Does Ownership Concentration Affect Corporate Bond Volatility? The Role of Illiquidity [*]

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Abstract

This paper analyzes the relation between ownership concentration and corporate bond volatility. We show that more concentrated mutual fund ownership is associated with higher volatility of corporate bonds. This relation is stronger among more illiquid bonds, during periods of heightened bond market illiquidity, and among bonds held by corporate bond funds that invest in more illiquid assets and experience higher or more correlated liquidity shocks. Using a sample of fund mergers, we further show that increases in bond volatility are not driven by the endogenous ownership structure of bonds, but rather the non-fundamental liquidity demand of large concentrated asset owners.

Keywords: Ownership concentration, bond volatility, corporate bonds, corporate bond funds, bond illiquidity, liquidity shocks, price fragility

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Abstract

This paper analyzes the relation between ownership concentration and corporate bond volatility. We show that more concentrated mutual fund ownership is associated with higher volatility of corporate bonds. This relation is stronger among more illiquid bonds, during periods of heightened bond market illiquidity, and among bonds held by corporate bond funds that invest in more illiquid assets and experience higher or more correlated liquidity shocks. Using a sample of fund mergers, we further show that increases in bond volatility are not driven by the endogenous ownership structure of bonds, but rather the non-fundamental liquidity demand of large concentrated asset owners.

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1. Introduction

The past few years have witnessed a steady growth of the U.S. corporate bond market. According to the Securities Industry and Financial Markets Association, the amount of outstanding corporate debt has more than doubled from $4 trillion to $9 trillion during 2002-2017. Yet the total assets of the bond market are known to be concentrated in the hands of some giant institutional investors. For example, UBS analysts report that the top five (20) investment companies hold $886 billion ($1.76 trillion) and $264 billion ($605 billion) in U.S. investment-grade and high-yield bonds, respectively, equivalent to 15% (30%) and 20% (46%) of their corresponding markets in 2016 (Turner (2016)). Observing this pattern, some commentators argue that a high degree of ownership concentration in the corporate bond market may lead to wild swings in bond prices. Their main concern is that large investors such as bond funds tend to sell aggressively when experiencing a large number of redemption requests during market downturns, thus further aggravating turbulent market conditions (e.g., Feroli, et al. (2014); Manconi, et al. (2012)). However, no academic research has directly studied the effect of concentrated ownership of corporate bonds, and in particular, how it interacts with bond market illiquidity in propagating the fragility in the corporate bond market.

Our paper aims to fill this gap by empirically studying the impact of ownership concentration on corporate bond volatility. For our purpose, we mainly focus on the concentrated ownership structure of corporate bonds by mutual funds that have played an increasingly important role in the corporate bond market in recent years. The Refinitiv eMAXX database shows that the outstanding par amount of corporate bonds held by mutual funds has increased from $298 million to $1.76 trillion during 2002-2017; by the end of 2017, these funds account for approximately 20% of total corporate bonds outstanding, as compared to 30% by insurance companies. However, unlike mutual funds that might be forced to liquidate their positions to provide daily liquidity to investors, insurance companies are typically buy-and-hold investors that are mainly concerned about the asset-liability mismatch, and thus are less likely to liquidate their positions when experiencing non-fundamental liquidity shocks.

Ex-ante, it is unclear whether and how ownership concentration affects corporate bond volatility. On the one hand, the existing literature suggests that asset volatility can arise from few large concentrated asset owners. For example, Gabaix, et al. (2006) present a theoretical model where excess volatility is driven by trades of few large institutional investors in a relatively illiquid market. This theory suggests that large institutional trades can generate significant spikes in returns and volume even in the absence of important news related to corporate fundamentals. Greenwood and Thesmar (2011) further argue that the non-diversifiable liquidity shocks across few large asset owners can make the asset "fragile," inducing higher volatility for assets with a more concentrated ownership structure.

Under this framework, we expect to observe a positive relation between ownership concentration and return volatility for corporate bonds, especially given their distinctive illiquidity features. Corporate bonds typically trade over the counter and thus are characterized by much lower liquidity than equities. As a result, compared to equity funds, corporate bond funds tend to incur larger trading costs (e.g., transaction costs and price impact) when liquidating their relatively more illiquid positions upon investor redemptions. Furthermore, asset illiquidity gives rise to liquidity mismatch or transformation for open-end corporate bond funds that are required to meet daily redemption requests from their investors. Investors in more illiquid funds have greater incentives to redeem their shares ahead of others to obtain a "first-mover" advantage since the redemption costs are borne by the remaining fund investors (Chen, et al. (2010); Zeng (2017);

Goldstein, et al. (2017)). In other words, asset illiquidity creates strategic complementarities among corporate bond fund investors in their redemption decisions, resulting in fund outflows that eventually lead funds to sell their holdings for non-fundamental related reasons. Jiang, et al. (2021) further show that corporate bonds held by more illiquid funds experience higher return volatility and more outflow-induced mutual fund selling. Hence, the illiquidity nature of corporate bonds can aggravate the fragility induced by a concentrated ownership structure.

On the other hand, some recent studies (e.g., Choi, et al. (2020)) argue that corporate bond funds well manage investor redemption requests by maintaining sufficient cash buffers and/or selectively trading liquid assets; as a result, trading by bond funds exerts little price pressure even during the financial crisis. Then it is plausible that efficient liquidity management of corporate bond funds can mitigate the effect of ownership concentration, if any, on bond return volatility.

Using a sample of 6,068 U.S. corporate bonds issued by 1,247 firms from July 2002 to June 2017, we first examine whether increased ownership concentration by mutual funds is associated with higher volatility of corporate bonds. We measure bond ownership concentration by the Herfindahl-Hirschman Index (HHI) and the total percentage ownership of the top three or five corporate bond funds with the largest holdings of the bond (Top 3 or Top 5). We find that bonds with a more concentrated ownership structure exhibit higher total and idiosyncratic volatilities. The significant positive relation between ownership concentration and bond volatility is not subsumed by the effects of any relevant bond characteristics such as illiquidity and credit rating, or issuer characteristics such as leverage and earnings volatility. In terms of economic significance, for instance, a one-standard-deviation increase in HHI, Top3, and Top5, respectively, leads to increases of 2.89% (2.82%), 3.99% (4.19%), and 4.74% (5.07%) of a standard deviation in total (idiosyncratic) bond volatility. Therefore, we reject the null hypothesis that efficient liquidity management of corporate bond funds can fully mitigate the impact of ownership concentration on the return volatility of corporate bonds.

To investigate whether the non-fundamental liquidity shocks experienced by corporate bond mutual funds drive the positive relation between ownership concentration and bond volatility, we next explore the variations among bonds with different exposures to non-fundamental liquidity shocks. If higher volatility of bonds with a more concentrated ownership structure arises from the limited diversification of non-fundamental liquidity shocks across few large owners, then we expect that (i) bonds that are more difficult to liquidate when their owners experience liquidity shocks, and (ii) bonds held by corporate bond funds that are more susceptible to high or correlated liquidity shocks should experience a higher sensitivity of volatility to ownership concentration.

Consistent with our conjectures, we show that the relation between ownership concentration and bond volatility is stronger among bonds that are more difficult to liquidate. Specifically, we find that this relation is stronger (i) among more illiquid bonds, such as bonds with higher Amihud (2002) illiquidity measures, bonds with a higher percentage of days within a given month that have no trade (Dick-Nielsen, et al. (2012)), and bonds with higher Roll (1984) illiquidity measures; (ii) during periods of heightened market illiquidity as measured by the Chicago Board Options Exchange (CBOE) Volatility Index (VIX) (Bao, et al. (2011)) and the TED spread (i.e., the difference between the three-month London Interbank Offered Rate (LIBOR) and the three-month Treasury-bill rate) (Brunnermeier and Pedersen (2009)); and (iii) among bonds held by corporate bond funds with more illiquid portfolios (as measured by the position-weighted average Amihud (2002) illiquidity of bonds held by a given fund) or limited cash buffers (i.e., holdings of cash and Treasury bonds). Further, we show that the relation between ownership concentration and bond volatility is stronger among bonds held by corporate bond funds that are more susceptible to high or correlated liquidity shocks, i.e., funds with higher portfolio turnover, higher outflow-underperformance sensitivity, and/or higher flow correlations. Overall, our findings support the hypothesis that ownership concentration of corporate bond funds can induce higher bond volatility due to the trading of few large asset owners who experience non-fundamental liquidity shocks.

To provide more direct evidence for our hypothesis, we construct a measure in a way similar to Coval and Stafford (2007) to capture the flow-induced net mutual fund selling. We show that corporate bonds with a more concentrated ownership structure indeed experience higher flow-driven net fund selling, indicating that ownership concentration restricts the diversification of liquidity shocks across few asset owners when they experience liquidity shocks to the extent that they need to liquidate their positions. We also find that the selling of the underlying bonds by corporate bond funds subsequently pushes up bond volatility. These results suggest that flow-induced mutual fund selling is a channel through which ownership concentration affects bond volatility.

While our results are consistent with the hypothesis that a concentrated ownership structure induces bond volatility, an important concern is that the ownership structure of corporate bonds is potentially endogenous. It is possible that the relation between ownership concentration and bond volatility simply reflects the preferences of large corporate bond funds toward those bonds with volatile fundamentals. Or any omitted variables that correlate with both bond volatility and ownership concentration might drive our results. Note that we control for an extensive set of bond- and issuer-level characteristics related to bond volatility and also include issuer- and time-fixed effects to mitigate the potential omitted variable concerns.

To further establish causality, along the lines of McLemore (2019), we use a sample of 140 corporate bond fund mergers from Morningstar as a quasi-natural experiment to capture exogenous increases in ownership concentration of corporate bonds. We argue that corporate bonds commonly held by both acquiring and target funds before the mergers would experience exogenous increases in ownership concentration (e.g., HHI) which are unlikely driven by the preferences of corporate bond funds. Indeed, Jayaraman, et al. (2002) argue that mutual fund mergers are most likely driven by either the poor performance of the target funds or due to strategic reasons such as economies of scale or duplicated investment objectives. We then adopt a difference-in-difference approach and show that bonds experiencing increases in ownership concentration induced by mutual fund mergers exhibit higher volatility in the post-merger period, even after controlling for the trading activities of acquirers and other funds around the mergers. These findings mitigate the potential endogeneity concerns, thus lending further support to our hypothesis that a more concentrated ownership structure would induce higher return volatility of corporate bonds.

Another alternative hypothesis is that the observed increase in bond volatility may reflect the improvement in price efficiency induced by informed trading rather than non-fundamental liquidity trading of few large asset owners. To explore this possibility, we analyze the relation between ownership concentration and bond price inefficiency. The results show that bonds with higher ownership concentration exhibit lower price efficiency, implying that non-fundamental liquidity trading of few concentrated bondholders induces more noise in bond prices rather than improve the price efficiency. Thus, we reject the alternative hypothesis that the higher volatility of bonds with a more concentrated ownership structure indicates higher price efficiency.

We contribute to the literature in several ways. First, our study is related to a growing body of literature on price fragility in the corporate bond market. Prior studies have documented mixed evidence on whether flow-driven mutual fund selling induces corporate bond price fragility. Several papers suggest that massive investor redemptions lead to price pressures on corporate bonds because corporate bond funds are forced to sell aggressively in response to redemptions (Manconi et al. (2012); Zeng (2017); Goldstein et al. (2017); Falato, et al. (2020); Jiang et al. (2021)). By contrast, Choi et al. (2020) argue that efficient liquidity management can mitigate the impact of investor redemptions and find little evidence of corporate bond price pressures even during periods of financial crisis. While these studies mainly focus on the effects of flow-driven mutual fund selling on corporate bonds, we provide new evidence that ownership concentration can be an important source of bond price fragility, and that flow-driven mutual fund selling is the underlying mechanism through which concentrated ownership affects corporate bond volatility.

Second, this study advances our understanding of how the illiquidity of corporate bonds helps shape the relation between ownership concentration and bond price fragility. Prior literature has focused on the relation between ownership concentration and volatility in the equity market (Ben-David, et al. (2021); Greenwood and Thesmar (2011)), which generally has a more diversified ownership structure and much higher liquidity than the bond market. We contribute to this literature by providing the first empirical evidence on the impact of ownership concentration on asset volatility in the corporate bond market and further exploring how different dimensions of illiquidity of corporate bonds propagate bond price fragility. Importantly, we document that the economic impact of ownership concentration on price fragility in the bond market appears to be more significant than that in the equity market.

Lastly, this paper extends the literature on the roles of institutional investors in influencing bond prices, liquidity, and volatility. The existing studies mainly focus on the effects of *aggregate* ownership of a particular type of institutional investors, such as corporate bond funds (Anand, et al. (2021)), exchange-traded funds (Dannhauser (2017)), and insurance companies (Ellul, et al. (2011); Chen, et al. (2020)). Our study highlights that *concentrated* ownership of bond mutual funds contains additional information and is an important contributor to corporate bond volatility.

The rest of the paper proceeds as follows. Section 2 develops our hypotheses. Section 3 describes the data and variables. Section 4 presents our main empirical findings. Section 5 presents several additional tests. Section 6 concludes.

2. Hypothesis Development

Our hypotheses are built on the existing literature on the impact of non-fundamental demand shocks from institutional investors on asset prices and volatility. Prior studies suggest that the investor demands unrelated to asset fundamentals, e.g., the flow-driven demands from mutual funds, can affect asset prices (Coval and Stafford (2007); Frazzini and Lamont (2008); Lou (2012)). Moreover, the existing research points out that the non-fundamental demand shocks experienced by few large concentrated institutional investors have important implications for asset price fluctuations, especially during periods of financial crisis. For example, Gabaix et al. (2006) present a theoretical model where excess volatility is driven by trades of few large institutional investors in a relatively illiquid market. This theory suggests that large institutional trades can generate significant spikes in returns and volume even in the absence of important news related to corporate fundamentals. Greenwood and Thesmar (2011) further elaborate that return volatility can arise from a concentrated ownership structure where non-fundamental liquidity shocks are not diversifiable across few large asset owners. Specifically, for an asset held by few owners who have large percentage stakes, if one (or more) of its owners experiences liquidity shocks, e.g., for reasons uncorrelated with firm fundamentals, to the extent that they need to scale down or even liquidate their portfolios, then their trades may not be easily taken over by those of other asset owners, thus resulting in price impact and higher volatility. By contrast, for an asset held by a diversified group of small owners, if one of its owners experiences liquidity shocks that induce selling of their positions for non-fundamental reasons, then the impact of their trades is minimal and negligible since their trades are rapidly accommodated, or canceled out, by those of many other owners that hold the same positions. In other words, the demand shocks across few large concentrated asset owners can lead to massive liquidity trades, which subsequently translate into price pressures and higher return volatilities, particularly, for those assets held by owners that experience large or correlated liquidity shocks. Following these arguments, we expect a positive relation between ownership concentration and return volatility for corporate bonds. This leads to our first hypothesis (H1).

H1. There exists a significant positive effect of ownership concentration on corporate bond volatility.

Alternatively, if corporate bond funds well manage investor redemption requests by maintaining sufficient cash buffers and/or selectively trading liquid assets, their trades would lead to little price pressure even during the financial crisis (Choi et al. (2020)). Thus, our null hypothesis ($H1_0$) is that we expect little or no impact of ownership concentration on corporate bond volatility.

$H1_0$. There exists no significant positive relation between ownership concentration and corporate bond volatility.

A distinctive feature of the corporate bond market is that corporate bonds are relatively illiquid assets. As a result, if corporate bond funds experience non-fundamental liquidity shocks, they tend to incur larger trading costs or generate greater price impact when liquidating their positions upon investor redemptions (Qin and Wang (2021)). Moreover, asset illiquidity gives rise to liquidity mismatch or transformation for open-end corporate bond funds that provide daily liquidity redemption rights to their investors. The investors in more illiquid funds have greater incentives to redeem their shares ahead of others to obtain a "first-mover" advantage since the redemption costs like transaction costs or price impact are borne by the remaining fund investors (Chen et al. (2010); Zeng (2017); Goldstein et al. (2017)). In other words, bond illiquidity creates strategic complementarities among fund investors in their redemption decisions, thus generating a risk of runs on these funds (i.e., "investor runs"). Jiang et al. (2021) further show that asset illiquidity of bond funds leads to higher bond volatility and more outflow-induced mutual fund selling in the corporate bond market. Moreover, mutual fund selling induced by investor redemptions has powerful spillover effects among peer funds that hold the same bonds, thus leading to further asset sales and a large price impact (Falato et al. (2020)). Hence, we expect that the illiquidity of corporate bonds aggravates the excess bond volatility induced by a concentrated ownership structure. This leads to our second hypothesis (H2).

H2. The effect of ownership concentration on corporate bond volatility is stronger among more illiquid bonds.

The same logic also applies to changes in market liquidity over time. When the overall bond market illiquidity is heightened (e.g., when bonds trade even less frequently and more costly), the outflows of corporate bond funds are intensified, and liquidation costs imposed on funds due to large outflows are more severe. Bao et al. (2011) show that the increase in aggregate stock market volatility strongly and positively affects the illiquidity of corporate bonds. Given a limited supply of liquidity during periods of heightened market illiquidity, mutual fund selling can generate a large swing in prices and elevate bond volatility (Manconi et al. (2012)). The domino effect of liquidation by corporate bond fund investors in such periods thus amplifies the excess bond volatility induced by concentrated ownership. This leads to our third hypothesis (H3).

H3. The effect of ownership concentration on corporate bond volatility is stronger during periods of higher market illiquidity.

Similarly, corporate bond funds with more illiquid portfolios incline to incur larger trading costs when they adjust their positions upon redemptions. Relative to their liquid counterparts, illiquid corporate bond funds are more sensitive to bad performance and experience stronger strategic complementarities among investors when funds underperform. Accordingly, liquidity shocks trigger more outflows from corporate bond funds that hold mainly illiquid portfolios and eventually lead to mutual fund selling and generate higher price impact and volatility (Goldstein et al. (2017); Jiang et al. (2021); Manconi et al. (2012)). Therefore, we expect that bonds held by more illiquid corporate bond funds tend to exhibit a stronger relation between ownership concentration and volatility. This leads to our fourth hypothesis (H4).

H4. The effect of ownership concentration on corporate bond volatility is stronger among bonds held by corporate bond funds with higher portfolio illiquidity.

Lastly, we relate the corporate bond volatility induced by ownership concentration to the non-fundamental liquidity shocks faced by corporate bond funds. Intuitively, funds exposed to higher liquidity shocks (e.g., funds with higher portfolio turnover or flow-performance sensitivity) are expected to trade more frequently and induce higher redemption costs (Chordia (1996); Gaspar, et al. (2005)). Also, corporate bond funds that face more correlated liquidity shocks, such as funds that face more correlated fund flows, are more likely to trade in the same direction and impose higher price impact (Chordia (1996); Manconi et al. (2012); Gaspar et al. (2005); Greenwood and Thesmar (2011); Koch, et al. (2016)). Following these arguments, we expect that bonds held by corporate bond funds facing higher liquidity needs and/or more correlated liquidity shocks tend to show a more pronounced effect of ownership concentration on bond volatility. This leads to our fifth hypothesis (H5).

H5. The effect of ownership concentration on corporate bond volatility is stronger among bonds held by corporate bond funds facing higher and/or more correlated liquidity shocks.

3. Data and Variables

3.1. Corporate Bond Sample

We construct our corporate bond sample from multiple data sources. First, we obtain the bond pricing data from the enhanced version of the Trade Reporting and Compliance Engine (TRACE), which provides real-time transaction data of all publicly traded corporate bonds since July 2002. Following Dick-Nielsen (2009) and Dick-Nielsen (2014), we clean the enhanced TRACE data by eliminating canceled, corrected, and reversed trades. We then merge TRACE with the Mergent Fixed Income Securities Database (FISD) to obtain bond issue and issuer characteristics and delete any bonds with missing coupons, interest payment frequency, or maturity date. We further exclude variable rate bonds, non-U.S. dollar-denominated bonds, 144A bonds, preferred securities, convertible bonds, and bonds that are structured notes, mortgage-backed, asset-backed, agency-backed, equity-linked, or part of the unit deal, and only keep U.S. publicly traded bonds with the types of Corporate Debentures (CDEB), Corporate Medium-Term Note (CMTN), and Corporate Medium Term Note Zero (CMTZ). As we need to calculate monthly bond volatility using daily returns, we also require a bond to have a minimum of ten daily return observations within a month to be included in the sample. Next, we obtain stock and accounting information for bond issuers from the Center for Research in Security Prices (CRSP)/Compustat Merged database.

Finally, we merge the bond information with the Morningstar database, which provides detailed portfolio holdings of both live and dead mutual funds. Although funds were required by law to publicly disclose holdings semiannually until May 2004 and quarterly thereafter, many funds voluntarily report holdings to Morningstar at a higher (e.g., monthly) frequency.[1] As we only focus on corporate bonds, we obtain the holdings information of corporate bond funds with the Morningstar categories of "High Yield Bond," "Long-Term Bond," "Intermediate-Term Bond," "Short-Term Bond," "Multisector Bond," and "Corporate Bond." Our final sample includes 6,068 corporate bonds issued by 1,247 firms from July 2002 to June 2017.

3.2. Main Variables

In this subsection, we primarily focus on our main variables (i.e., ownership concentration and corporate bond volatility). The detailed definitions of a complete list of all variables (including all controls) appear in Appendix A.

[1] On average, Morningstar provides portfolio holdings data for a fund over six times a year during our sample period. For those fund-months with missing data, we forward fill holdings for up to six months in our main analysis.

To measure ownership concentration for each corporate bond, we first calculate a mutual fund's percentage ownership (*PctOwn*) in a bond as the par amount of the bond held by the fund divided by the total par amount of the bond held by all corporate bond funds, i.e.,

$$\mathrm{PctOwn}_{j,f,t} = \frac{ParAmt_{j,f,t}}{\sum_{f=1}^{F} ParAmt_{j,f,t}}, \tag{1}$$

where $ParAmt_{j,f.t}$ is the par amount of bond *j* held by fund *f* in month *t*, and *F* is the total number of corporate bond funds holding bond j. Then we construct three measures to capture the ownership concentration of a corporate bond.[2] First, we estimate the Herfindahl-Hirschman Index (HHI) for each bond in any given month as the sum of squares of percentage ownership across all corporate bond mutual funds that hold the bond, i.e.,

$$HHI_{j,t} = \sum_{f=1}^{F} PctOwn_{j,f,t}^2. \tag{2}$$

We also construct two alternative ownership concentration measures, namely, Top 3 and Top 5. Top 3 (Top 5) is defined as the total percentage ownership of the top three (five) funds with the largest holdings of the bond in each month.

To estimate corporate bond volatility for a given month, we first calculate daily corporate bond returns as follows:

$$R_t = \frac{P_t + AI_t + C_t}{P_{t-1} + AI_{t-1}} - 1, \tag{3}$$

where P_t is the trading volume-weighted average clean price, AI_t is the accrued interest calculated using bond issue information (e.g., coupon rate and maturity) from FISD, and C_t is the coupon

[2] As we measure ownership concentration mainly based on mutual fund ownership of corporate bonds, a potential concern is that measurement error tends to be higher when fund ownership is lower. To alleviate this concern, we divide our sample bonds into two subsamples based on fund ownership and then repeat our main tests. The results remain qualitatively similar for both high and low fund ownership groups.

paid in day t. Note that we only calculate daily returns for day t if the transaction prices are available for both day t and day $t-1$.

We then compute two measures of volatility for bonds with a minimum of ten daily return observations within a month. The first measure is the total return volatility, defined as the standard deviation of daily bond returns in a given month. The second measure is the idiosyncratic volatility, defined as the standard deviation of the residuals from the following Fama and French (1993) five-factor model for a given month:

$$R_{j,t} - R_{f,t} = \alpha_j + \beta_{j,Mkt}MKT_t + \beta_{j,SMB}SMB_t + \beta_{j,HML}HML_t$$

$$+\beta_{j,Term}TERM_t + \beta_{j,DEF}DEF_t + \varepsilon_{j,t}, \tag{4}$$

where R_j is the daily return of bond j, R_f is the daily risk-free rate, MKT is the daily market excess return, SMB is the small-minus-big size factor defined as the difference in daily average returns between small and big portfolios, HML is the high-minus-low book-to-market factor defined as the difference in daily average returns between value and growth portfolios, $TERM$ is the term spread factor defined as the difference between Bloomberg Barclays long-term U.S. Treasury bond index daily returns and the daily risk-free rate, and DEF is the default spread factor defined as the difference in daily returns between Bloomberg Barclays long-term U.S. corporate and Treasury bond indices.[3]

Finally, we construct control variables used in the regressions. First, we include lagged total or idiosyncratic volatility to control for the persistence in volatility over time. We also include mutual fund ownership, calculated as the total par amount of a given bond held by all corporate

[3] We thank Kenneth R. French for making daily data on the Fama and French (1993) three factors (MKT, SMB, and HML) available at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research.

bond funds as a fraction of the bond's par amount outstanding. Next, following Bao and Pan (2013), we control for bond issue-level characteristics, including the logarithm of par amount outstanding, bond age, duration, credit rating, a call dummy, and the Amihud (2002) bond illiquidity measure. We further control for issuer-level characteristics, including accounting variables that are used for default prediction (e.g., Altman (1968); Campbell, et al. (2008)) such as firm size, profit, interest coverage, sales/assets, retained earnings/assets, and net income/assets, and proxies for the volatility of fundamentals such as cash flow volatility (Minton and Schrand (1999)), leverage volatility (Collin - Dufresne and Goldstein (2002)), sales volatility (Sufi (2009)), and earning volatility (Jayaraman (2008)). All control variables are defined in Appendix A.

3.3. Descriptive Statistics

Table 1 presents summary statistics of all variables for the entire sample, which includes a total of 127,643 bond–month observations for 6,068 distinct bonds during 2002Q3-2017Q2. In general, our sample corporate bonds show a substantial variation in volatility. For instance, the average total (idiosyncratic) volatility is 0.736% (0.564%) with a standard deviation of 0.557% (0.449%). Moreover, the average HHI, Top3, and Top5 are 0.223, 0.63, and 0.763, respectively, indicating that our sample bonds are highly concentrated in the hands of few corporate bond funds.

[Insert Table 1 about here]

Since we restrict our sample to those with all dependent and independent variables available, our sample bonds are relatively larger than a typical bond in FISD. For example, the average par value of bonds in our sample is $689 million, as compared to that of $446 million in the full FISD sample. In addition, the firms in our sample also tend to be large and financially strong, with average total assets of 31.9 billion, average earnings to assets ratio of 25%, and an average coverage ratio of close to 10. As a result, the bonds in our sample are relatively more liquid than an average bond in the FISD sample, especially given that we require our sample bond to have a minimum of ten daily return observations within a month. However, as shown later in Section 4.2, our results are stronger among more illiquid bonds. Therefore, the inclusion of more liquid corporate bonds in our sample only biases us against finding significant results.

In Table 2, we sort the sample bonds into five quintiles every month based on each of the three ownership concentration measures and report average total and idiosyncratic volatilities of corporate bonds by quintiles. The table shows that both total and idiosyncratic volatilities increase monotonically with HHI. For instance, average daily total (idiosyncratic) volatility increases from 0.689% (0.526%) in the bottom-HHI quintile to 0.995% (0.770%) in the top-HHI quintile. The difference in average total (idiosyncratic) volatility between the top- and bottom-HHI quintiles is 0.31% (0.24%) with a Newey and West (1987) *t*-statistic of 11.07 (11.03). We also observe similar patterns using alternative ownership concentration measures, i.e., Top 3 and Top 5. The univariate analysis provides the first preliminary evidence on the positive relation between ownership concentration and corporate bond volatility.

[Insert Table 2 about here]

4. Empirical Analysis

4.1. Main Findings

In this subsection, we start by investigating the relation between ownership concentration and corporate bond volatility. Our first hypothesis (H1) predicts that more concentrated ownership can lead to higher bond volatility due to the non-fundamental liquidity shocks experienced by corporate bond funds. To test this hypothesis, we estimate the following regression:

$$Vol_{j,t+1} = \beta_0 + \beta_1 OC_{j,t} + \beta_2 X_{j,t} + \alpha_j + \gamma_t + \varepsilon_{j,t+1}, \tag{5}$$

where $Vol_{j,t+1}$ denotes bond j's total or idiosyncratic volatility in month t+1, $OC_{j,t}$ denotes bond j's ownership concentration in month t as measured by HHI, Top3, or Top5, and $X_{j,t}$ denotes a vector of control variables, including lagged total or idiosyncratic volatility, mutual fund ownership, and issue- and issuer-level characteristics that are correlated with bond volatility in the next month (i.e., the logarithm of amount outstanding, bond age, duration, credit rating, a call dummy, the Amihud illiquidity measure, firm size, profit, interest coverage, sales/assets, retained earnings/assets, net income/assets, cash flow volatility, leverage volatility, sales volatility, and earnings volatility). We also include issuer fixed effect (α_j) to control for any time-invariant unobservable issuer-level characteristics that are relevant to a bond's volatility, and month fixed effect (γ_t) to control for time-varying macroeconomic conditions.[4] The main coefficient of interest (β_1) captures the effect of ownership concentration on bond volatility. We draw statistical inferences based on standard errors that are double-clustered at the issuer and month levels.

[Insert Table 3 about here]

Table 3 reports regression results using total and idiosyncratic bond volatilities as the dependent variables, respectively, in Columns 1-3 and 4-6. The table shows that the coefficients on ownership concentration are positive and statistically significant at the 1% level across all specifications regardless of the volatility or ownership concentration measures considered. For instance, based on total (idiosyncratic) bond volatility, the coefficients on HHI, Top3, and Top5

[4] The untabulated results using issue and month fixed effects or issuer × month fixed effect remain qualitatively similar.

are 0.094 (0.074), 0.117 (0.099), and 0.159 (0.137), with *t*-statistics of 7.42 (6.78), 8.94 (8.64), and 10.08 (9.94), respectively. In terms of economic significance, a one-standard-deviation increase in HHI leads to 2.89% (2.82%) of a standard deviation increase in total (idiosyncratic) bond volatility.[5] Similarly, an increase of one standard deviation in Top3 (Top5) is associated with increases of 3.99% (4.74%) and 4.19% (5.07%) of a standard deviation in total and idiosyncratic bond volatilities, respectively. By contrast, Ben-David et al. (2021) show that a one-standard-deviation increase in Top 3 (Top 5) institutional ownership is associated with an increase of 2.19% (2.88%) of a standard deviation in stock volatility.[6] Therefore, from an economic perspective, the effect of ownership concentration on asset volatility in the corporate bond market appears to be more pronounced than that documented in the equity market. Taken together, these findings are consistent with H1 that the bonds with a more concentrated ownership structure have higher volatility. We thus reject our null hypothesis ($H1_0$) that there is no significant positive relation between ownership concentration and bond volatility.

Then we turn to the control variables. As expected, corporate bond volatility is highly persistent, as indicated by the highly significant positive coefficients on lagged volatility. The coefficients on mutual fund ownership, however, are statistically insignificant, implying that the positive relation between ownership concentration and bond volatility is not driven by the aggregate level of corporate bond fund ownership. The coefficients on all the issue-level characteristics (except for the call dummy) are significant with the expected signs. Specifically, we find that smaller and older bonds with longer duration, lower credit quality, and lower liquidity

[5] The increases in total and idiosyncratic volatilities (relative to a standard deviation) are calculated as 0.094×0.171/0.557=2.89% and 0.074×0.171/0.449=2.82%, respectively.

[6] Based on Ben-David et al. (2021), the economic significance of the effect of Top 3 (Top 5) institutional ownership on stock volatility is computed as the estimated coefficient of 1.096 (1.08) on Top 3 (Top 5) from Table 2 times the standard deviation of 0.051 (0.068) for Top3 (Top 5) from Table 1 divided by the standard deviation of 2.55% for stock volatility from Table 1: 1.096×0.051/2.55 = 2.19% (1.08×0.068/2.55 = 2.88%).

tend to have higher return volatility. The issuer-level characteristics, nevertheless, are mostly insignificant in explaining corporate bond volatility, possibly because they are largely subsumed by the issue-level characteristics and the issuer and time fixed effects. One exception is that the coefficients on firm profitability show a consistent negative sign, indicating that bonds issued by firms with weaker financial performance tend to have higher volatility.

4.2. The Effect of Corporate Bond Illiquidity

Next, we explore how corporate bond illiquidity affects the relation between ownership concentration and bond volatility in this subsection. Our second hypothesis (H2) predicts that if the concentrated ownership structure induces corporate bond volatility due to the non-fundamental liquidity shocks experienced by corporate bond funds, more illiquid bonds should exhibit a stronger relation between ownership concentration and volatility for at least two reasons. First, more illiquid bonds are more difficult to price and more expensive to liquidate. Second, bond illiquidity creates strategic complementarities among corporate bond fund investors or peer funds holding the same assets, which can lead to excessive investors outflows that aggravate the outflow-induced mutual fund selling among corporate bond funds (e.g., Chen et al. (2010); Goldstein et al. (2017); Falato et al. (2020)).

To test H2, we consider the following general regression specification:

$$Vol_{j,t+1} = \beta_0 + \beta_1 OC_{j,t} + \gamma OC_{j,t} \times Char_{j,t} + \delta Char_{j,t} + \beta_2 X_{j,t} + \alpha_j + \gamma_t + \varepsilon_{j,t+1}, \quad (6)$$

where $Char_{j,t}$ denotes the conditional characteristic of bond j in month *t*, and other variables are as defined in Equation (5). In this test, $Char$ refers to the illiquidity level of a given bond in each month. Our main variable of interest is then the interaction term between ownership concentration and bond illiquidity. A positive coefficient (γ) on this interaction term indicates that the impact of ownership concentration on bond volatility is more pronounced among more illiquid bonds.

We adopt three measures of corporate bond illiquidity at monthly frequency. The first is the Amihud (2002) illiquidity measure, defined as the median of the daily average price impact of bond trades within a month (Bao and Pan (2013)). The second measure is *Bond Zero*, calculated as the percentage of days within a given month that the bond does not have any trades (Dick-Nielsen et al. (2012)). The last one is the Roll (1984) illiquidity measure, which is constructed by first calculating the daily Roll measure as two times the square root of minus the covariance between consecutive returns on days with at least one transaction using a rolling window of 21 trading days if the covariance is less than zero (and zero otherwise), and then taking the median of daily measures within a month (Dick-Nielsen et al. (2012)).

[Insert Table 4 about here]

Table 4 presents regression results using each of the above three bond illiquidity measures. In Columns 1–3 (4–6), we use total (idiosyncratic) bond volatility as the dependent variable. The results show that bonds with lower levels of liquidity exhibit a stronger relation between ownership concentration and bond volatility. For example, based on the Amihud (2002) illiquidity measure (Panel A), the coefficients on the interaction term between ownership concentration and bond illiquidity are 6.251 (5.221), 11.323 (9.099), and 14.870 (12.281) with *t*-statistics of 1.93 (1.87), 3.09 (2.77), and 3.29 (3.01), respectively, when volatility is measured by total (idiosyncratic) bond volatility and ownership concentration is measured by HHI, Top 3, and Top 5. The results based on alternative proxies of bond illiquidity, i.e., *Bond Zero* (Panel B) and the Roll (1984) illiquidity measure (Panel C) are similar. Specifically, for both of the alternative bond illiquidity measures, we find that the coefficients on the interaction term between ownership concentration and bond illiquidity are all positive and significant at the 1% level, regardless of the bond volatility or ownership concentration measures considered.

Overall, consistent with H2, the results indicate that the effect of ownership concentration on corporate bond volatility is stronger among more illiquid bonds.

4.3. The Effect of Bond Market Illiquidity

In this subsection, we then analyze whether the effect of a concentrated ownership structure on bond volatility is conditional on bond market illiquidity. Following the similar arguments above, we expect the relation between ownership concentration and corporate bond volatility to be more pronounced during periods of heightened bond market illiquidity under our third hypothesis (H3). In particular, when the overall market is more illiquid (i.e., when bonds trade less frequently and more costly), corporate bond funds may suffer intensified investor outflows and subsequently higher liquidation costs. The domino effect of liquidation incurred by corporate bond fund investors may thus amplify the excess volatility induced by a concentrated ownership structure.

To test H3, we use the following specification:

$$Vol_{j,t+1} = \beta_0 + \beta_1 OC_{j,t} + \gamma OC_{j,t} \times MIL_t + \beta_2 X_{j,t} + \alpha_j + \gamma_t + \varepsilon_{j,t+1}, \tag{7}$$

where MIL_t denotes the level of bond market illiquidity in month *t*, and other variables are again as defined in Equation (5). We use two standard measures of bond market illiquidity as in the literature (e.g., Bao et al. (2011); Brunnermeier and Pedersen (2009)): (1) the VIX, and (2) the TED spread, computed as the difference between the three-month London Interbank Offered Rate (LIBOR) and the three-month Treasury-bill rate.[7] Note that a positive coefficient (γ) on the

[7] As a robustness check, we also calculate bond market illiquidity as the par value weighted-average of the Amihud (2002) or Roll (1984) illiquidity measures of individual corporate bonds, and find similar results.

interaction term between ownership concentration and bond market illiquidity would support our conjecture in H3.

[Insert Table 5 about here]

Table 5 reports regression results using VIX and the TED spread to proxy for bond market illiquidity in Panels A and B, respectively. For both panels, we use total (idiosyncratic) bond volatility as the dependent variable in Columns 1–3 (4–6). In general, we observe significant positive coefficients on the interaction term between ownership concentration and bond market illiquidity across all regressions. For instance, for total (idiosyncratic) volatility, the coefficient on the interaction term between HHI and VIX is 0.448 (0.363) with a *t*-statistic of 2.64 (2.59). Similarly, the coefficients on the interaction term between HHI and TED are 1.986 and 1.662 with *t*-statistics of 2.45 and 2.38, respectively, for total and idiosyncratic volatilities. The results using Top 3 and Top 5 as the measures of ownership concentration are also similar. Overall, the findings are consistent with our conjecture in H3 that the effect of ownership concentration on corporate bond volatility is more distinct during periods of lower bond market liquidity.

4.4. The Effect of Corporate Bond Fund Illiquidity

In this subsection, we next explore whether the relation between ownership concentration and bond volatility is related to the portfolio illiquidity of corporate bond funds. Intuitively, corporate bond funds with more illiquid portfolios tend to incur larger trading costs when they liquidate their positions upon investor redemptions. Bonds held by more illiquid funds also exhibit stronger strategic complementarities among investors when funds underperform (Goldstein et al. (2017)). Similar logic also applies to funds with limited cash buffers (i.e., limited holdings of cash and Treasury securities) who are more likely to sell bonds in their portfolios to meet redemption requests. Therefore, under our fourth hypothesis (H4), we expect the effect of a concentrated ownership structure on bond volatility to be stronger among the bonds held by more illiquid funds, i.e., funds with more illiquid assets and/or lower cash and Treasury holdings.

To test this hypothesis, we use Equation (6) where $Char$ refers to bond-level average fund illiquidity, i.e., the position-weighted average illiquidity level of corporate bond funds that hold the bond in each month. The coefficient (γ) on the interaction term between ownership concentration and bond-level average fund illiquidity indicates whether more illiquid corporate bond funds would aggravate their underlying bonds' excess volatility induced by the concentrated ownership structure.

To estimate bond-level average fund illiquidity, we consider two measures of fund-level portfolio illiquidity. The first is the par value-weighted average Amihud (2002) illiquidity measure across all corporate bonds held by the fund. Another measure is the fund's total percentage holdings of cash and Treasury securities. Note that a higher (lower) value of the first (second) measure indicates that the funds are exposed to more illiquid assets. We then calculate bond-level average fund illiquidity as the position-weighted average fund-level illiquidity across all corporate bond funds that hold the bond in a given month. The bond-level average fund illiquidity measures thus capture the extent to which bonds are held by corporate bond funds that are exposed to illiquid assets.

[Insert Table 6 about here]

Table 6 presents regression results regarding how bond-level average fund illiquidity affects the relation between ownership concentration and bond volatility. We estimate bond-level average fund illiquidity based on the Amihud (2002) measure and the fund's cash and Treasury holdings, respectively, in Panels A and B. For both panels, Columns 1–3 (4–6) use total (idiosyncratic) volatility as the dependent variable. As shown in Panel A, the coefficients on the interaction terms between ownership concentration and bond-level average fund illiquidity using the Amihud (2002) measure are all positive and significant at the 1% or 5% level, regardless of the concentration measures considered. This implies that the effect of ownership concentration on bond volatility is stronger among the bonds held by corporate bond funds with more illiquid portfolios. Similarly, Panel B shows that the positive relation between ownership concentration and bond volatility is more pronounced among the bonds held by corporate bond funds with limited cash buffers. For instance, the coefficients on the interaction terms between ownership concentration and bond-level average fund holdings of cash and Treasury securities are significantly negative at the 1% level in all regressions.

Overall, consistent with H4, we document that corporate bonds held by more illiquid funds tend to show a stronger positive relation between ownership concentration and volatility. The results suggest that the asset illiquidity of corporate bond funds helps propagate the impact of a concentrated ownership structure on the return volatility of their underlying bonds.

4.5. The Effect of Corporate Bond Fund Liquidity Shocks

Finally, we investigate whether the excess bond volatility induced by a concentrated ownership structure is related to the extent of liquidity shocks experienced by corporate bond funds. Intuitively, corporate bond funds are more likely to scale down their positions or liquidate their underlying corporate bonds to meet the redemption requests of investors with exogenous liquidity needs when they more frequently face high liquidity shocks (Chordia (1996); Manconi et al. (2012); Gaspar et al. (2005); Greenwood and Thesmar (2011); Koch et al. (2016)). The mutual fund selling driven by liquidity shocks subsequently leads to price pressure and drives up volatility on the funds' underlying bonds. Therefore, if the concentrated ownership structure induces corporate bond volatility due to the non-fundamental liquidity shocks experienced by corporate bond funds, we expect this effect to be stronger among the bonds held by corporate bond funds that face higher or more correlated liquidity shocks under our fifth hypothesis (H5).

To test this hypothesis, we again use Equation (6) where $Char$ refers to bond-level average fund liquidity shocks, i.e., the position-weighted average fund liquidity shocks across all corporate bond funds that hold the bond in each month. Following the literature, we adopt three measures of fund-level liquidity shocks. First, as argued in Manconi et al. (2012), corporate bond funds with higher portfolio turnover rates are typically matched with the investors with higher exogenous liquidity needs, and thus bear a higher risk of liquidating their positions at a cost. Therefore, we use the fund turnover obtained from Morningstar as the first fund-level proxy for the extent of liquidity shocks experienced by corporate bond funds. The bond-level average fund turnover is computed as the position-weighted average fund turnover across all funds holding the bond.

Second, corporate bond funds with greater sensitivity of outflows to bad performance also face higher liquidity shocks because these funds are more likely to be forced to liquidate their positions at a cost to meet the redemption requests of their investors. Hence, our second fund-level measure is the sensitivity of outflows to negative alpha, calculated as $\beta_1 + \beta_2$ from the following regression as in Goldstein et al. (2017):

$$Flow_{f,t} = \alpha + \beta_1 Alpha_{f,t-12\to t-1} + \beta_2 Alpha_{f,t-12\to t-1} \times I\left(Alpha_{f,t-12\to t-1} < 0\right) + \beta_3\left(Alpha_{f,t-12\to t-1} < 0\right) + \gamma Controls_{f,t} + \varepsilon_{f,t}, \tag{8}$$

where $Alpha_{f,t-12\to t-1}$ is the average monthly alpha for a given fund over the past year, $I\left(Alpha_{f,t-12\to t-1} < 0\right)$ is equal to one if the fund has a negative alpha in the past year and zero otherwise, $Flow_{f,t}$ is the fund flow in a given month, and $Controls_{f,t}$ include lagged fund flow, the natural logarithm of total net assets (TNA), the natural logarithm of fund age (in months), and fund expense ratio.[8] The bond-level average outflow-underperformance sensitivity is computed as the position-weighted average outflow-underperformance sensitivity across all funds that hold the bond.

Lastly, corporate bond funds with more correlated investor flows are more likely to trade in the same direction to meet the correlated liquidity needs of investors (Koch et al. (2016)), thus imposing higher price impact on their underlying bonds and exacerbating the volatility induced by concentrated ownership (Greenwood and Thesmar (2011)). As a result, we use the flow correlation to measure the correlated liquidity shocks faced by corporate bond funds, and then calculate the bond-level average flow correlation as the position-weighted average of flow correlations in the past 12-months between each pair of corporate bond funds that hold the bond in each month.

[Insert Table 7 about here]

Table 7 reports regression results on the impact of bond-level average fund liquidity shocks on the relation between ownership concentration and bond volatility, based on each of the above three measures of fund liquidity shocks. Again, Columns 1–3 (4–6) use total (idiosyncratic) volatility as the dependent variable. Panel A shows that the coefficients on the interaction terms between ownership concentration and bond-level average fund turnover are all significantly positive at the 1% level, indicating that the positive relation between ownership concentration and bond volatility is more pronounced among the bonds held by corporate bond funds with higher turnover. Similarly, Panel B shows that the bonds held by funds with a higher sensitivity of

[8] Consistent with Goldstein et al. (2017), the untabulated result shows that the average sensitivity of outflows to negative alpha in our sample is around 0.843.

outflows to negative alpha exhibit a stronger positive relation between ownership concentration and volatility, indicating that these funds are more likely to liquidate the bonds in their portfolios upon investor redemptions, thus magnifying the excess bond volatility induced by ownership concentration. Finally, Panel C shows that the relation between ownership concentration and bond volatility is more pronounced among the bonds held by corporate bond funds facing more correlated flows.

Overall, the findings are consistent with H5 that the excess volatility of corporate bonds induced by a concentrated ownership structure can arise from the liquidity-driven mutual fund trading by few large asset owners who experience liquidity shocks, especially among those bonds held by corporate bond funds that face higher and/or more correlated liquidity shocks.

5. Further Analysis

5.1. Channel: Flow-induced Mutual Fund Selling

Our story is centered on the argument that bond return volatility can arise from a concentrated ownership structure due to the limited diversification of liquidity shocks across few large asset owners. In other words, the relation between bond volatility and ownership concentration is driven by the response of corporate bond funds to accommodate the liquidity demands from investors to the extent that they are forced to sell off their underlying corporate bond positions. To provide more direct evidence that flow-induced mutual fund selling is a channel through which ownership concentration affects bond volatility, we construct a measure ($NetSell$) in a way similar to Coval and Stafford (2007) to capture the flow-induced net mutual fund selling as follows:

$$NetSell_{j,t} = \frac{\sum_{f=1}^{F}(SellAmt_{f,j,t}|Flow_{f,t}<0 - BuyAmt_{f,j,t}|Flow_{f,t}>0)}{AmtOut_{j,t-1}}, \quad (9)$$

where $SellAmt_{f,j,t}$ ($BuyAmt_{f,j,t}$) is the amount of sales (purchases) of bond j held by fund f in period *t* when the fund experiences outflows (inflows), *F* is the total number of funds holding bond j in period t, and $AmtOut_{j,t-1}$ is the total par amount outstanding of bond j in period t-1.[9] This measure captures the difference in flow-induced mutual fund selling and buying when funds face outflows and inflows, respectively. A high positive (negative) value of $NetSell$ indicates a large amount of net selling (buying) induced by fund outflows (inflows).

To examine whether ownership concentration is associated with flow-induced mutual fund net selling that consequently drives up bond volatility, we estimate the following two regressions:

$$NetSell_{j,t+1} = \delta_0 + \delta_1 OC_{j,t} + \delta_2 X_{j,t} + \alpha_j + \gamma_t + \varepsilon_{j,t+1}, \quad (10)$$

$$Vol_{j,t+1} = \pi_0 + \pi_1 NetSell_{j,t+1} + \pi_2 X_{j,t} + \alpha_j + \gamma_t + \varepsilon_{j,t+1}, \quad (11)$$

where $NetSell_{j,t+1}$ is the flow-induced net mutual fund selling of bond j in month t+1, and all of the other variables are again as defined in Equation (5).

[Insert Table 8 about here]

Panel A of Table 8 reports regression results of $NetSell$ in month $t+1$ on ownership concentration in month t as in Equation (10). In Columns (1) – (3), we show that the coefficients on ownership concentration are positive and statistically significant at the 5% or 1% level across all specifications regardless of the ownership concentration measures considered. In columns (4) – (6), we further control for the lagged value of $NetSell$ to capture any persistence in flow-induced net fund selling and find similar results. Panel B of Table 8 reports regression results of volatility

[9] Given that many funds in our sample only report quarterly holdings, we construct this measure at quarterly frequency.

in month $t+1$ on $NetSell$ in month $t+1$ as in Equation (11). The results show that the coefficients on $NetSell$ are significantly positive when we use both total and idiosyncratic bond volatilities as dependent variables, indicating that more flow-induced mutual fund net selling translates into higher volatility of underlying bonds.

In sum, our findings establish a direct link among ownership concentration, flow-induced net mutual fund selling, and corporate bond volatility: ownership concentration restricts the diversification of liquidity shocks across few large asset owners when one or more of them experiences liquidity shocks to the extent that they need to liquidate their positions, and the net selling of the funds facing liquidity demands subsequently pushes up return volatility of their underlying bonds. The results suggest that flow-induced mutual fund selling is a channel through which ownership concentration affects corporate bond volatility.

5.2. Endogeneity

While the evidence thus far suggests that a concentrated ownership structure might induce corporate bond volatility due to the non-fundamental liquidity demand of few large concentrated corporate bond funds, an important concern is that the ownership structure of corporate bonds is potentially endogenous. First, the relation between ownership concentration and bond volatility may reflect the preference of corporate bond funds towards those bonds with volatile fundamentals. Second, any unobservable omitted factors that are correlated with both ownership concentration and bond volatility can drive our results.

To address potential endogeneity issues, we have conducted various tests. For instance, we control for an extensive set of issue- and issuer-level determinants related to bond volatility and include issuer and time-fixed effects to mitigate the potential omitted variable concerns. To further establish causality, we use a quasi-natural experiment to capture exogenous increases in ownership concentration of corporate bonds. Specifically, along the lines of McLemore (2019), we use a sample of 140 corporate bond mutual fund mergers during 2002Q3-2017Q2 from Morningstar.[10] The average size of acquiring funds is 1.46 billion, while that of target funds is only 308 million. We argue that the bonds that are commonly held by both acquiring and target funds before the mergers would experience exogenous increases in ownership concentration after the mergers because such merger-induced changes in ownership concentration are unlikely driven by the preferences of corporate bond funds. Indeed, Jayaraman et al. (2002) show that mutual fund mergers are most likely driven by the poor performance of target funds or due to strategic reasons such as economies of scale or duplicated investment objectives.

To test whether the exogenous increases in ownership concentration induced by fund mergers would drive up bond volatility in the post-merger periods, we adopt a difference-in-difference (DiD) regression. Specifically, we separate the bonds held by acquiring or target funds before the mergers into two groups: those that are held both by acquiring and target funds prior to the mergers are considered as the treatment bonds, while the remaining are considered as the control bonds. Then we estimate the following DiD regression around the mergers:

$$Vol_{j,t+1} = \beta_0 + \beta_1 Treat_j + \theta Treat_j \times POST_{j,t} + \delta POST_{j,t} + \beta_2 X_{j,t} + \alpha_j + \gamma_t + \varepsilon_{j,t+1}, \quad (12)$$

where $Treat_j$ is a continuous treatment variable defined as the expected change in HHI induced by the mergers for the treatment bonds, which is computed as $(PctOwn_{acq} + PctOwn_{targ})^2 - (PctOwn_{acq}^2 + PctOwn_{targ}^2)$ in the period before the mergers, and zero for the control bonds

[10] There are several other papers that use the setting of asset management firm mergers, such as Massa, et al. (2021) and Ben-David et al. (2021).

which do not experience any changes in HHI induced by the mergers; $POST_{j,t}$ is the post-merger dummy variable that equals one (zero) for the 12 months after (before) the merger completion month; all the other variables are again as defined in Equation (5). Our main variable of interest is the interaction term between the treatment variable and the post-merger dummy ($Treat_j \times POST_{j,t}$). The coefficient on this interaction term, θ, captures the difference in the effects of exogenous changes in HHI induced by the mutual fund mergers on bond volatility between the treatment and control bonds.

[Insert Table 9 about here]

The results in Columns 1 and 3 of Table 9 show that the coefficients on $Treat \times POST$ are significantly positive at the 1% level for both total and idiosyncratic volatilities, indicating that the treatment bonds are more likely to have higher volatility in the post-merger period than in the pre-merger period, as compared to the control bonds. To validate that the fund mergers can indeed increase the realized HHI of the treatment bonds, we also report regression results of the realized HHI in the post-merger period as a function of our treatment variable in Column 5 of Table 9. The positive and significant coefficient on the $Treat$ variable confirms that the treatment bonds affected by the mutual fund mergers do experience a higher level of bond ownership concentration relative to the control bonds following the mergers. Finally, we account for the possibility that the acquirers and other corporate bond funds rebalance their positions in response to the mutual fund mergers. Specifically, we control for the trades of acquirers and other corporate bond funds in the treated and control bonds around the merger events. The results reported in Columns 2 and 4 of Table 9 remain intact after controlling for the trading of underlying treated and control bonds by acquirers or other corporate mutual funds.

Taken together, using a sample of mutual fund mergers that are less subject to endogeneity concerns, the results lend further support to our hypothesis that ownership concentration can induce volatility in corporate bonds.

5.3. Noise Trading vs. Price Efficiency

Our results so far are consistent with the hypothesis that a more concentrated ownership structure induces higher return volatility in corporate bonds. One might argue, however, that the observed increase in bond volatility could instead only reflect the improvement in price efficiency introduced by the informed trading of those large corporate bond funds (e.g., trading that is related to corporate fundamentals). To examine this possibility, we construct a measure of bond price inefficiency as the absolute value of the first-order autocorrelation of daily corporate bond returns within a given month with a minimum of ten daily return observations. We then examine the relation between ownership concentration and the price inefficiency of corporate bonds using the same specification in Equation (5) except that we use the bond price inefficiency instead of bond volatility as the dependent variable.

[Insert Table 10 about here]

Table 10 reports regression results without (with) controls in Columns 1–3 (4–6). The results show that the coefficients on the ownership concentration measures (HHI, Top 3, and Top 5) are all significantly positive at the 1% level except in Column 4 where the coefficient on HHI is positive but insignificant. In general, the findings suggest that the bonds with higher ownership concentration exhibit lower price efficiency. This implies that liquidity trading by corporate bond funds due to the concentrated ownership structure induces more noise into bond prices rather than improve the price efficiency of bonds. Thus, we reject the alternative hypothesis that the higher volatility of bonds with a more concentrated ownership structure indicates higher price efficiency.

5.4. Robustness Tests

In this subsection, we present three additional robustness tests. We first control for the effect of insurance companies and then perform a firm-level analysis. Lastly, we use an alternative corporate bond factor model to calculate idiosyncratic bond volatility.

5.4.1. Control for the Effect of Insurance Companies

Other than mutual funds, large institutions such as insurance companies are also major investors in the corporate bond market. However, unlike mutual funds that adjust their portfolio holdings in response to investor redemption requests, insurance companies are typically buy-and-hold investors who are mainly concerned about the asset-liability mismatch so that they do not always liquidate their positions when experiencing non-fundamental liquidity shocks.[11] Therefore, we only consider the effect of corporate bond mutual funds in the baseline analysis.

Nevertheless, one could still argue that our results might simply be driven by the failure to control for the effect of insurance companies. In particular, if the ownership concentration of corporate bond mutual funds is highly correlated with that of insurance companies, we may have an inflated estimate of the effect of ownership concentration by corporate bond funds on bond volatility due to the omitted variables that also affect bond volatility.

To address this potential concern, we further control for the effect of insurance companies in the robustness analysis. Specifically, we obtain the information on quarterly corporate bond

[11] For instance, Chen, et al. (2021) show that insurance companies tend to exhibit preferred habitat investment behavior.

ownership by insurance companies from the Refinitiv eMAXX database.[12] We then construct the measures of bond ownership and ownership concentration (HHI, Top 3, and Top 5) by insurance companies as in Section 3.2, and add these controls in Equation (5).

[Insert Table 11 about here]

The results in Table 11 show that the coefficients on the measures of ownership concentration by mutual funds remain consistently positive and significant at the 1% level, after controlling for the effect of insurance companies. Indeed, the coefficients on the measures of ownership concentration by insurance companies are mostly insignificant. Thus, although insurance companies are the biggest holders of corporate bonds, bonds held by few concentrated large insurers do not appear to exhibit higher volatility. Overall, the evidence suggests that our findings are robust after controlling for the effects of other major institutional investors in the corporate bond market such as insurance companies.

5.4.2. Firm-level Analysis

Thus far, we have focused on bond-level analysis by examining whether ownership concentration of individual bonds affects their return volatilities. However, firms often have multiple bonds outstanding at the same time, thus leading to highly correlated volatilities among the bonds from the same issuer. Therefore, one possibility is that our results are driven by the over-representation of bonds issued by a few large issuers. To address this concern, we keep the largest bond issued by each issuer each month and then re-estimate Equation (5) using firm-level data.

[12] The eMAXX database mainly provides corporate bond ownership by mutual funds and insurance companies. On average, roughly 26% of bonds are held by insurance companies during the sample period of July 2002 to June 2017. Note that the database also provides incomplete ownership data by other institutions (such as pension funds and banks), which collectively only hold roughly 3% of corporate bonds in the sample, so we mainly control for the effect of insurance companies.

[Insert Table 12 about here]

The evidence in Table 12 shows that the firm-level results are similar to those of the bond-level analysis in Table 3. For instance, the coefficient estimates on ownership concentration are all positive and significant at the 1% level, regardless of the bond volatility or ownership concentration measures considered. Overall, our results are robust to the firm-level analysis.

5.4.3. Alternative Corporate Bond Factor Model

Bai, et al. (2019) propose new monthly common risk factors to account for downside risk, credit risk, and liquidity risk in corporate bond returns. To ensure that our results based on idiosyncratic volatility are not driven by the omission of these newly proposed factors, we use the following four-factor model as in Bai et al. (2019):[13]

$$R_{j,t} - R_{f,t} = \alpha_j + \beta_{j,Mktbond} MKTbond_t + \beta_{j,DRF} DRF_t + \beta_{j,CRF} CRF_t + \beta_{j,LRF} LRF_t + \varepsilon_{j,t}, \quad (13)$$

where R_j is the monthly return of bond j, R_f is the risk-free rate, $MKTbond$ is the excess corporate bond market return, *DRF* is the downside risk factor, CRF is the credit risk factor, and *LRF* is the liquidity risk factor. We then calculate idiosyncratic volatility as the standard deviation of the residuals from Equation (13) using monthly bond return data over the previous 24 months on a rolling window basis and use this measure as the dependent variable in Equation (5).

[Insert Table 13 about here]

The results in Table 13 are consistent with our baseline findings in Table 3. For instance, the coefficients on ownership concentration are significantly positive at the 5% (1%) level for HHI

[13] We thank Turan G. Bali for making the data on corporate bond factors available on his website: https://sites.google.com/a/georgetown.edu/turan-bali/data-working-papers.

(Top3 and Top5). Overall, our results are robust to the use of an alternative corporate bond factor model (Bai et al. (2019)) in calculating idiosyncratic bond volatility.

6. Conclusion

In this paper, we analyze whether and how concentrated ownership by corporate bond mutual funds affects corporate bond volatility. We hypothesize that if corporate bond funds sell aggressively to meet redemption requests especially in turbulent market periods, bonds with more concentrated ownership tend to have higher return volatility due to the non-diversifiable liquidity shocks experienced across few large concentrated asset owners (Gabaix et al. (2006); Greenwood and Thesmar (2011)). Consistent with our hypotheses, we show that ownership concentration is significantly positively related to total and idiosyncratic volatilities of corporate bonds, especially among more illiquid bonds, during periods of higher bond market illiquidity, and among bonds held by corporate bond funds that hold more illiquid assets and face higher and more correlated liquidity shocks. These findings indicate the presence of bond price fragility driven by ownership concentration of corporate bond funds and magnified through the illiquidity of their assets.

We also provide more direct evidence that flow-induced mutual fund selling is a channel through which ownership concentration affects corporate bond volatility. Using a sample of corporate bond fund mergers, we further show that increases in bond volatility are not driven by the endogenous ownership structure of bonds, but rather the non-fundamental liquidity demand of large concentrated asset owners. Finally, we show that bonds with higher ownership concentration exhibit lower price efficiency, implying that non-fundamental liquidity trading of few concentrated corporate bond funds induces more noise in bond prices.

Our study has important implications for investors, fund managers, and regulators alike. For example, corporate bond fund managers can take different measures, including increasing cash buffers or putting restrictions on redemption requests from investors, to mitigate the effect of price fragility. Regulators should also be aware that the increasing ownership concentration would induce higher price fragility in the corporate bond market and such externalities may have a greater impact during periods of bond market uncertainties, which may eventually adversely affect bond market stability and real economic activities.

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Appendix A. Variable Definitions

Variables	Definitions
Total Volatility	The total bond return volatility, computed as the standard deviation of daily bond returns within a given month with a minimum of ten daily return observations.
Idiosyncratic Volatility	The idiosyncratic bond return volatility, computed as the standard deviation of the residuals from the regressions of daily bond returns on the Fama and French (1993) five factors within a given month with a minimum of ten daily return observations.
HHI	The Herfindahl-Hirschman Index (HHI) of bond ownership concentration by corporate bond mutual funds, constructed as the sum of squares of the percentage ownership across all funds that hold the bond in a given month, where the percentage ownership is defined as the par amount holding of each fund divided by the total par amount holdings of all corporate bond funds.
Top 3	The sum of the percentage ownership of the top three corporate bond mutual funds with the largest holdings of the bond in a given month, where the percentage ownership is defined as the par amount holding of each fund divided by the total par amount holdings of all funds.
Top 5	The sum of the percentage ownership of the top five corporate bond mutual funds with the largest holdings of the bond in a given month, where the percentage ownership is defined as the par amount holding of each fund divided by the total par amount holdings of all funds.
Mutual Fund Ownership	The aggregate percentage holdings of the bond by all corporate bond mutual funds in a given month, computed as the total par amount holdings of the bond by all funds divided by the bond's par amount outstanding.
Log(Amt)	The natural logarithm of the bond's par amount outstanding (in $mm).
Bond Age	The number of years since the bond's issue date.
Duration	The modified duration of the bond.
Credit Rating	A numerical transformation of Standard & Poor's bond ratings, where 1={AAA}, 2={AA+, AA, AA-}, 3={A+, A, A-}, 4={BBB+, BBB, BBB-}, 5={BB+, BB, BB-}, 6={B+, B, B-}, and 7={below B-}.
Call Dummy	A dummy variable equals one if the bond is callable, and zero otherwise.
Amihud	The monthly Amihud (2002) illiquidity measure of the bond, constructed by first calculating the daily average price impact measure, $\frac{1}{N_t}\sum_{j=1}^{N_t}\frac{\lvert r_j \rvert}{Volume_j}$, where N_t is the number of trades in day t, r_j is the return of trade j, and $Volume_j$ is the face value of trade j in $mm, and then taking the median of daily measures within a month as in Bao and Pan (2013).
Firm Size	The natural logarithm of the firm's total assets in each quarter (in $mm).
Profit	The ratio of the firm's earnings before interest and taxes (EBIT) to its total assets in each quarter.
Coverage	The sum of the firm's EBIT and interest expenses divided by its interest expenses in each quarter.
Sales/Assets	The ratio of the firm's revenue to its total assets in each quarter.
Retained Earnings/Assets	The ratio of the firm's retained earnings to its total assets in each quarter.

Net Income/Assets	The ratio of the firm's net income to its total assets in each quarter.
Cash Flow Volatility	The standard deviation of the firm's quarterly operating cash flows to total assets ratios over the past five years.
Earnings Volatility	The standard deviation of the firm's quarterly EBIT to total assets ratios over the past five years.
Leverage Volatility	The standard deviation of the firm's quarterly total leverage ratios over the past five years, where the total leverage is computed as the firm's long-term debts plus current liabilities divided by its total assets.
Sales Volatility	The standard deviation of the firm's quarterly total revenue to total assets ratios over the past five years.
Bond Zero	The percentage of days within a given month that a given bond has no trade, following Dick-Nielsen et al. (2012).
Roll	The monthly Roll (1984) illiquidity measure of the bond, constructed by first calculating the daily Roll measure as two times the square root of minus the covariance between consecutive returns, $2\sqrt{-cov(r_j, r_{j-1})}$, if the covariance is less than zero, and zero otherwise, on days with at least one transaction using a rolling window of 21 trading days, and then taking the median of daily measures within a month as in Dick-Nielsen et al. (2012).
VIX	The Chicago Board Options Exchange (CBOE) volatility index.
TED	The TED spread computed as the difference between the three-month London Interbank Offered Rate (LIBOR) and the three-month Treasury-bill rate.
Fund Illiquidity	The bond-level average fund illiquidity for a given bond, calculated as the position-weighted average fund-level illiquidity across all corporate bond mutual funds holding the bond in a given month, where the fund-level illiquidity is computed as the position-weighted average Amihud (2002) illiquidity measure across all corporate bonds held by the fund.
Cash & Treasury	The bond-level average fund holdings of cash and Treasury for a given bond, computed as the position-weighted average cash and governance bond percentage holdings across all corporate bond mutual funds that hold the bond in a given month.
Fund Turnover	The bond-level average fund turnover for a given bond, computed as the position-weighted average fund turnover across all corporate bond mutual funds that hold the bond in a given month.
Outflow Sensitivity	The bond-level average fund's outflow sensitivity to bad performance for a given bond, computed as the position-weighted average outflow-underperformance sensitivity across all corporate bond mutual funds that hold the bond in a given month, where the outflow-underperformance sensitivity is $\beta_1 + \beta_2$ computed from the following regression as in Goldstein et al. (2017): $$Flow_{f,t} = \alpha + \beta_1 Alpha_{f,t-12\rightarrow t-1} + \beta_2 Alpha_{f,t-12\rightarrow t-1} \times I\left(Alpha_{f,t-12\rightarrow t-1} < 0\right) + \beta_3\left(Alpha_{f,t-12\rightarrow t-1} < 0\right) + \gamma Controls_{f,t} + \varepsilon_{f,t},$$ where $Alpha_{f,t-12\rightarrow t-1}$ is the average monthly alpha for a given fund over the past year, $I\left(Alpha_{f,t-12\rightarrow t-1} < 0\right)$ is equal to one if the fund has a negative alpha in the past year and zero otherwise, $Flow_{f,t}$ is the fund flow in a given month, and $Controls_{f,t}$ include lagged fund flow, the natural logarithm of total net assets (TNA), the natural logarithm of fund age in months, and fund expense ratio.

Flow Correlation	The bond-level average fund's flow correlation for a given bond, compute as the position-weighted average trailing 12-month flow correlation across all corporate bond mutual funds that hold the bond in a given month.
NetSell	A flow-induced mutual fund selling pressure measure, following Coval and Stafford (2007): $$NetSell_{j,t} = \frac{\sum_{f=1}^{F}(SellAmt_{f,j,t} \vert Flow_{f,t} < 0 - BuyAmt_{f,j,t} \vert Flow_{f,t} > 0)}{AmtOut_{j,t-1}},$$ Where $SellAmt_{f,j,t}$ ($BuyAmt_{f,j,t}$) is the amount of sales (purchases) of bond *j* held by fund *f* in period *t* when the fund experiences outflows (inflows), *F* is the total number of funds holding bond *j* in period *t*, and $AmtOut_{j,t-1}$ is the total par amount outstanding of bond *j* in period *t*-1.
Treat	The treatment variable, defined as the expected change in the Herfindahl-Hirschman Index (HHI) induced by the merger events for the treatment bonds and zero for the control bonds.
Post	The dummy variable that equals one (zero) for the 12 months after (before) the merger completion month.
Trade (Acquirers)	The trade of acquiring funds in a given bond around the merger events.
Trade (Others)	The trade of other corporate bond funds in a given bond around the merger events.
Price Efficiency	The price efficiency of bond prices, calculated as the absolute value of the first-order autocorrelation of daily corporate bond returns within a given month with a minimum of ten daily return observations.
HHI (Insurers)	The Herfindahl-Hirschman Index of bond ownership concentration by insurance companies, constructed as the sum of squares of the percentage ownership across all insurance companies that hold the bond in a given quarter, where the percentage ownership is defined as the par amount holding of each insurance company divided by the total par amount holdings of all insurance companies.
Top3 (Insurers)	The sum of the percentage ownership of the top three insurance companies with the largest holdings of the bond in a given quarter, where the percentage ownership is defined as the par amount holding of each insurance company divided by the total par amount holdings of all insurance companies.
Top5 (Insurers)	The sum of the percentage ownership of the top five insurance companies with the largest holdings of the bond in a given quarter, where the percentage ownership is defined as the par amount holding of each insurance company divided by the total par amount holdings of all insurance companies.
Insurer Ownership	The aggregate percentage holdings of the bond by all insurance companies in a given quarter, computed as the total par amount holdings of the bond by all insurance companies divided by the bond's par amount outstanding.
Idiosyncratic Volatility (BBW)	The idiosyncratic bond return volatility, computed as the standard deviation of the residuals from the regressions of monthly bond returns on the Bai et al. (2019) (BBW) four factors over the previous 24 months on a rolling window basis.

Table 1. Summary Statistics

This table shows summary statistics of key variables used in the baseline regressions for our sample corporate bonds during July 2002–June 2017. Total volatility is the standard deviation of daily bond returns within a given month with a minimum of ten daily return observations. Idiosyncratic volatility is the standard deviation of the residuals from the regressions of daily bond returns on the Fama and French (1993) five factors in a given month with a minimum of ten daily return observations. Our measures of corporate bond fund ownership concentration include a) Herfindahl-Hirschman Index (HHI), constructed as the sum of squares of the percentage ownership of a given bond across all corporate bond funds that hold the bond in a given month, where the percentage ownership is defined as the par amount of the bond held by each fund divided by the total par amount of the bond held by all funds; b) Top 3, defined as the sum of the percentage ownership of the top three corporate bond funds with the largest holdings of the bond in a given month; and c) Top 5, calculated as the sum of the percentage ownership of the top five corporate bond funds with the largest holdings of the bond in a given month. Control variables include the lagged volatility measure, mutual fund ownership, bond-level characteristics (logarithm of amount outstanding (log(Amt)), bond age, duration, credit rating, a call dummy, and the Amihud (2002) illiquidity measure (Amihud)), and issuer-level characteristics (firm size, profit, interest coverage, sales/assets, retained earnings/assets, net income/assets, cash flow volatility, leverage volatility, sales volatility, and earnings volatility). All variables are defined in Appendix A and winsorized at the upper and lower 1% levels.

	Mean	Median	Obs.	SD	P25	P75
Volatility Measures:						
Total Volatility (%)	0.736	0.579	127643	0.557	0.342	0.956
Idiosyncratic Volatility (%)	0.564	0.430	127643	0.449	0.252	0.732
Concentration Measures:						
HHI	0.223	0.173	127643	0.171	0.113	0.269
Top 3	0.630	0.618	127643	0.190	0.483	0.768
Top 5	0.763	0.777	127643	0.166	0.637	0.903
Control Variables:						
Mutual Fund Ownership	0.087	0.062	127643	0.074	0.034	0.118
Log(Amt)	13.443	13.459	127643	0.638	13.118	13.816
Bond Age	3.963	3.052	127643	3.366	1.592	5.290
Duration	5.886	5.029	127643	3.699	3.242	7.090
Credit Rating	3.797	4.000	127643	1.164	3.000	4.000
Call Dummy	0.874	1.000	127643	0.332	1.000	1.000
Amihud	0.003	0.001	127643	0.004	0.000	0.003
Firm Size	10.371	10.452	127643	1.326	9.488	11.400
Profit	0.025	0.023	127643	0.015	0.015	0.032
Coverage	9.932	6.694	127643	10.302	4.024	12.022
Sales/Assets	0.200	0.147	127643	0.153	0.102	0.239
Retained Earnings/Assets	0.251	0.213	127643	0.252	0.077	0.378
Net Income/Assets	0.015	0.013	127643	0.013	0.007	0.021
Cash Flow Volatility	0.009	0.007	127643	0.008	0.004	0.010
Leverage Volatility	0.042	0.033	127643	0.028	0.022	0.053
Sales Volatility	0.031	0.020	127643	0.030	0.011	0.039
Earnings Volatility	0.009	0.007	127643	0.006	0.005	0.011

Table 2. Bond Volatility Sorted by Ownership Concentration

The table reports average corporate bond volatility sorted by corporate bond fund ownership concentration during July 2002–June 2017. Every month we sort all corporate bonds into quintiles based on each of the three corporate bond fund ownership concentration measures, including the Herfindahl-Hirschman Index of fund ownership (HHI), the ownership of top three funds (Top 3), and the ownership of top five funds (Top 5), and then report the average total and idiosyncratic volatilities of corporate bonds in each quintile. Q5-Q1 reports the differences in average total or idiosyncratic volatility between the top and bottom quintiles of ownership concentration. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. The Newey and West (1987) *t*-statistics are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Q1 (Bottom)	Q2	Q3	Q4	Q5 (Top)	Q5-Q1
Sorted by HHI:						
Total Volatility (%)	0.689	0.742	0.785	0.864	0.995	0.31***
						(11.07)
Idiosyncratic Volatility (%)	0.526	0.572	0.604	0.668	0.770	0.24***
						(11.03)
Sorted by Top 3:						
Total Volatility (%)	0.689	0.739	0.777	0.856	1.014	0.32***
						(10.98)
Idiosyncratic Volatility (%)	0.527	0.570	0.597	0.661	0.786	0.26***
						(11.17)
Sorted by Top 5:						
Total Volatility (%)	0.681	0.740	0.785	0.855	1.005	0.33***
						(11.04)
Idiosyncratic Volatility (%)	0.521	0.569	0.603	0.658	0.781	0.27***
						(11.39)

Table 3. Regressions of Bond Volatility on Ownership Concentration

This table presents regression results of total and idiosyncratic corporate bond volatilities on corporate bond fund ownership concentration during July 2002–June 2017. Measures of ownership concentration include the Herfindahl-Hirschman Index of fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). The controls in all specifications include the lagged volatility measure, mutual fund ownership, bond characteristics (logarithm of amount issued (Log(Amt)), bond age, duration, credit rating, call dummy, and Amihud), and issuer-level characteristics (firm size, profit, interest coverage, sales/assets, retained earnings/assets, net income/assets, cash flow volatility, leverage volatility, sales volatility, and earnings volatility). All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI	0.094***			0.074***		
	(7.42)			(6.78)		
Top 3		0.117***			0.099***	
		(8.94)			(8.64)	
Top 5			0.159***			0.137***
			(10.08)			(9.94)
Lagged Volatility	0.424***	0.423***	0.422***	0.355***	0.354***	0.353***
	(40.47)	(40.60)	(40.64)	(38.20)	(38.30)	(38.37)
Mutual Fund Ownership	0.001	0.023	0.023	-0.003	0.017	0.042
	(0.02)	(0.65)	(1.46)	(-0.09)	(0.54)	(1.36)
Log(Amt)	-0.109***	-0.103***	-0.099***	-0.096***	-0.091***	-0.087***
	(-19.61)	(-18.43)	(-17.41)	(-20.30)	(-18.95)	(-17.71)
Bond Age	0.006***	0.006***	0.006***	0.005***	0.005***	0.005***
	(6.42)	(5.73)	(5.54)	(6.40)	(5.67)	(5.45)
Duration	0.038***	0.038***	0.038***	0.028***	0.028***	0.028***
	(27.31)	(27.59)	(27.85)	(27.50)	(27.90)	(28.24)
Credit Rating	0.027***	0.028***	0.029***	0.025***	0.026***	0.027***
	(3.93)	(4.18)	(4.30)	(4.18)	(4.43)	(4.55)
Call Dummy	-0.009	-0.011	-0.013	-0.003	-0.005	-0.006
	(-0.71)	(-0.88)	(-1.02)	(-0.28)	(-0.45)	(-0.59)
Amihud	13.351***	13.238***	13.218***	14.922***	14.825***	14.805***
	(11.37)	(11.28)	(11.27)	(13.23)	(13.16)	(13.16)
Firm Size	-0.006	-0.005	-0.005	-0.005	-0.004	-0.004
	(-0.63)	(-0.55)	(-0.50)	(-0.64)	(-0.55)	(-0.50)
Profit	-1.171***	-1.166***	-1.158***	-1.171***	-1.165***	-1.158***
	(-4.89)	(-4.84)	(-4.81)	(-5.76)	(-5.71)	(-5.68)
Coverage	0.000**	0.000**	0.000*	0.000*	0.000*	0.000*
	(2.08)	(2.03)	(1.97)	(1.91)	(1.86)	(1.80)
Sales/Assets	-0.004	-0.000	0.002	-0.004	-0.001	0.001
	(-0.08)	(-0.01)	(0.05)	(-0.11)	(-0.04)	(0.02)
Retained Earnings/Assets	0.061*	0.059*	0.058*	0.061**	0.060**	0.058**
	(1.96)	(1.94)	(1.90)	(2.46)	(2.45)	(2.39)
Net Income/Assets	0.131	0.142	0.150	0.155	0.163	0.170
	(0.77)	(0.82)	(0.87)	(1.07)	(1.12)	(1.17)
Cash Flow Volatility	0.140	0.108	0.135	0.459	0.429	0.450
	(0.23)	(0.18)	(0.23)	(0.90)	(0.86)	(0.90)
Leverage Volatility	0.073	0.073	0.075	0.070	0.071	0.072
	(0.50)	(0.51)	(0.53)	(0.58)	(0.60)	(0.61)
Sales Volatility	-0.165	-0.171	-0.168	-0.098	-0.103	-0.101
	(-1.13)	(-1.16)	(-1.15)	(-0.75)	(-0.78)	(-0.77)
Earnings Volatility	-0.898	-0.791	-0.767	-0.931	-0.837	-0.813
	(-0.99)	(-0.88)	(-0.86)	(-1.20)	(-1.09)	(-1.06)
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.722	0.722	0.723	0.670	0.671	0.671

Table 4. Ownership Concentration and Bond Volatility: The Effect of Bond Illiquidity

This table presents regression estimates of total and idiosyncratic corporate bond volatilities on corporate bond fund ownership concentration conditional on bond illiquidity during July 2002–June 2017. Measures of ownership concentration include the Herfindahl-Hirschman Index of fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). In Panel A, bond illiquidity is measured by the Amihud (2002) illiquidity measure (Amihud), defined as the median of the daily average price impact of bond trades within a month (Bao and Pan (2013)). In Panel B, bond illiquidity is measured by Bond Zero, calculated as the percentage of days with a given month that the bond has no trade (Dick-Nielsen et al. (2012)). In Panel C, bond illiquidity is measured by the Roll (1984) illiquidity measure (Roll), constructed by first calculating the daily Roll measure as two times the square root of minus the covariance between consecutive returns on days with at least one transaction using a rolling window of 21 trading days if the covariance is less than zero (zero otherwise), and then taking the median of daily measures within a month (Dick-Nielsen et al. (2012)). The controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Amihud						
HHI	0.069***			0.053***		
	(4.20)			(3.61)		
HHI × Amihud	6.251*			5.221*		
	(1.93)			(1.87)		
Top 3		0.086***			0.074***	
		(5.68)			(5.58)	
Top 3 × Amihud		11.323***			9.099***	
		(3.09)			(2.77)	
Top 5			0.122***			0.107***
			(6.80)			(6.86)
Top 5 × Amihud			14.870***			12.281***
			(3.29)			(3.01)
Amihud	11.595***	5.306**	1.078	13.456***	8.449***	4.778
	(7.95)	(2.04)	(0.30)	(9.92)	(3.55)	(1.47)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.722	0.722	0.723	0.670	0.671	0.671

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Bond Zero						
HHI	0.046***			0.040***		
	(2.94)			(3.03)		
HHI × Bond Zero	0.573***			0.377***		
	(5.04)			(3.90)		
Top 3		0.066***			0.063***	
		(4.63)			(5.11)	
Top 3 × Bond Zero		0.729***			0.477***	
		(6.81)			(5.21)	
Top 5			0.103***			0.098***
			(6.21)			(6.81)
Top 5 × Bond Zero			0.829***			0.541***
			(6.68)			(5.15)
Bond Zero	0.191***	-0.151**	-0.326***	0.179***	-0.046	-0.160**
	(5.05)	(-2.12)	(-3.37)	(5.58)	(-0.77)	(-1.98)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.722	0.722	0.723	0.670	0.671	0.671
Panel C: Roll						
HHI	0.018			0.024		
	(0.89)			(1.37)		
HHI × Roll	5.223***			3.328***		
	(3.80)			(2.92)		
Top 3		0.009			0.018	
		(0.52)			(1.10)	
Top 3 × Roll		9.747***			7.105***	
		(6.85)			(5.48)	
Top 5			0.021			0.032*
			(1.03)			(1.70)
Top 5 × Roll			13.164***			9.819***
			(8.03)			(6.49)
Roll	7.398***	2.319**	-1.504	7.874***	4.027***	1.059
	(11.59)	(2.32)	(-1.14)	(13.52)	(4.26)	(0.85)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.722	0.722	0.723	0.670	0.671	0.671

Table 5. Ownership Concentration and Bond Volatility: The Effect of Bond Market Illiquidity

This table presents regression estimates of total and idiosyncratic bond volatilities on corporate bond fund ownership concentration conditional on bond market illiquidity during July 2002–June 2017. Measures of ownership concentration include the Herfindahl-Hirschman Index of fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). Bond market illiquidity is measured by VIX (CBOE's Volatility index) and TED (the difference between the three-month LIBOR and Treasury-bill rate) in Panels A and B, respectively. The controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses.***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: VIX						
HHI	0.006			0.003		
	(0.19)			(0.11)		
HHI × VIX	0.448***			0.363**		
	(2.64)			(2.59)		
Top 3		0.036			0.030	
		(0.97)			(1.01)	
Top 3 × VIX		0.426**			0.358**	
		(2.18)			(2.24)	
Top 5			0.079*			0.066*
			(1.72)			(1.77)
Top 5 × VIX			0.423*			0.378*
			(1.79)			(1.94)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.722	0.722	0.723	0.670	0.671	0.671
Panel B: TED						
HHI	0.066***			0.051***		
	(4.42)			(3.83)		
HHI × TED	1.986**			1.662**		
	(2.45)			(2.38)		
Top 3		0.090***			0.077***	
		(6.37)			(6.24)	
Top 3 × TED		2.377***			1.856***	
		(2.98)			(2.67)	
Top 5			0.132***			0.116***
			(7.86)			(7.95)
Top 5 × TED			2.482**			1.914**
			(2.60)			(2.30)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.722	0.722	0.723	0.670	0.671	0.671

Table 6. Ownership Concentration and Bond Volatility: The Effect of Fund Illiquidity

This table presents regression estimates of total and idiosyncratic bond volatilities on corporate bond fund ownership concentration conditional on bond-level average fund illiquidity during July 2002–June 2017. Measures of ownership concentration include the Herfindahl-Hirschman Index of fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). Bond-level average fund illiquidity is the position-weighted average fund-level illiquidity across all corporate bond funds that hold the bond in a given month, where fund-level illiquidity is measured by the position-weighted average Amihud (2002) illiquidity measure (Amihud) of all corporate bonds held by the fund and the fund's percentage holdings of cash and Treasury securities (Cash & Treasury) in Panels A and B, respectively. The controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Fund Illiquidity						
HHI	0.038*			0.027		
	(1.69)			(1.42)		
HHI × Fund Illiquidity	19.415**			15.464**		
	(2.09)			(2.04)		
Top 3		0.031			0.026	
		(1.17)			(1.19)	
Top 3 × Fund Illiquidity		37.178***			29.929***	
		(2.92)			(2.79)	
Top 5			0.057*			0.049*
			(1.73)			(1.77)
Top 5 × Fund Illiquidity			44.989***			37.530***
			(2.78)			(2.72)
Fund Illiquidity	29.332***	6.433	-4.492	31.799***	13.167	3.111
	(4.59)	(0.60)	(-0.31)	(6.04)	(1.44)	(0.25)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.723	0.723	0.724	0.672	0.672	0.672
Panel B: Cash & Treasury Holdings						
HHI	0.151***			0.122***		
	(8.03)			(7.83)		
HHI × Cash & Treasury	-0.003***			-0.002***		
	(-3.56)			(-3.49)		
Top 3		0.190***			0.157***	
		(7.83)			(7.64)	
Top 3 × Cash & Treasury		-0.004***			-0.003***	
		(-3.74)			(-3.44)	
Top 5			0.233***			0.194***
			(7.84)			(7.63)
Top 5 × Cash & Treasury			-0.004***			-0.003***
			(-3.21)			(-2.86)
Cash & Treasury	0.002***	0.003***	0.004***	0.001***	0.003***	0.003***
	(4.76)	(4.20)	(3.47)	(5.24)	(4.17)	(3.32)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127643	127643	127643	127643	127643	127643
Adj. R^2	0.722	0.723	0.723	0.670	0.671	0.671

Table 7. Ownership Concentration and Bond Volatility: The Effect of Fund Liquidity Shocks

This table presents regression estimates of total and idiosyncratic bond volatilities on corporate bond fund ownership concentration conditional on various bond-level measures that capture corporate bond funds' exposure to liquidity shocks during July 2002–June 2017. Measures of ownership concentration include the Herfindahl-Hirschman Index of fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). In Panel A, bond-level fund liquidity shock is measured by bond-level average fund turnover, calculated as the position-weighted average fund turnover across all funds that hold the bond in a given month. In Panel B, bond-level fund liquidity shock is measured by bond-level average fund outflow sensitivity, calculated as the position-weighted average fund outflow sensitivity to bad performance, which is $\beta_1 + \beta_2$ estimated from the following regression as in Goldstein et al. (2017):

$$Flow_{f,t} = \alpha + \beta_1 Alpha_{f,t-12\to t-1} + \beta_2 Alpha_{f,t-12\to t-1} \times I\left(Alpha_{f,t-12\to t-1} < 0\right)$$
$$+\beta_3\left(Alpha_{f,t-12\to t-1} < 0\right) + \gamma Controls_{f,t} + \varepsilon_{f,t},$$

where $Alpha_{f,t-12\to t-1}$ is the average monthly alpha for a given fund over the past year, $I\left(Alpha_{f,t-12\to t-1} < 0\right)$ is equal to one if the fund has a negative alpha in the past year and zero otherwise, $Flow_{f,t}$ is the fund flow in a given month, and $Controls_{f,t}$ include lagged fund flow, the natural logarithm of total net assets (TNA), the natural logarithm of fund age in months, and fund expense ratio. In Panel C, bond-level fund liquidity shock is measured by bond-level average fund flow correlation, calculated as the position-weighted average of flow correlations in the past 12-months between each pair of funds that hold the bond in a given month. The controls in all specifications are as defined in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Fund Turnover						
HHI	0.050***			0.026*		
	(3.04)			(1.83)		
HHI × Fund Turnover	0.000***			0.000***		
	(3.42)			(4.16)		
Top 3		0.060***			0.039**	
		(3.17)			(2.44)	
Top 3 × Fund Turnover		0.000***			0.000***	
		(3.35)			(3.91)	
Top 5			0.097***			0.072***
			(3.95)			(3.46)
Top 5 × Fund Turnover			0.000***			0.000***
			(2.61)			(3.17)
Fund Turnover	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(-6.45)	(-4.93)	(-3.61)	(-7.58)	(-5.74)	(-4.36)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127275	127275	127275	127275	127275	127275
Adj. R^2	0.723	0.723	0.723	0.671	0.671	0.671

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Fund Outflow-underperformance Sensitivity						
HHI	0.087***			0.070***		
	(6.90)			(6.33)		
HHI × Outflow Sensitivity	0.000**			0.000**		
	(2.41)			(2.11)		
Top 3		0.108***			0.091***	
		(8.08)			(7.81)	
Top 3 × Outflow Sensitivity		0.000**			0.000**	
		(2.30)			(2.25)	
Top 5			0.150***			0.129***
			(9.23)			(9.06)
Top 5 × Outflow Sensitivity			0.000**			0.000**
			(2.04)			(2.01)
Outflow Sensitivity	-0.000	-0.000**	-0.000**	-0.000	-0.000**	-0.000*
	(-1.59)	(-2.12)	(-1.97)	(-1.09)	(-1.97)	(-1.89)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127526	127526	127526	127526	127526	127526
Adj. R^2	0.722	0.722	0.723	0.670	0.670	0.671

	(1)	(2)	(3)	(4)	(5)	(6)
Panel C: Flow Correlation						
HHI	0.078***			0.063***		
	(4.86)			(4.62)		
HHI × Flow Correlation	0.217**			0.138*		
	(2.60)			(1.94)		
Top 3		0.080***			0.071***	
		(5.87)			(5.97)	
Top 3 × Flow Correlation		0.316***			0.214***	
		(4.01)			(3.09)	
Top 5			0.116***			0.105***
			(6.99)			(7.22)
Top 5 × Flow Correlation			0.401***			0.272***
			(4.07)			(3.12)
Flow Correlation	0.008	-0.163***	-0.273***	0.034	-0.085	-0.161**
	(0.23)	(-2.61)	(-3.16)	(1.23)	(-1.58)	(-2.13)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	124265	124265	124265	124265	124265	124265
Adj. R^2	0.714	0.715	0.715	0.661	0.662	0.662

Table 8. Ownership Concentration, Flow-induced Mutual Fund Selling, and Bond Volatility

This table examines the relation between ownership concentration, flow-induced mutual fund selling, and bond volatility during July 2002–June 2017. Panel A reports regression results of flow-induced net mutual fund selling on ownership concentration, and Panel B reports regression results of total and idiosyncratic bond volatilities on flow-induced net mutual fund selling. Measures of ownership concentration include the Herfindahl-Hirschman Index of corporate bond fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). The flow-induced net mutual fund selling ($NetSell$) is defined in a way similar to Coval and Stafford (2007) as follows:

$$NetSell_{j,t} = \frac{\sum_{f=1}^{F}(SellAmt_{f,j,t}|Flow_{f,t} < 0 - BuyAmt_{f,j,t}|Flow_{f,t} > 0)}{AmtOut_{j,t-1}},$$

where $SellAmt_{f,j,t}$ ($BuyAmt_{f,j,t}$) is the amount of sales (purchases) of bond *j* held by fund *f* in period *t* when the fund experiences outflows (inflows), F is the total number of funds holding bond *j* in period *t*, and $AmtOut_{j,t-1}$ is the total par amount outstanding of bond *j* in period *t*-1. The controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Flow-induced Net Mutual Fund Selling and Ownership Concentration

	NetSell					
	(1)	(2)	(3)	(4)	(5)	(6)
HHI	0.001**			0.001**		
	(2.22)			(2.48)		
Top 3		0.002***			0.002***	
		(3.05)			(3.37)	
Top 5			0.002***			0.002***
			(2.86)			(3.16)
Lagged NetSell				0.091***	0.091***	0.091***
				(8.17)	(8.18)	(8.20)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	119507	119505	119507	114790	114788	114790
Adj. R^2	0.094	0.094	0.094	0.105	0.105	0.105

Panel B: Volatility and Flow-induced Net Mutual Fund Selling

	Total Volatility	Idiosyncratic Volatility
	(1)	(2)
NetSell	0.327***	0.219***
	(3.33)	(2.76)
Lagged Total Volatility	0.483***	
	(43.49)	
Lagged Idiosyncratic Volatility		0.457***
		(46.27)
Controls	Yes	Yes
Issuer F.E.	Yes	Yes
Month F.E.	Yes	Yes
Observations	109553	109553
R^2	0.783	0.747

Table 9. Bond Volatility around Mutual Fund Mergers

This table presents the difference-in-difference (DiD) regression results of total and idiosyncratic bond volatilities on the change of ownership concentration induced by mutual fund mergers. The sample contains 140 corporate bond fund mergers from Morningstar during July 2002–June 2017. The bonds involved in the mergers are grouped into two groups: the treatment group includes those bonds that are commonly held by acquiring and target funds before the mergers, and the control group includes the remaining bonds. The treatment variable (*Treat*) is defined as the expected change in the Herfindahl-Hirschman Index of corporate bond fund ownership (HHI) induced by the merger events for the treatment bonds and zero for the control bonds. *POST* is the post-merger dummy variable that equals one (zero) for the 12 months after (before) the merger completion month. Columns 1–2 (3–4) report the DiD regression results using total (idiosyncratic) volatility as the dependent variable. Columns 2 and 4 further control for the trades of acquirers and other corporate bond funds around mergers. Column 5 reports regression results of the realized HHI in the post-merger period on the treatment variable. The controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility		Idiosyncratic Volatility		HHI
	(1)	(2)	(3)	(4)	(5)
POST	0.008*	0.006	0.007**	0.006	
	(1.96)	(1.42)	(2.11)	(1.59)	
Treat	-0.088	-0.060	-0.067	-0.031	0.492***
	(-1.04)	(-0.97)	(-0.86)	(-0.58)	(4.85)
POST × Treat	0.176***	0.142***	0.198***	0.152***	
	(3.32)	(3.07)	(4.18)	(3.71)	
Trade (Acquirer)		1.313		0.664	
		(0.96)		(0.57)	
Trade (Others)		-0.350**		-0.299**	
		(-2.13)		(-2.02)	
Controls	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes
Observations	45262	43459	45262	43459	26592
Adj. R^2	0.708	0.711	0.659	0.662	0.531

Table 10. Ownership Concentration and Bond Price Efficiency

This table presents regression results of bond price efficiency on corporate bond fund ownership concentration during July 2002–June 2017. The bond price efficiency is constructed as the absolute value of the first-order autocorrelation of daily corporate bond returns within a month with a minimum of ten daily return observations. Measures of ownership concentration include the Herfindahl-Hirschman Index of corporate bond fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). Columns 1–3 (4–6) report the results without (with) controls. The controls are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Bond Price Efficiency					
	(1)	(2)	(3)	(4)	(5)	(6)
HHI	0.050***			0.002		
	(11.62)	0.071***		(0.38)		
Top 3		(14.01)			0.016***	
					(3.24)	
Top 5			0.094***			0.027***
			(15.50)			(4.34)
Controls	No	No	No	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	292403	292403	292403	127643	127643	127643
R^2	0.055	0.057	0.058	0.092	0.092	0.093

Table 11. Ownership Concentration and Bond Volatility: Controlling for the Effect of Insurers

This table presents regression results of total and idiosyncratic bond volatilities on corporate bond fund ownership concentration after controlling for the effect of insurance companies during July 2002–June 2017. The Herfindahl-Hirschman Index (HHI) of corporate bond fund (insurance company) ownership is constructed as the sum of squares of the percentage ownership of a given bond across all corporate bond funds (insurance companies) that hold the bond in a given month, where the percentage ownership is defined as the par amount of the bond held by each fund (insurance company) divided by the total par amount of the bond held by all funds (insurance companies). Top 3 and Top 5 by mutual funds (insurance companies) are defined as the sum of the percentage ownership of the top three and five corporate bond funds (insurance companies) with the largest holdings of the bond in a given month, respectively. Mutual fund (Insurer) ownership is the total par amount of a given bond held by all corporate bond funds (insurance companies) as a fraction of the bond's par amount outstanding. The other controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and time fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI	0.091***			0.072***		
	(7.22)			(6.64)		
HHI (Insurers)	0.051*			0.027		
	(1.90)			(1.21)		
Top 3		0.110***			0.093***	
		(8.51)			(8.21)	
Top 3 (Insurers)		0.025			0.012	
		(1.56)			(0.86)	
Top 5			0.147***			0.127***
			(9.48)			(9.39)
Top 5 (Insurers)			0.031*			0.018
			(1.90)			(1.26)
Mutual Fund Ownership	0.076**	0.091**	0.114***	0.064*	0.078**	0.099***
	(2.04)	(2.48)	(3.11)	(1.90)	(2.36)	(3.00)
Insurer Ownership	0.146***	0.142***	0.142***	0.127***	0.123***	0.123***
	(8.45)	(7.98)	(7.88)	(8.47)	(8.04)	(7.99)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	126252	126252	126252	126252	126252	126252
Adj. R^2	0.723	0.723	0.723	0.671	0.672	0.672

Table 12. Ownership Concentration and Bond Volatility: Firm-level Analysis

This table presents regression results of total and idiosyncratic corporate bond volatilities on corporate bond fund ownership concentration at the firm level. The sample includes the largest bond issued by a given issuer during July 2002–June 2017. Measures of ownership concentration include the Herfindahl-Hirschman Index of corporate bond fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). The controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Total Volatility			Idiosyncratic Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
HHI	0.145***			0.116***		
	(5.81)			(5.47)		
Top 3		0.157***			0.130***	
		(6.77)			(6.60)	
Top 5			0.207***			0.176***
			(7.62)			(7.65)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	43558	43558	43558	43558	43558	43558
Adj. R^2	0.704	0.704	0.704	0.656	0.656	0.657

Table 13. Ownership Concentration and Bond Volatility: Alternative Four-factor Model

This table presents regression results of an alternative measure of idiosyncratic corporate bond volatility on corporate bond fund ownership concentration. The idiosyncratic bond return volatility is computed as the standard deviation of the residuals from the regressions of monthly bond returns on the Bai et al. (2019) (BBW) four factors over the previous 24 months on a rolling window basis. Measures of ownership concentration include the Herfindahl-Hirschman Index of corporate bond fund ownership (HHI), the ownership of the top three funds (Top 3), and the ownership of the top five funds (Top 5). The controls in all specifications are as in Table 3. All variables are defined in Appendix A and winsorized at the upper and lower 1% levels. All specifications include issuer and month fixed effects. The *t*-statistics based on standard errors two-way clustered at the issuer and month levels are presented in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Idiosyncratic Volatility (BBW)		
	(1)	(2)	(3)
HHI	0.029**		
	(2.37)		
Top 3		0.043***	
		(2.84)	
Top 5			0.052***
			(2.73)
Controls	Yes	Yes	Yes
Issuer F.E.	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes
Observations	196464	196464	196464
Adj. R^2	0.928	0.928	0.928