity to cross trade. These regressions include cusip x quarter fixed effects and standard errors clustered at the family level. The variable ' Similar Funds' is the number of funds holding similar bonds in the previous four quarters. Similar bonds are defined using 18 categories based on credit ratings (IG or not), size of issuance (small, medium or larger), and time to maturity (short, intermediate, or long). All regressions include an intercept which is not reported. Standard errors are reported in parentheses.

	(1)	(2)	(3)	(4)
Dependent Variable:	Off-Tape Cross	Fund Offset Cross	Off-Tape Cross	Fund Offset Cross
Investment Grade Ind.	-0.0009	0.0182***		
	(0.0007)	(0.0005)		
Ln(# Trades q-1)	-0.0208***	-0.0043***		
	(0.0004)	(0.0002)		
Issue Size Tercile	0.0006	0.0010***		
	(0.0005)	(0.0003)		
144A Ind.	0.0156***	-0.0043***		
	(0.0009)	(0.0004)		
Ln(Bond Age)	-0.0088***	-0.0012***		
	(0.0004)	(0.0003)		
Ln(Family TNA)			0.0031***	-0.0041
			(0.0008)	(0.0049)
# Funds w/ Similar Bonds			-0.0000	0.0023*
			(0.0001)	(0.0014)
Observations	3,322,551	3,322,551	3,328,659	3,328,659
Adjusted R-squared	0.0529	0.2444	0.3309	0.0969
Family x Quarter FE	Yes	Yes		
Bond x Quarter FE			Yes	Yes

Table 5: Extreme Fund Flows

This table reports regressions of cross trade measures on indicators for families that experience an extreme fund flow in a particular quarter. Using fund-quarter data, we place funds into deciles based on flows for the period. Funds in decile one have extreme outflows and funds in decile 10 have extreme inflows. We then identify family-quarters for which at least one fund encounters extreme inflows or outflows. The Extreme Flow indicator is set to one if any fund has an extreme outflow or inflow. The dependent variables are the Off-Tape Cross and Fund Offset Cross indicators, measured at the cusip-family-quarter level. All regressions include bond x quarter fixed effects and standard errors are clustered at the family x quarter level. All regressions include an intercept which is not reported. Standard errors are reported in parentheses.

	(1)	(2)	(3)	(4)
Dependent Variable:	Off-Tape Cross		Fund Offset Cross	
Extreme Flow Indicator	0.0027***	0.0022***	0.0123*	0.0105
	(0.0004)	(0.0004)	(0.0065)	(0.0066)
Family Size Tercile		0.0085***		0.0308***
		(0.0004)		(0.0033)
Observations	2,672,519	2,672,519	2,672,519	2,672,519
Adjusted R-squared	0.7159	0.7160	0.1020	0.1031
Bond x Quarter Fixed Effects	Yes	Yes	Yes	Yes

Table 6: Triggering Funds and Counterparty Funds

This table provides summary statistics on determinants of the triggering fund and counterparty funds in bond cross trading. In 1-to-1 cross trade, triggering funds are the ones which sell the bond. In 1-to-many trades, the triggering funds are the one which have one large trade size. The counterparty funds are the ones who are trading with triggering funds during cross trades. We first aggregate cross trading data to the fund-quarter level. Columns (1) and (2) report the sample means for triggering funds and counterparty funds, respectively. Column (3) reports the sample mean for funds that do not engage in cross-trading. Columns (4)–(6) present pairwise comparisons across these groups. In Panel A, the Extreme Outflow (Inflow) is an indicator if a fund's flow in quarter q1 falls in the lowest (highest) decile across all funds, where quarter q is the cross-trade quarter. The High Flow-to-Performance is an indicator if a fund's sensitivity of flows to past 12-month performance in quarter q1 is in the top quartile among funds within the same family. Flow–performance sensitivity is estimated on a rolling basis using the past three years of data. In Panel B, High Total Fee is an indicator if funds' expense ratio is at the highest quartile among funds in the same family. High Performing Fund is indicator if funds' past 12 month moving average returns is at the highest quartile among funds in the same investment style. Larger Fund is indicator if fund size is at the highest quartile among funds in the same family. Young Fund is indicator if fund age is at the lowest quartile among funds in the same family. Standard errors are clustered at the fund level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Triggering Funds Crossing in Quarter	Counterparty Funds Crossing in Quarter	Funds with No Crossing in Quarter	(1) vs. (2)	(1) vs. (3)	(2) vs. (3)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Fund Flow Measures						
All Funds						
Extreme Outflow	11%	8%	10%	***		***
Extreme Inflow	9%	9%	10%			
High Flow-to-Performance	26%	22%	26%	**		***
Bond Funds						
Extreme Outflow	11%	8%	11%	**		***
Extreme Inflow	7%	10%	9%	**		
High Flow-to-Performance	24%	25%	27%			
Panel B: High Value Fund Measures						
All Funds						
High Total Fee (A)	28%	23%	26%	**		
High Performing Fund (B)	25%	25%	26%			
Larger Fund (C)	29%	29%	25%		*	
Young Fund (D)	21%	16%	25%	***	**	***
Union (A, B, C, D)	72%	67%	69%	**		
Bond Funds						
High Total Fee (A)	35%	28%	26%	*	***	
High Performing Fund (B)	30%	29%	24%		***	**
Larger Fund (C)	28%	33%	25%	*		*
Young Fund (D)	23%	22%	23%			
Union (A, B, C, D)	77%	76%	66%		***	***

Table 7: Fee Spread and Cross Trade

This table reports fund-pair–level analysis of fee spreads among corporate bond funds. For each fund pair that actually engaged in a cross trade, we construct matched control fund pairs. Control pairs are defined as the triggering fund (the fund initiating a cross trade) matched with other corporate bond funds in the same family that (i) have not yet participated in a cross trade and (ii) traded corporate bonds within the past two years. Cross Trade is an indicator equal to one if a fund pair participates in a cross trade in a given quarter. For each cross trade between triggering fund and counterparty fund on a given bond and month, the value-weighted fee spread is calculated as the difference in expense ratios between the triggering fund and its counterparties, weighted by each counterparty's share of the absolute trading size relative to the total cross-traded size. These trade-level spread is then aggregated to triggering fund-counterparty fund pair at the quarterly level, with weights proportional to the absolute trade size of each CUSIP for the triggering fund. The equal-weighted fee spread is the difference in expense ratios between the triggering fund and its counterparty funds, giving each counterparty equal weight regardless of the trade size. A cohort refers to the set of cross-traded fund pairs and matched fund control pairs associated with a triggering fund in a given quarter. Standard errors are clustered at the triggering-fund and quarter levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent Variables:	Value-weighted Fee Spread	Equal-weighted Fee Spread
	(1)	(2)
Cross Trade	0.080***	0.073***
	(0.019)	(0.019)
Cohort FE	Yes	Yes
Observations	32,280	32,280
Adjusted R^2	0.519	0.519

Table 8: Consequence of Cross Trade on Performance

This table presents results on fund pair level analysis on the return spread. For each fund pair that actually engaged in a cross trade, we construct matched control fund pairs. Control pairs are defined as the triggering fund (the fund initiating a cross trade) matched with other corporate bond funds in the same family that (i) have not yet participated in a cross trade and (ii) traded corporate bonds within the past two years. Cross Trade is an indicator equal to one if a fund pair participates in a cross trade in quarter q. The value-weighted return spread is calculated as the difference in style-adjusted fund returns between the triggering fund and its counterparty funds (the funds taking the other side of the trade), weighted by each counterparty's share of the absolute trading size relative to the total cross-traded size for a given bond and quarter. These trade-level return spread is then aggregated to triggering fund-counterparty fund pair at the quarterly level, with weights proportional to the absolute trade size of each CUSIP for the triggering fund. The equal-weighted fee spread is the difference in style-adjusted fund returns between the triggering fund and its counterparty funds, giving each counterparty equal weight regardless of the trade size. A cohort refers to the set of cross-traded fund pairs and matched fund control pairs associated with a triggering fund in a given quarter. Standard errors are clustered at the triggering-fund and quarter levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Value-weighted Return Spread

Dependent Variables:	Value-weighted Return Spread (q) (1)	Value-weighted Return Spread (q+1) (2)	Value-weighted Return Spread (q+2) (3)
Cross Trade	1.16	0.248	-1.88
	(2.12)	(2.14)	(1.61)
Cohort FE	Yes	Yes	Yes
Observations	32,280	32,280	32,280
Adjusted R^2	0.258	0.243	0.279

Panel B: Equal-weighted Return Spread

Dependent Variables:	Equal-weighted Return Spread (q) (1)	Equal-weighted Return Spread (q+1) (2)	Equal-weighted Return Spread (q+2) (3)
Cross Trade	1.12	0.119	-1.83
	(2.09)	(2.19)	(1.54)
Cohort FE	Yes	Yes	Yes
Observations	32,280	32,280	32,280
Adjusted R^2	0.258	0.243	0.279

Table 9: Savings on Transaction Costs

We report realized savings on transaction costs for *Off-Tape Cross* and *Fund Offset Cross* trades. For each cusip, we obtain monthly bid-ask spread measures from WRDS Bond Returns database and average to the quarterly-level. We place bonds into 18 portfolios based on rating (investment grade, high yield/no rating), issue size (less than $500 million, $500 to $1 billion, $1 billion or greater), and age (3 years or less, 3 to 10 years, greater than ten years). Then, for each cusip-quarter observation, we utilize the median portfolio spread. We define the half spread as .5*bid-ask spread. To estimate total potential spending on transaction costs each cusip-family-quarter, we aggregate total (unsigned) holding changes across all funds, then multiply by one-half of the spread estimate. We then aggregate these transaction cost estimates to the family-quarter level (Panel A) and industry-quarter level (Panel B). For realized off-tape savings, we multiply the half spread times the dollars saved (in par) and for savings on fund offset cross trades and maximum available to cross we multiple by the full bid-ask spread. We do this at the cusip-family-quarter level, then sum to the family-quarter level and report a simple average in Panel A. In Panel B, we compute industry savings by aggregating savings to the quarter level. In Panel B, half bid-ask spreads (Column 2) are weighted averages based on total spending on transaction costs each quarter. Stress periods include the financial crisis (July 2007 to April 2009) and Covid (March 2020 to June 2020). Large families are families in the top tercile of AUM.

	(1)	(2)	(3)	(4)	(5)	(6)
	# Obs	Average Half Bid-Ask Spread	Total Potential Spending on Transaction Costs	Savings on Off-Tape Cross Trades	Savings on Fund Offset Cross Trades	Savings on Max Available to Cross
Panel A: Realized Savings on Transaction Costs–Family level: Average per Quarter						
Full Sample	15,463	0.18%	984,735	81,379	34,413	78,009
Investment Grade	13,846	0.18%	515,583	32,481	24,509	43,082
High Yield/Not Rated	12,950	0.19%	624,571	62,443	14,886	47,083
Stress Periods	1,189	0.32%	1,224,767	115,627	47,719	109,305
Large Families	8,954	0.19%	1,657,905	137,649	58,873	131,090
Panel B: Realized Savings on Transaction Costs–Industry level: Average per Quarter						
Full Sample	64	0.20%	237,921,156	19,661,913	8,314,495	18,847,661
Investment Grade	64	0.20%	111,543,051	7,026,959	5,302,407	9,320,615
High Yield/Not Rated	64	0.20%	126,378,105	12,634,954	3,012,088	9,527,046
Stress Periods	7	0.34%	208,035,371	19,640,136	8,105,435	18,566,198
Large Families	64	0.20%	231,951,285	19,257,985	8,236,658	18,340,265

Table 10: Regulatory Impact

This table presents results on the impact on cross trading activity of the New SEC Rule 2a-5 (also known as "fair value rule"), which became effective in September 2022. The post-regulation period includes 2022 Q4 and 2023 Q1-Q3. The pre-regulation period includes 2021 Q3-Q4 and 2022 Q1-Q2. In columns 1-6 the dependent variable is the *Off-Tape Cross* Indicator and in columns 7-9 the dependent variable is the *Fund Offset Cross* Indicator. Columns (1)-(3) are based on measures at the cusip-quarter (industry) level and columns (4)-(9) are based on measures at the cusip-family-quarter (family) level. All regressions include bond fixed effects and standard errors (reported in parentheses) are clustered at the bond x quarter level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Cusip-Quarter Level			Cusip-Family-Quarter Level					
	Off-Tape Cross Indicator			Off-Tape Cross Indicator			Fund Offset Cross Indicator		
	Full	IG	HY/NR	Full	IG	HY/NR	Full	IG	HY/NR
Post-Reg Indicator	-0.019***	-0.014***	-0.030***	-0.008***	-0.004***	-0.008***	-0.009***	-0.007***	-0.011***
	(0.003)	(0.003)	(0.008)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	73,250	53,938	19,097	538,137	314,472	223,619	538,137	314,472	223,619
Adjusted R-squared	0.392	0.381	0.407	0.541	0.577	0.537	0.145	0.156	0.072
Bond Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

A Internet Appendix

A.1 Cross trade ranking

A fund pair is defined by one triggering fund (the initiator of the trade) and one counterparty fund. We classify cross trades into two categories: 1) 1-to-1: the triggering fund trades with exactly one counterparty fund and 2) 1-to-many: the triggering fund splits its trade across multiple counterparties (up to five counterparties). We further distinguish between: 1) Exact matches, where the trade quantities line up exactly across funds and 2) 2% tolerance matches, where quantities align within a $\pm 2\%$ band to allow for reporting frictions or partial fills.

When multiple potential matches exist, we apply an algorithm that prioritizes the most plausible cross trade pairs to ensure that identified cross trades are unique and non-repetitive. When a particular trade appears in more than one possible cross trade set, the algorithm resolves overlaps based on the following criteria: the likelihood of a true cross trade increases when the triggering fund has a larger trade size, the number of available counterparties is smaller, and the trade quantities match exactly.

Illustrative examples are provided in Table A1. Example 1 demonstrates that larger trades are prioritized over smaller ones. Two potential cross trade sets exist: the first includes funds A, B, and C, and the second includes funds C and D. Because the first set has the larger total trade size, it is selected as the cross trade. Once fund C is assigned to that set, it is no longer available to match with fund D. Example 2 illustrates that cross trades involving fewer funds are prioritized. Fund A and B could potentially cross trade with each other, with less than a 1% difference in trade size. Another possible set includes funds A, C, D, and E. Since the first set involves fewer participants, it is selected as the primary cross trade. Example 3 shows that exact trade matches are prioritized over approximate matches.

Table A1: Illustrative Examples of Cross-Trade Prioritization Rules

This table provides illustrative examples of cross trade prioritization rule when there are multiple plausible cross trade within the same family, bond and report date.

Example 1:	Prioritize the large trades				
Report date	Bond cusip	FamilyID	FundID	Trade	Cross trade
2010-11-31	Bond I	Family A	fundA	-120000	1
	Bond I	Family A	fundB	110000	1
	Bond I	Family A	fundC	10000	1
	Bond I	Family A	fundD	-10000	
Example 2:	Prioritize fewer trades				
Report date	Bond cusip	FamilyID	FundID	Trade	Cross trade
2010-11-31	Bond I	Family A	fundA	-120000	1
	Bond I	Family A	fundB	119000	1
	Bond I	Family A	fundC	5000	
	Bond I	Family A	fundD	100000	
	Bond I	Family A	fundE	15000	
Example 3:	Prioritize exact trades				
Report date	Bond cusip	FamilyID	FundID	Trade	Cross trade
2010-11-31	Bond I	Family A	fundA	-120000	1
	Bond I	Family A	fundB	120000	1
	Bond I	Family A	fundC	118000	

Figure A1: Correlations between Cross Trade Measures

This figure shows correlations between family off-tape and Fund Offset Cross measures at the family-cusip-quarter level. The horizontal axis is an indicator of *Family Off-tape* for a family, bond cusip, and quarter. Bars represent the average value of the *Fund Offset Cross* trades in each group.

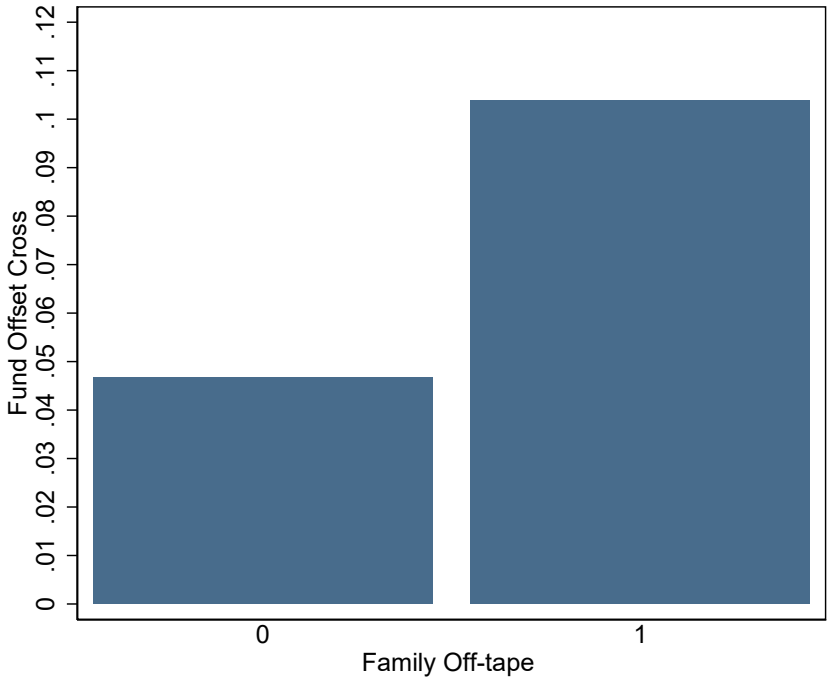
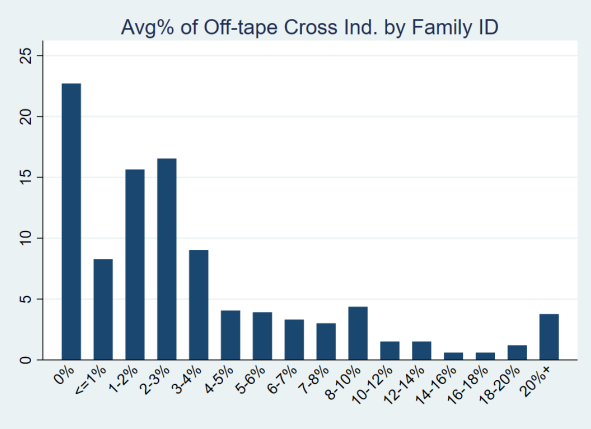


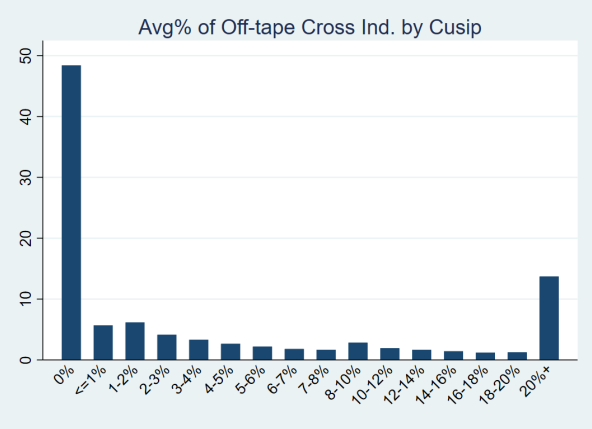
Figure A2: Distribution of Our Cross Trading Measures by Family and by Bonds

This figure displays the dispersion of our cross trading measures. Panel A and B shows the distribution of the *Off-tape Cross Indicator* by family and by bonds, respectively. Panels C and D shows the distribution of the *Fund Offset Cross Indicator* by family and by bond. For panel A and C, we first compute the average percentage of *Off-tape Cross Indicator* for each family over bonds and time and then place families into 17 different groups based on their average percentage of *Off-tape Cross Indicator*. We show the frequency distribution of these families across these groups. Panels B and D are created similarly, but with bond cusips.

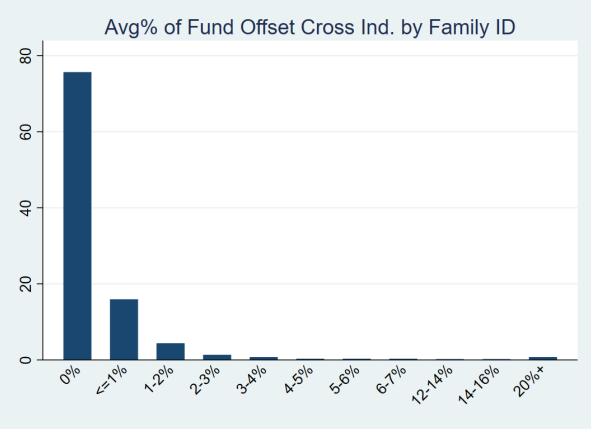
Panel A



Panel B



Panel C



Panel D

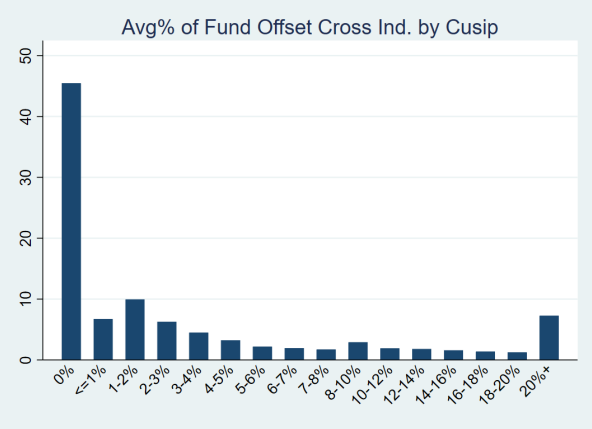


Table A2: Data Samples. This table summarizes the steps involved in constructing the corporate bond trades and mutual fund holdings samples. Corporate bond trade data are from TRACE (Trade Reporting and Compliance Engine), bond descriptive data are from the Mergent Fixed Income Securities Database (FISD), and mutual fund holdings data are from the CRSP Mutual Fund Database. Our final sample covers the January 2008 to June 2023 period. We start by obtaining a sample of bonds from FISD, merging to TRACE, then merging to CRSP mutual fund holdings to obtain a sample of funds holding the sample of bonds described in Panel A. We apply a series of filters to eliminate holdings changes that occur for reasons unrelated to funds' discretion as outlined in Panel B.

Panel A: Corporate Bond Trade Sample Construction

	# Cusips	# Trades
Corporate bonds in FISD After FISD cleaning	59,064	
Corporate bonds in TRACE and FISD	42,942	188,121,483
Exclude bonds with < 5 trades over sample period, primary market transactions, and trades with reported trade size $>$ issue size, reported after the amount outstanding falls to zero, or reported by dealer with offshore trades.	41,993	183,027,808
Retain dates January 2008 to June 2023	34,371	160,872,537

Panel B: Addditional Filters

	# of fund-cusip-report dt	# of fund-cusip-qtr	# of family-cusip-qtr	# of cusip-qtr
(0) Start with CRSP holdings	56,238,384			
(1) If the same effective date has multiple report dates in the original holdings, take the one from the most recent report dt; this affects "nbr_sharesSTART" in the following month as well	56,238,384			
(2) Discard large changes of positions (i.e. extreme buys or sells)	56,004,400			
(3) Keep if changes of holdings are nonzero	17,950,545			
(4) Delete if report date $<$ offering date or report date $>$ maturity date	17,746,393			
(5) Drop if the report date has > 3 month lags	17,156,534			
(6) Delete if a fund undergoes reclassification events	17,110,140			
(7) Delete if a bond matures within a year	16,546,141			
(8) Remove if trade $>$ the offering amount	16,545,240			
(9) Remove if a bond is in the offering quarter	14,833,386			
(10) Remove if a bond matures in the quarter	14,833,386			
(11) Remove if the % of ETF share class $> 10\%$ of the fund's asset	10,605,232			
To aggregate to the family level				
(12) Aggregate at the calendar quarter		7,114,778		
(13) Remove if familyID is not available		6,831,996		
(14) Aggregate at the family x cusip x qtr level			3,168,230	
To aggregate to the industry level				
(15) Start from (12) and aggregate at the cusip x qtr level				465,921

Table A3: Prevalence of Cross Trading in Corporate Bonds II

This table reports summary statistics of cross trading measures in corporate bonds. Panel A reports the conditional statistics on the prevalence of cross trades based on the CRSP mutual fund data. Panel B reports the statistics of the continuous cross trading measures using the dollar par volume. *Off-tape Cross Indicator* is a dummy variable equal to one if positive (negative) changes of total family holdings in a bond exceed the quantity of total customer buys (sells) reported on TRACE. *Fund Off-set Cross Indicator* is a dummy variable equal to one if (1) total buy trades and sell trades in bond i, in family F during quarter q are both non-zero and (2) partial sum of buy trades match partial sum of sell trades within the family within 2% of each other, and zero otherwise. *Max Avail to Cross Indicator* is a dummy variable that takes the value of one if the min (positive holdings of total family holdings, negative changes of total family holdings) is non-zero or 0 otherwise.

Panel A: Conditional Analyses

	(1)	(2)	(3)	(4)	(5)	(6)
	% Bond-Qtrs w/ Off-tape Cross Indicators	% Bond-Family-Qtrs w/ Off-tape Cross Indicator	% Bond-Fund-Qtrs w/ Off-tape Cross Indicators	% Bond-Family-Qtrs w/ Fund Offset Cross Indicators	% Bond-Family-Qtrs w/ Max Avail to Cross Indicators	% Bond-Family-Qtrs w/ union of (2) and (4)
Conditional 2+ Funds		3.2%	2.4%	5.8%	17.5%	8.6%
Conditional 5+ Funds		3.2%	2.4%	5.8%	17.5%	8.6%
Conditional Monthly holdings	8.2%	5.3%	4.3%	12.3%	17.7%	
Revised Quarterly (Monthly indicators, unconditional)	18.3%	5.7%	4.0%	5.9%	15.1%	
Merged CRSP MF + eMaxx		3.6%	3.1%	12.2%	19.6%	

Panel B: Using Dollar Par Volume

	(1)	(2)	(3)	(4)
	Total Holdings Changes Off-tape	% Holdings Changes Off-tape Family Level	% Holdings Fund Offset Cross	% Holdings Max Avail to Cross
Unconditional	7.9%	2.7%	2.3%	8.2%
Conditional 2+ Funds		2.6%	2.4%	8.6%
Conditional 5+ Funds		2.6%	2.8%	9.4%
Conditional Monthly holdings	5.8%	4.2%	10.3%	12.9%
Revised Quarterly (Monthly indicators, unconditional)	13.2%	4.6%	5.4%	8.1%
Merged CRSP MF + eMaxx		0.9%	3.6%	3.4%