Bond Price Fragility and the Structure of the Mutual Fund Industry*

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We show that mutual funds with a large share of a bond issue sell their holdings of that issue to a lower extent when they experience redemptions, arguably because they attempt to avoid a drop in the bond price and the consequent negative feedback effects on the unsold part of their position. Since large bond funds tend to hold large shares of outstanding bond issues, they end up exercising a stabilizing effect on the bonds they hold. Bonds with greater ownership concentration outperform during periods of turmoil and have lower overall price volatility. We provide evidence that the tendency of bond funds to limit negative price spillovers on their large positions can help explain how the Fed's Secondary Market Corporate Credit Facility quickly stabilized both eligible and ineligible bonds.

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Mutual funds' increased role within the corporate bond market has raised concerns among policymakers about financial stability.[1] Bond mutual funds invest in illiquid assets but issue liquid liabilities, which their investors can redeem on demand. When large redemptions occur, these funds may be forced to sell their holdings at fire sales prices. Fire sales can amplify the initial shock and lead to more redemptions and sales because the price drops negatively affect the performance of other funds holding the same bonds (Falato, Hortaçsu, Li and Shin, 2020). Vicious circles through which redemptions lead to fire sales and fire sales lead to more redemptions are particularly worrisome, because low fund returns have been shown to generate outflows at an increasing rate (Goldstein, Jiang and Ng, 2017). The interconnectedness of bond mutual funds' holdings and redemptions could ultimately lead to diversification disasters (Ibragimov, Jaffee and Walden, 2011; Wagner, 2011).

These concerns have led the Financial Stability Board to launch a consultation to consider funds with more than $100 billion in assets under management as systemically important financial institutions. This paper provides evidence suggesting that the focus on large funds as drivers of financial instability may be misplaced. We conjecture that intermediaries that own a large proportion of a bond internalize the effects of their trading on the price of that bond and behave in a way that stabilizes the bond's price when negative shocks occur. Naturally, large funds tend to own larger shares of outstanding bond issues relative to small funds and may therefore provide greater price stability during stressful periods.

Consistent with the above hypothesis, we find that when faced with large redemptions at the fund or industry levels, bond mutual funds decrease their positions to a lower extent in issues of which they hold a large share. Furthermore, the results are stronger for the more illiquid high-yield bonds, for which any sales can be expected to have larger negative spillovers

[1] These concerns have been voiced in the Financial Stability Board (2017), the IMF Global Financial Stability Report (2018), and more recently, in June 2019, after the LF Woodford Equity Income Fund suspended redemptions, by the Governor of the Bank of England, Mark Carney. Similar concerns are likely to have brought the Fed to heavily intervene in the bond market during the Spring 2020 in response to the COVID pandemic.

on prices. Finally, we provide evidence suggesting that the trading patterns we document are not driven by funds being more optimistic about the bonds in which they hold large positions, or any other forms of bond-specific information. Only large funds, whose positions tend to be large relative to the market, exhibit the propensity to protect their large positions.

The effects of bond mutual funds' stabilizing behavior are apparent in the cross-section of bond returns. Bond issues with more concentrated mutual fund ownership, as measured by ownership of the largest fund owner, experience less pronounced price declines in periods of distress and have overall lower price volatility. Importantly, funds whose portfolios comprise a larger fraction of positions representing large shares of outstanding issues perform better during periods of aggregate outflows and consequently experience fewer redemptions.

Our findings have implications for how the industrial structure of bond mutual funds is related to financial fragility. On the one hand, large funds necessarily do larger trades, which potentially increase volatility. On the other hand, large funds, holding large shares of outstanding bond issues, are more likely to internalize the externalities of their trades and as a result, they may reduce the price volatility of the bond issues in which they hold large stakes. We show that the second effect prevails. In addition, we show that the effects of large funds' trades in bonds in which they hold smaller positions are not distinguishable from those of smaller funds.

Our findings suggest a mechanism for why Koijen and Yogo (2019) find that higher asset price volatility is associated with ownership by small, not large, institutions. Since large market players internalize the impact of their trades on security prices, particularly for illiquid securities, such as corporate bonds, they are not destabilizing, as Gabaix, Gopikrishnan, Plerou, and He (2006) and Ben-David, Franzoni, Moussawi and Sedunov (2021) argue in the context of the equity market.

To sharpen our identification and corroborate our interpretation of the empirical evidence, we exploit the Fed's intervention following the COVID-19 crisis. On March 23, 2020, the Fed's pledged to purchase investment grade corporate bonds with less than five-year maturity through the Secondary Market Corporate Credit Facility (SMCCF).[2] The Fed provided a price backstop and increased the liquidity of SMCCF-eligible bonds thus exogenously eliminating the negative price spillovers of mutual funds' trades in these bonds, but not in ineligible bonds. This exogenous shock to the negative price spillovers of bond sales allows us to test whether the stabilizing behavior of bond funds and the consequent effects on bond returns and price volatility are indeed driven by the funds' desire to limit price spillovers.

We start exploring how fund trading and the effect of ownership concentration on bond returns varies, before and after the Fed's intervention, distinguishing between eligible investment-grade bonds, ineligible investment-grade bonds, and ineligible high-yield bonds. In particular, while we expect funds to sell to a lower extent all categories of bonds in which they held large shares before the Fed's announcement, the stabilizing trading behavior should be concentrated in ineligible bonds after the Fed provided a price backstop for investment-grade bonds with less than five-year maturity, effectively eliminating the negative price spillovers of bond sales.

Any changes in funds' trading behavior and in the effect of ownership concentration on bond returns affecting eligible, but not ineligible bonds can be ascribed to the price backstop provided by the Fed's announcement. Thus, by showing that mutual funds' behavior changes for SMCCF-eligible bonds, but not for other bonds, we alleviate concerns that unobserved bond or fund characteristics drive our baseline results.

[2] These purchases were subsequently extended to fallen angels on April 9, 2020. We show that this announcement does not drive our findings.

Consistent with our conjectures, we show that before the Fed's announcement, bond mutual funds with large shares of outstanding issues tried to stabilize the prices of all categories of bonds, including eligible and ineligible investment-grade bonds, as well as high-yield bonds. The effects of these attempts are clearly reflected in bond returns. During March 2020, when the disruption arising from the pandemic becomes apparent, bonds with more concentrated mutual funds' ownership have higher returns, although the effect is not statistically significant for the most illiquid high-yield bonds, presumably because the large redemptions made the stabilizing trades vane.

In the months following the Fed's announcement, we find that bond mutual funds no longer try to stabilize the prices of eligible bonds. The stabilizing trading behavior is instead confined to ineligible bonds, both investment-grade and high-yield, for which the Fed did not provide a backstop and the negative price spillovers were still relevant. Consequently, ownership structure becomes unrelated to the returns for investment-grade bonds eligible for purchase by the Fed, that is, to the bonds in which, thanks to the Fed's backstop, the price externalities of sales were limited. Finally, consistent with the shift in the funds' stabilizing trading behavior to a smaller set of securities, after the Fed's intervention, high ownership concentration has a quantitatively larger effect on the returns of ineligible investment grade and high yield bonds than in the earlier period.

Not only does this exercise increases confidence in the interpretation of our findings, but it also helps us to shed light on how bond funds' incentives to limit the impact of their trades helped to stabilize high-yield bonds. Notwithstanding its relatively small purchases of a subset of investment grade bonds, the Fed succeeded in stabilizing the entire market also by increasing the efficacy of bond mutual funds' incentives to stabilize prices. The trading behavior of bond funds seeking to limit the negative spillovers of their trades can help explain why, following the Fed's intervention, ineligible investment-grade and high-yield bonds experienced even larger price appreciations than the eligible investment-grade bonds.

This paper is related to several strands of the literature. Our paper can help to explain why evidence of fire sales following negative shocks to bond mutual funds is mixed. Flow-driven sales by mutual funds have been shown to lead to downward price pressure (Manconi, Massa and Yasuda, 2012; Jiang, Li and Wang, 2021). Furthermore, bad past performance has been shown to trigger simultaneous sales from institutional investors, which in turn lead to price distortions on the downside (Cai, Han, Li and Li, 2019). However, the presence of bond mutual funds with liquidity-providing trading styles alleviates bond market fragility (Anand, Jotikasthira, and Venkataraman, 2020). Arguably, for this reason, and because bond funds maintain significant liquidity cushions, Choi, Hoseinzade, Shin, and Tehranian (2020) find little evidence that corporate bond mutual funds generate fire sales after controlling for time-varying issuer-level information. Chernenko and Sunderam (2020) show that equity mutual funds hold higher cash reserves when they are more exposed to fire sales. We contribute to this literature by showing that funds internalize the price consequences of their trades when they own a large proportion of an outstanding issue, and that the ownership structure of bond issues consequently affects bond returns.

We also contribute to a strand of the literature exploring how the ownership structure of an asset affects its price volatility. Greenwood and Thesmar (2011) show that mutual fund ownership affects non-fundamental stock price volatility and argue that this may arise from the behavior of a few concentrated owners or from correlated liquidity shocks across many owners. We show that ownership concentration can be stabilizing. The mechanism that we propose and test is particularly relevant in the bond market because bonds are illiquid and the negative externalities of distressed sales are potentially larger than in equity markets (Ellul, Jotikasthira, and Lundblad, 2011). In addition, firms make a myriad of small bond issues, and each bond issue has a capitalization that is much smaller than the equity market capitalization for a typical company. As a consequence, within the mutual fund industry, ownership in the bond market is often concentrated in few mutual funds. This makes particularly relevant our conjecture that fund managers internalize the negative effects of their sales on the price of the issues in which they own large stakes. Our results suggest that at least in the corporate bond market, regulators should direct their attention to disperse ownership by intermediaries with correlated liquid shocks rather than to large funds and bond issues with concentrated ownership.

Finally, the paper contributes to a strand of the literature documenting the effects of the COVID-19 crisis and the consequent Fed's interventions on the bond market. Falato, Goldstein and Hortaçsu (2021) and Ma, Xiao, and Zeng (2020) document large outflows from US bond funds during February and March 2020 and the positive effects on the stability of the assets for funds more exposed to the Fed's interventions. Kargar et al. (2021) and O'Hara and Zhou (2021) document a drop in liquidity conditions in the bond market that was quickly reversed by the Fed's announcements. Haddad, Moreira and Muir (2021) document large and persistent selling pressure in the bond market, affecting especially investment grade bonds, during March 2020. To the best of our knowledge, we are the first to focus on the effect of the Fed's policies on mutual funds' trading, which in turn help explain the cross-section of bond returns.

1. Data Sources and Descriptive Statistics

1.1 Sample Funds

We obtain data on bond mutual fund holdings from Morningstar, data on fund characteristics from Morningstar Direct, data on bond characteristics from Mergent's Fixed Income Securities Database (FISD), and data on corporate bond transactions from FINRA's enhanced TRACE database. In the first part of the analysis, our main sample covers the period from 1/2003 to 12/2019. In the second part of the analysis, when we consider the consequences of the COVID shock and the Fed's intervention, the sample period is 9/2019 – 9/2020 (that is, six months before to six months after the COVID shock in March 2020). Detailed variable definitions are in the Appendix.

We focus on open-end mutual funds classified by Morningstar as taxable bond funds. There are a total of 2,240 unique funds, but, given our focus on the corporate bond market, we include only 1,016 funds, for which corporate bonds are at least 50% of the portfolio holdings (of these, 484 invest mostly in investment-grade bonds, while 532 invest mostly in high-yield bonds). Because of the imposition of this cutoff, only seven bond index funds (out of 77) remain in the sample. Also, the cutoff implies that a large majority of the funds' positions in our sample consist of high-yield bonds.

Using Morningstar along with Morningstar Direct, we construct a survivorship bias-free dataset that includes information on a variety of fund characteristics, such as total net assets under management (TNA), returns, flows, fees, and fund-level bond holdings. While the SEC requires mutual funds to report holdings on a quarterly basis, some funds report their holdings more frequently. Approximately 74% of the fund reporting-period observations in our sample are monthly, while most of the remaining are quarterly. Our changes in position variables thus vary between funds based on reporting frequency. Omitting observations for funds that do not report monthly holdings leaves our results unaffected.

Table 1, Panel A reports descriptive statistics for various fund attributes, with the first five columns highlighting the main sample (42,251 fund-reporting period observations). The distribution of fund TNA is positively skewed, with the average of approximately $1.3 billion and the median of only $0.33 billion. The median fund has negligible rear load fee, and institutional share classes account for about 50% of TNA. Consistent with the growth in bond mutual funds documented by Goldstein et al. (2017), our sample funds experience significant inflows. The average monthly fund flow is 0.6% of TNA, with the 10^{th} and 90^{th} percentile at -3.0% and 5.2%, respectively, indicating significant variation across funds and over time.

The average fund holds 12.2% of its portfolio in very liquid securities, which include 6.6% in cash and cash equivalents, 5.6% in government bonds, and 77.5% in corporate bonds. Due to our screening, our sample funds are disproportionately high-yield, which is reflected in the average credit quality of their corporate bond holdings. In addition, compared to the average corporate bond (see Table 1 Panel C), the bonds held by our sample funds are on average more liquid, younger and larger in issue size.

1.2 Bond Position Size and Ownership Concentration

Table 1, Panel B reports descriptive statistics for the funds' corporate bond positions, with the first five columns highlighting the main sample (11,312,852 fund-bond-reporting period observations). Funds turnover about 17% of their existing positions in a month, which is equivalent to about 200% over a year. Conditional on holding a particular bond at the beginning of the period, the funds increase and decrease the position 6% and 11% of the times, respectively. The average change in position is a decrease of 4.6%.

Just like the fund's TNA, the fund's position size in a bond, relative to the bond issue size, is positively skewed with an average of 0.6%, a median of only 0.2%, and a 90^{th} percentile of 1.5%. Summing across all funds in the same family, we find that the family's position size is about 2-3 times as large (equivalent to 2-3 funds in the same family holding the same bond) and is similarly positively skewed.

In the cross section, the main determinant of fund position size is the fund's asset size. The logarithm of fund's TNA explains 47% of the variation in fund's average position size and 46% of the variation in the fraction of portfolio of a fund that consists of positions that are in the top decile for position size. Put differently, large funds hold more large positions in outstanding issues. All other fund characteristics in Table 1, Panel A collectively explain just another 8-9% of the variation in the fraction of a fund portfolio that consists of large positions.

Nonetheless, there is a significant overlap in position size between small and large funds. For example, if we split the sample into funds with TNA above and below the median on each report date, we find that the 25th percentile of position size for funds with TNA above the median is about the same as the 75th percentile of the position size with TNA below the median. The trading impact of large funds trading in their small positions can thus be thought of as similar to that of smaller funds.

Interestingly, the average position size, as well as the fraction of top positions in the portfolio of funds with TNA above the median increases by about 5-10% in the months immediately following the periods of large individual or aggregate outflows and reverts back to the mean in about six months. This is consistent with the idea that in periods of turmoil funds avoid liquidating positions that may cause negative price spillovers to their portfolios. Such a strategy however appears costly because it leads to portfolio underdiversification and is reversed in normal times, when negative spillovers are smaller or less likely to arise.

1.3 Bond level data

Following Bessembinder et al. (2018) and Anand et al. (2021), our corporate bond sample includes only bonds in the FISD database that are classified as non-puttable U.S. Corporate Debentures and U.S. Corporate Bank Notes (bond type-CDEB or USBN). Of these bonds, a total of 32,006 distinct CUSIPs are held by bond funds at some point in our sample. Table 1, Panel C reports descriptive statistics on bond characteristics, with the first five columns again highlighting the main sample (1,514,632 bond-month observations).

On average, the bond maturity is 8.7 years, the issue size is $593 million, and the bond age is 4.5 years. Approximately 67% of the bond-month observations are for investment-grade bonds.[3] Together, all taxable mutual funds own about 10% of the average bond issue in our sample. On average, the largest mutual fund holds 3.5% of a bond issue and the largest family 4.6%. The share of the largest mutual fund exhibits significant variation across bonds and over time. For example, the 10th and 90th percentiles of the top fund ownership are 0.4% and 8.0%, respectively. Unsurprisingly, the top mutual funds have a larger share in smaller issues. Top mutual fund ownership is also higher in issues with a higher proportion of mutual fund ownership. Mutual fund ownership tends to be higher in bonds with short- and medium-term maturity, while long-term bonds are typically held by insurance companies.

For each bond-month, we calculate the return as the prorated coupon plus the change in value-weighted average price (VWAP) of the bond from the last day on which there are transactions in the previous month to the last day on which there are transactions in the current month, divided by the VWAP on the last day of the previous month. We only use VWAPs that lie in the last 10 days of each month. A total of 1,063,873 bond-month observations have non-missing returns. The average bond return in our sample is about 29 basis points per month. Bond returns vary significantly across bonds and over time, with the 10th and 90th percentiles equal to -2.0% and 2.8% per month, respectively. Bond prices also vary significantly within a month, with the average price range equal to 3.1%.

We define flow-induced fire sales (FIFS) following Edmans, Goldstein, and Jiang (2012) with a slight modification on the flow cutoff (more details in the Appendix), and bond price fragility following Greenwood and Thesmar (2011). Specifically, FIFSs aim to measure the notional selling pressure experienced by a bond because of the redemptions experienced by the mutual funds holding it. In the same spirit, bond price fragility measures the expected volatility of trading by the mutual funds based on the past variance and covariance of flows

[3] An investment-grade bond is a bond whose credit rating is an equivalent of BBB- or better. The credit ratings are from Moody's, S&P, and Fitch. If the ratings are available from all three agencies, we use the middle rating. If the ratings are available from two agencies, we use the worse rating.

they experienced. FIFS and bond price fragility have been shown to capture the destabilizing effects of mutual fund ownerships and flows, from which we isolate the stabilizing effects of mutual funds' ownership concentration.

Both FIFS and bond price fragility are smaller in magnitude for the corporate bonds in our sample than for the stocks in Edmans et al. (2012) and in Greenwood and Thesmar (2011), respectively, for two reasons. First, aggregate mutual fund ownership is smaller for bonds than for stocks. Second, our observations are monthly and hence we use monthly flows, while both Edmans et al. (2012) and Greenwood and Thesmar (2011) use quarterly flows.

1.4 The Covid Sample

The last three columns of Table 1, Panels A, B, and C report the means of fund-, portfolio-, and bond-level variables for the three sub-periods of our COVID sample – pre-shock (9/2019 – 2/2020), COVID shock (3/2020), and post-shock (4/2020-9/2020). The significance of the COVID shock is apparent. The average monthly fund flows and returns are -4.6% and -9.2%, respectively; [4] 87% of funds experience outflows and virtually all funds experience negative returns. As a result of the large outflows, funds liquidate a large number of corporate bond positions. Of all the funds' positions entering the shock period, 22.0% are reduced or eliminated (compared with 10.9% in the main sample and 13.2% in the pre-shock period). The average change in position is a decrease of 11.5% (compared with a decrease of 4.6% in the main sample and a decrease of 6.1% in the pre-shock period). The post-shock period is similar to the pre-shock period along most dimensions, except that the average fund return exhibits a strong rebound.

[4] Despite the large negative number, the average fund flow still underestimates the full extent of market stress. Large funds experience larger outflows, and so the aggregate net outflow of all funds is about -5.2%, consistent with the estimate of Falato, Goldstein, and Hortacsu (2021).

The COVID shock appears to be associated with extremely negative returns and high volatility also for corporate bonds. The average return in March 2020 is -7.4%, over three times lower than the 10^{th} percentile of the main sample (-2.0%), and the average price range is 18.6%, about three times the 90^{th} percentile in the main sample (6.2%). In the post-shock period, the Fed's intervention appears to somewhat calm the market. Bond prices rebound strongly, resulting in an average monthly return of 1.8%. Volatility subsides, but remains elevated, as indicated by the average price range of 4.8%, twice as large as the average in the pre-crisis period.

2. Fund Trading

We conjecture that managers that own a large share of an outstanding bond issue take into account that bond sales are likely to affect prices and to feedback on the market valuation of the bonds they hold. By limiting the sales of the bonds in which they hold large shares during periods of market turmoil, fund managers can limit price drops and the negative feedback effects on the unsold part of their position. We would then expect that fund managers sell these bonds to a lower extent when they experience redemptions.

Table 2 shows how fund managers change their positions in different bond issues depending on the share of the issue they own. We control for the characteristics of the bond issues that may affect trading; in particular, as is common in the literature (see, for example, Edwards, Harris, and Piwowar, 2007; Ellul et al., 2015; Jiang et al., 2021), we include controls for bond age and bond issue size, which allow us to capture the liquidity of a bond issue.

We consider fund behavior in periods with large aggregate outflows from bond mutual funds (columns 1 to 3) and in periods in which the individual mutual funds experience large outflows (columns 4 to 6), respectively. We define periods of large aggregate outflows as those in which the combined percentage flows of all bond mutual funds are in the bottom decile of our sample period. Similarly, we consider mutual funds that experience shocks as the funds with flows in the bottom quintile during a month. However, not all funds report positions monthly; for the funds that report only quarterly holdings, we consider the average monthly flows during the quarter to capture periods of large redemptions.

The aggregate and fund level definitions of shocks allow us to evaluate different implications of our hypothesis. The first definition allows us to consider periods in which all bonds mutual funds on average experience redemptions and have to sell their assets. These are the periods that raise concerns for financial stability. For this reason, it is important to explore whether there exist stabilizing forces within the mutual fund industry, when bond mutual funds must collectively contract their balance sheets.

It is however possible that during periods of extreme outflows, large mutual funds, being more reputable, experience less outflows and have to sell to a lower extent. Since large mutual funds mechanically hold a larger share of any bond issue, fund size could mechanically drive the findings if small funds experience more redemptions in periods of market turmoil. For this reason, we also explore fund trading in a subsample in which each individual fund experiences flows in the bottom quintile.

In both samples, the estimates clearly show that funds that hold a large share of an outstanding issue decrease their position in that issue to a lower extent when they experience turmoil. For example, the estimates in column (1) of Table 2 suggest that when the aggregate flows are in the bottom decile of our sample, funds decrease positions in which their share of the outstanding issue is in the top decile of our fund-bond-time sample by about 1.45% less than otherwise similar positions in which they own a smaller share of the outstanding issue (relative to the mean position change of -5.20% in this sample).

Results are qualitatively and quantitatively invariant whether we consider periods with aggregate outflows from the bond mutual fund industry or individual mutual funds experiencing large outflows. In addition, the pattern appears to be largely driven by high-yield bonds. Investment grade bonds are more liquid and sales have smaller negative effects on their price, at least during normal times.

Figure 1 provides a different characterization of our finding. It allows us to evaluate the alternative explanation that funds expect better performance from the securities in which they hold larger portfolio shares. In this case, funds would reduce their large positions to a lower extent when they experience financing constraints, regardless of the share of the outstanding issue they own and the externalities that their trade can have on the bond prices.

Small funds having lower net assets under management may hold small shares of an outstanding bond issue even if the bond issue is a large share of their portfolio. We thus distinguish funds depending on their total net assets under management. Each month, we sort the positions in each fund's portfolio in deciles. We then ask whether funds always sell their large positions to a lower extent when the industry or the individual fund experience redemptions. If funds' behavior is indeed driven by their desire of avoiding a negative effect on bond prices, we expect funds to sell bonds in which they hold large positions to a lower extent only if they are large.

Figure 1 shows that the lower propensity to sell bonds in which the fund holds large positions during periods of turmoil is driven by large funds, that is, by funds whose large positions tend to be a large share of the bond outstanding issue and whose trade is likely to have a larger price impact.

Our results are robust to different assumptions on the extent of internalization of externalities. It is plausible that managers may internalize externalities on the valuation of the bonds of other funds in the family. These effects may be limited because even the largest families have just a few bond funds. Moreover, these funds are often specialized in different segments of the bond market and are unlikely to have much portfolio overlap. Nevertheless, in

Panel A of Table 3, we test the robustness of our findings. Consistent with our earlier results, we continue to find that funds whose families hold a large share of a bond issue reduce their position in that issue to a lower extent when they experience large aggregate outflows. For example, the estimates in column (1) suggest that when the aggregate flows are in the bottom decile, funds whose family's position in a bond issue ranks in the top 10% of our sample decrease their holdings in that bond issue by 1.47% (relative to the mean position change of -5.20% in this subsample) less than in otherwise similar bond holdings in which the family has a smaller position size.

Panel B shows that our findings are not driven by the characteristics of the bond issue by including interactions of bond and fund reporting period fixed effects. The estimates demonstrate that during the same period funds with a large share of an outstanding issue sell that given bond issue less than other funds. This allows us to exclude that any characteristics of the bond issue, such as quality or liquidity, may drive our findings.

We have so far considered only fund trading when redemptions occur. In these situations, trading is unlikely to be information-driven, but rather forced by financial constraints. Externalities may therefore occur. These are precisely the periods in which we expect funds that own a large share of an issue to have particularly strong incentives to internalize the negative spillovers of their trades.

As a placebo, we consider periods with non-negative aggregate flows into the bond mutual funds' industry. In addition, we exclude any observations of funds that experience negative flows during a period. In this subsample, trading is more likely to be information-driven and to cause smaller negative spillovers. We should thus observe that the share of the equity issue owned by the fund matters less in explaining the magnitude of the sales. This is precisely what we find in Table 4. Only in column 3, when we consider high-yield bonds, we find a positive effect of the fund's ownership share in the issue on the change in the fund's position. Even then, the effect is marginally statistically significant and about half in magnitude in comparison to that estimated for periods with redemptions. This should not surprise as mutual funds' sales can have a negative price impact on the position even during normal times. Overall, the results of the placebo test support our conclusion that the trading of funds with large shares is driven by the desire to limit negative price spillovers and not by an informational advantage.

3. Bond Returns

So far, we have shown that mutual funds that own a large share of an outstanding bond issue are less inclined to sell when they experience redemptions, arguably in the attempt to stabilize bond prices. This section explores whether the behavior of funds that own a large share of an outstanding issue indeed stabilizes bond prices. If our conjecture that mutual funds with a large stake in an issue internalize the externalities of their trades were supported by the data, we should observe that bond issues with more concentrated bond mutual fund ownership experience less pronounced declines in periods of distress. We should also observe that the prices of these bond issues are, ceteris paribus, less volatile.

3.1 Average returns

Table 5 provides a first evaluation of the empirical evidence on bond returns. Each month, we sort bonds in deciles of top mutual fund ownership. We present average returns for each decile of top mutual fund ownership, distinguishing between periods of financial turmoil and normal times. In Panel A, we define periods of turmoil as months in which a particular bond issue experiences flow-induced fire sales in the top decile of the sample. In Panel B, we consider periods of aggregate outflows, defined as months of aggregate flows to bond mutual funds in the bottom decile; we also restrict the sample to bonds issues with aggregate mutual funds' ownership in the top quintile, as these issues are most likely to be affected.

For both definitions of financial turmoil, the returns of all bond portfolios appear negative and significantly lower than in normal times. This supports our definitions of turmoil. Importantly, during these periods, the returns of bonds in the top decile for ownership concentration are significantly higher than the returns of bonds in the bottom decile. These differences are economically and statistically significant only in periods of financial turmoil. On average, in Panel A, where we consider bonds experiencing flow-induced fire sales, the returns of bonds in which the ownership share of the top mutual fund is in the top decile outperform those in the bottom decile by an average of 0.61% per month, or 7.36% annualized. Thus, when mutual funds experience large redemptions, bonds in which the top mutual fund owns a larger share of the issue are less negatively affected.

Importantly, regardless of the definition of turmoil we use, it appears that ownership by the top mutual fund has larger impact on the returns of high-yield bonds than on those of investment-grade bonds. In Panel A, high-yield bonds that experience flow-induced fire sales and are in the top decile for the ownership share of the top mutual fund outperform those in the bottom decile by 0.96%, or 11.37% per annum. This is consistent with our earlier finding that managers' propensity to internalize the externalities of their sales is more accentuated in high-yield bonds, which are relatively more illiquid and would consequently be more likely to experience large drops of prices below their fundamental value.

Notably, in both panels of Table 5, mutual funds' ownership concentration is unrelated to expected bond returns in normal times. This suggests that bond issues with higher mutual funds' ownership concentration are not more illiquid because if this were the case they would have to provide a premium to investors in the form of higher expected returns (Chen, Lesmond, and Wei, 2007). Such an interpretation is also consistent with the evidence that in normal times, mutual funds do not trade bonds in which they have large ownership stakes any differently than other bonds.

Table 6 shows that these conclusions are robust when we control for other possible determinants of bond returns in a multivariate setting. The two panels refer to our two different definitions of market stress. The specifications control for the overall market movements using rating matched index returns and their interaction with (logged) bond maturity, allowing long maturity (or long duration) bonds to move more with the market. In addition, we include time and issuer fixed effects, and control for other bond characteristics that may affect returns, including (logged) bond maturity, (logged) bond issue size, (logged) bond age, a dummy variable for investment grade bonds, and dummy variables for bonds that are upgraded or downgraded in an interval of two months from the current month. In particular, the upgrade and downgrade dummies capture that information leading to a future rating change may already be available to market participants and affect their trading.

Finally, we control for bond mutual fund ownership (as a proportion of the bond's issue size), which according to Massa, Schumacher, and Wang (2021), may be lower in securities where mutual fund ownership concentration is higher. In our sample, however, higher mutual fund ownership is positively related to the proportion of the bond issue held by the top mutual fund. We test whether in periods with more intense flow-induced fire sales (Panel A) or more intense outflows from the mutual fund industry (Panel B), which –as we would expect– depress bond returns, a larger ownership share by the top mutual fund is associated with higher bond abnormal returns. It is apparent that this is the case. The effect is again both statistically and economically significant. Based on the estimates in column 2 of Panel A, when a bond issue experiences a flow-induced fire sale equal to the average of the largest 10% of our sample, increasing the top owner stake from 0.004 to 0.080 (that is, from the 10^{th} to the 90^{th} percentiles) increases the bond return by about 0.23% per month (5.188 x 0.006 x (0.080 – 0.004)), or 2.81% annualized.

The price effects of fund outflow are larger if we focus on the less liquid high-yield bonds. This is again consistent with funds internalizing the negative spillover effects of their trades, which tend to be larger for less liquid bonds. In addition, this subsample result also mitigates any concerns that the top mutual fund ownership is correlated with ownership by insurance companies, which in turn may have a stabilizing effect on bond prices. Insurance companies predominantly own investment grade bonds, not high-yield bonds.

3.2 Return Volatility

The trading behavior of mutual funds that hold a large stake in a bond issue is also expected to reduce the bond price volatility.

Figure 2 considers the volatility of bond prices. Measuring (realized) bond price volatility is challenging because the majority of bonds does not trade daily. Even when bonds are traded frequently, their transaction prices can be highly dispersed during the same trading day (O'Hara, Wang, and Zhou, 2018) and their measurable transaction costs are high (Edwards et al., 2007; Dick-Nielsen, Feldhutter, and Lando, 2012; and Bessembinder et al., 2018). For these reasons, following Alizadeh, Brandt, and Diebold (2002), among others, we use a price range measure of volatility, which is statistically efficient and robust to microstructure noise. Specifically, we calculate the price range of each bond from the last trading day of the previous month to the last trading day of the current month and normalize the range by the price on the last day of the previous month. We distinguish between investment grade bonds and high-yield bonds and present the average and median price range for different bond portfolios, sorted by deciles of the proportion of the issue held by the top mutual fund.

We observe that a larger stake of the top owner is associated with a monotonically decreasing pattern for our measure of bond price volatility. This supports our conjecture that a higher ownership stake gives investors' incentives to internalize externalities and reduces nonfundamental volatility. As we move from the bottom to top deciles of top mutual fund ownership, the average (median) monthly price range decreases from 2.82% to 2.10% (2.22% to 1.42%), a twenty-five (thirty-five) percent decrease.

Table 7 reproduces this result in a multivariate setting in which we again control for the overall market movements as well as bond characteristics. Columns 1 to 3 confirm the univariate evidence. It is evident that the reduction in volatility is particularly pronounced for the less liquid high-yield bonds. As we increase the top owner stake from 0.004 to 0.080 (that is, from the 10^{th} to the 90^{th} percentiles), the monthly price range decreases by 0.15% (-0.019 x (0.080 – 0.004)), on average, for all bonds, and by 0.21% (-0.028 x (0.080 – 0.004)) for high-yield bonds.

In columns 4 to 6, we control for the measure of price fragility introduced of Greenwood and Thesmar (2011), who show that stocks are exposed to non-fundamental shifts in demand if their owners face correlated shocks. In these specifications, the measure of price fragility is also positive and significant as Greenwood and Thesmar (2011) find to be the case for equity. We also control for the ownership by the largest ten families based on the total net asset under management and find that consistent with the findings of Ben David et al. (2021) for equity mutual funds, a higher ownership share by the largest ten families tends to increase price volatility. Most importantly, both controls leave unaffected the coefficients on top fund ownership, indicating that our results are robust. In addition, in the subsample of investment-grade bonds in column 5, ownership by the largest ten families loses statistical significance; in contrast, the effects of top fund ownership, our measure of concentration, are significant across specifications.

Finally, column 7 explores whether large bond mutual funds increase the volatility of the bonds in which they do not hold large positions. To do so, we exclude the bond issues with more concentrated ownership as captured by top mutual fund ownership in the top quintile, and test whether a higher proportion of shares held by the largest fund families increases bond price volatility in this subsample. We find no evidence that this is the case, as the coefficient on the ownership by the largest ten families is statistically insignificant in this subsample.

Overall, the above findings support our hypothesis that mutual funds that own a large proportion of an outstanding issue internalize the externalities of their trades in that issue. Since externalities are much more pronounced in less liquid assets, it is unsurprising that the decrease in volatility is more apparent for high-yield bonds. The positive effects of flow-induced trading on bond price volatility, which are often attributed to ownership concentration, are instead more likely to be driven by a high proportion of the bond issue being owned by many mutual funds with correlated flows.

4. Internalization of Externalities and the Effects of the Fed's Corporate Credit Facilities

We explore how the mechanisms we have highlighted can help explain the sharp rebound of high-yield bonds in March 2020, following the announcement of the Fed's intervention in the corporate bond market. This empirical exercise also allows us to sharpen our identification. As will be clear below, the Fed's intervention provided a price backstop for some bonds, but not others. This price backstop had the effect of limiting expected price externalities of distressed sales in some bond issues, but not in others. We can thus use the exogenous variation in expected price externalities to identify how the internalization of price externalities affects bond trading.

Between the months of February and March 2020, the average bond mutual fund experienced cumulative outflows of about 10% of net asset value (Falato, Goldstein, and Hortaçsu, 2021). All bonds, including investment grade bonds, experienced pronounced price drops, as mutual funds in their dash for cash rushed to sell their more liquid positions (Chaderina, Muermann, and Scheuch, 2018; Ma, Xiao, and Zeng, 2021). On March 23, 2020, to avert a crisis in the bond market, the Fed announced the purchases of investment grade bonds with less than five-year maturity remaining, as well as of U.S.-listed exchange-traded funds whose investment objective is to provide broad exposure to the market for U.S. corporate bonds. As expected, bond prices that had significantly dropped during March 2020 started to rebound.[5] Consistent with the findings of Haddad, Moreira and Muir (2021), the rebound affected all categories of corporate bonds, including investment grade bonds with more than five-year maturity and high-yield bonds. This is evident from Table 8, which shows monthly bond returns before and during the COVID crisis, distinguishing between investment grade, investment grade ineligible, and high yield bonds.

Wealth effects and the stop in redemptions can help explain the positive spillover of the Fed's announcement to ineligible bonds. Here, we show that the incentives of funds with a large share of an outstanding issue are likely to have contributed to the rebound.

In March 2020, when the disruption caused by the COVID-19 pandemic became apparent and large outflows from bond funds occurred, all bonds, including investment grade bonds, were affected by fire sales. Consequently, bond mutual funds were selling to a lower extent any bonds in which they had a large stake. The SMCCF provided a backstop for eligible investment grade bonds effectively mitigating any negative externalities of distressed sales on their price. We expect that after the announcement, starting from April 2020, fund managers

[5] We exclude fallen angels that became eligible for purchase in April 2020 to make sure that the price rebounds of high-yield bonds are not driven by the Fed policy.

could sell eligible investment grade bonds without worrying much about the price impact. They could thus trade in a way to minimize the impact of their trades on ineligible bonds.

This is precisely what we find in Table 9. We explore how the mutual funds subject to the largest outflows traded before and after the Fed's announcement. Funds with large shares of a particular bond issue tend to sell to a lower extent in March 2020, regardless of the bond ratings. The estimates in columns 2 (4) indicate that mutual funds decrease positions that are in the top decile of the bond outstanding issue by 2.09% (2.36%) less than positions in otherwise similar bonds in which they own a smaller share of the outstanding issue. This difference is economically significant, given that the mean position change in this sample is 11.52 percentage points.

Consistent with our conjecture, this pattern changes in the six months starting after March 2020. Bond mutual funds with large shares are more likely to sell if the bond issue is eligible for the SMCCF. In contrast, not only do funds with large ownership shares continue to sell more cautiously both ineligible investment grade bonds and high yield bonds, but the economic magnitude of the effect of having a large share on the change in the fund's position becomes larger. The estimates in column 7 indicate that mutual funds decrease positions in SMCCF ineligible investment grade bonds in which their ownership shares rank in the top 10% by 3.10 less than otherwise similar positions in which their ownership shares are smaller. This is again an economically significant effect, considering that the mean position change is -6.11 percentage points in this sample. The economic effect is similar in magnitude for SMCCF ineligible high-yield bonds in column 8.

Table 10 provides evidence that the changes in trading patterns can help explain bond returns. In particular, we investigate how an issue's ownership structure is related the issue's return before and after the Fed's announcement.

During March 2020, all bond issues experiencing flow-induced fire sales have higher returns if their ownership is more concentrated, as captured by the share owned by the top mutual fund. Following the announcement of the Fed, ownership structure does not appear to explain bond returns any longer for eligible bonds, that is, the bonds in which we do not observe any longer the stabilizing trading behavior of fund managers with a large share of the outstanding issue. On the contrary, the effect of the share owned by the top mutual fund is larger than in the previous period for ineligible bond issues.

The estimates in column 7 indicate that when a bond issue experiences extreme flow-induced fire sales equal to the average of the largest 10% of the ineligible investment grade bond sample, the bond's price drops by 2.71% (-4.511 x 0.006) in that particular month. However, increasing the top ownership stake from 0.004 to 0.080 (that is, the 10^{th} to the 90^{th} percentile) significantly alleviates the price pressure, reducing the magnitude of the price drop by as much as 2.06% (45.185 x 0.006 x (0.080 – 0.004)).

Similarly in the high-yield bonds subsample in column 8, following an extreme flow-induced fire sale equal to the average of the largest 10% of the high-yield bond sample, the bond's price drops by 2.53% (-3.613 x 0.007) in that particular month; increasing the top ownership stake from 0.004 to 0.080 (that is, from the 10^{th} to the 90^{th} percentiles) reduces the magnitude of the price drop by 1.78% (39.016 x 0.007 x (0.080 – 0.004)).

These findings provide a mechanism through which the Fed's announcement spilled over to ineligible bonds. Importantly, they also allow us to exploit an unexpected policy change as a shock to test our hypothesis that bonds funds with large shares of an outstanding issue internalize the price effects of their trades and limit or avoid fire sales in the bond market. In particular, the fact that mutual funds with a large share of the outstanding issue sell as much as other funds when the Fed's intervention limits the negative spillovers of their trades fully supports our interpretation of the empirical evidence. The Fed's intervention effectively eliminated the negative price spillovers of distressed sales. Consequently, bond mutual funds had no externalities to internalize.

5. Stabilizing Trading and Funds' Performance

This section explores whether mutual funds' internalization of negative price spillovers benefits performance. We view negative externalities arising from distressed sales as a cost for the fund manager. Funds whose portfolios are less exposed to the negative spillovers of fire sales should have better performance, especially in periods of financial turmoil.

To evaluate whether the stabilizing trading indeed benefits mutual funds' performance, we test whether funds whose portfolio comprises a larger share of positions that are in the top decile of the fund-bond-time sample perform better.

Table 11 shows the results. We find that funds that trade to avoid the negative price spillovers of fire sales in a larger fraction of their portfolio have better performance during periods of large aggregate outflows. As in our earlier results, the effect is largely driven by high-yield bond funds, that is, by funds in which the negative price spillovers would be larger. The effects are not only statistically, but also economically significant. Increasing the fraction of large positions from 0 to 0.665 (that is, from the 10^{th} to the 90^{th} percentiles) raises the fund's alpha during the periods of large aggregate outflows by 16.13 basis points (0.243 x 0.665) in the full sample. For funds focusing on high-yield bonds, the interdecile effects are 23.74 basis points (0.323 x 0.735). The mean of gross alpha in our sample is just -5.28 basis points.

We do not find significant differences in performance when we consider funds experiencing large individual outflows.

The conditional differences in alpha during periods of aggregate outflows translate in (smaller) differences in unconditional alpha between funds that hold relatively more large positions and other funds.

The better performance of bond funds whose portfolio comprises a larger proportion of outstanding issues' large shares appears to stabilize the fund's assets during periods of aggregate outflows. Table 12 shows that compared to funds with a fraction of large positions in the 10th percentile, those with a fraction of large positions in the 90th percentile experience flows that are 1.06 percentage points larger in the month immediately following the turmoil. Note that the average monthly flow is 0.60% in the full sample, and -0.50% in periods of large aggregate outflows. Thus, large mutual funds, being more likely to have large shares of outstanding issues, may help stabilize the funding of bond mutual industry thus contributing to financial stability.

6. Conclusion

We show that mutual funds trade in a way to minimize the negative price effects of flow-induced fire sales. In particular, funds with a large share of an outstanding issue appear to sell their holdings of that issue to a lower extent when they experience redemptions, arguably because they attempt to avoid negative feedback effects on the valuation of their remaining holdings of that issue. Such an interpretation is supported by evidence that bond issues with more concentrated ownership experience higher returns during periods of market turmoil and have lower price volatility.

We provide evidence that the stabilizing trading of bond funds with a large share of an outstanding issue can help explain how the intervention of the Fed in the bond market through the SMCCF was capable to quickly stabilize both eligible and ineligible bonds. By providing a backstop for eligible bonds, the Fed enabled bond funds with large shares to concentrate their stabilizing trading behavior on ineligible issues, whose prices quickly rebounded.

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Appendix: Variable Definitions

Fund-level variables
Frequency: fund-month or coarser, depending on each fund's reporting frequency.
Source: Morningstar and Morningstar Direct, unless specified.

Variable	Definition
Alpha	The fund's monthly return minus the benchmark return. The benchmark return is calculated using the factor model of Chen and Qin (2017). The factor loadings are estimated on a rolling basis, using the most recent 18 months. 1 means 1%.
Avg. maximum rear load	Value weighted average across all share classes of the maximum charge for redeeming the mutual fund shares, as of the previous report date. 0.01 means 1%.
Broker affiliation	Dummy variable that equals one if the fund's family is affiliated with a (SEC-registered) broker-dealer bank, and zero otherwise.
Cash as % of portfolio	Holdings of cash and cash equivalents, as a percentage of TNA, as of the previous report date. 1 means 1%.
Corporate bonds as % of portfolio	Holdings of corporate bonds, as a percentage of TNA, as of the previous report date. 1 means 1%.
Flow	Sum of dollar flows across all share classes in the current reporting period, divided by the number of months in the period and presented as a fraction of TNA at the beginning of the period (i.e., on the previous report date). 0.01 means 1%.
Government bonds as % of portfolio	Holdings of (U.S. and foreign) government bonds, as a percentage of TNA, as of the previous report date. 1 means 1%.
Institutional share class fraction	Fraction of institutional share classes in the fund's TNA, as of the previous report date. 0.01 means 1%.
ln(1 + Fund age)	Natural log of 1 plus the fund's age in years, as of the previous report date.
ln(1 + Fund TNA)	Natural log of 1 plus the fund's total net assets (TNA) in dollars, as of the previous report date.
ln(1 + Family TNA)	Natural log of 1 plus the TNA in dollars of all taxable bond funds in the fund's family, as of the previous report date.
ln(1 + Portfolio avg. bond age)	Natural log of 1 plus the value weighted average bond age in years, based on the offering date of each bond from Mergent FISD and market value as of the previous report date from Morningstar. The offering dates from Mergent FISD are only available for corporate bonds.
ln(1 + Portfolio avg. bond issue size)	Natural log of 1 plus the value weighted average bond issue size in $1,000, based on the offering amount of each bond from Mergent FISD and the fund's market value as of the previous report date from Morningstar. The offering amounts from Mergent FISD are only available for corporate bonds.
Portfolio avg. coupon rate	Value weighted average coupon rate, based on the coupon rate and the market value of each bond position as of the previous report date from Morningstar. 1 means 1%.
Portfolio avg. credit rating	Value weighted average credit rating, based on the credit ratings from Moody's, S&P, and Fitch and the market value as of the previous report date from Morningstar. The ratings are only available for corporate bonds. If the

Variable	Definition
	ratings are available from all three agencies, the middle rating is used. If the ratings are available from two agencies, the worse rating is used. Rating scales are 1 for AAA (and equivalent), 2 for AA+, 3 for AA, and so on.
Portfolio effective duration	Value weighted average effective duration in years, based on the authors' calculation given bond characteristics from Morningstar and Mergent FISD and the market value as of the previous report date from Morningstar. Equity duration is assumed to be zero.
Return	Average monthly return in the current reporting period. 0.01 means 1%.
Top decile positions/ TNA (LARGEFRAC)	Value of the fund's positions that are in the top decile of position size in the sample, divided by the fund's TNA.

Position-level variables
Frequency: fund-bond-month or coarser, depending on each fund's reporting frequency.
Source: Morningstar, unless specified.

Variable	Definition
Decile of fund (family) position size, Top decile of fund (family) position size	Decile of fund (or family) position size based on the "pooled" sorting of all fund-bond-period observations. Fund position size is the fund's position in a bond divided by the bond's issue size. Family position size is the sum of positions in a bond across all taxable bond funds in the family, divided by the bond's issue size. Only corporate bonds that Mergent FISD classifies as non-puttable U.S. Corporate Debentures and U.S. Corporate Bank Notes (bond type-CDEB or USBN) are included. Decile 0 is the smallest and decile 9 is the largest. Top decile of fund (or family) position size is a dummy variable that equals one if the decile of fund (or family) position size is 9, and zero otherwise.
Position change	Change in fund position in a particular bond over the current reporting period as a fraction of beginning-of-period position (i.e., position on the previous report date). 0.01 means 1%.

Bond-level variables
Frequency: bond-month.
Source: Mergent FISD, Morningstar, and (academic) TRACE.

Variable	Definition
Bond maturity, ln(1 + Bond maturity)	Maturity in years (natural log of 1 plus maturity). For each bond, maturity is the time between a particular date and the bond's maturity date. For the position level tests, the bond maturity is as of the previous report date. For bond level tests, the bond maturity is as of the end of the previous month.
Downgrade	Dummy variable that equals one if the bond is downgraded from investment to non-investment grades within plus and minus two months from the current month, and zero otherwise.
Flow-induced fire sales (FIFS)	*FIFS*(*b*,*t*) is the sum of notional sales driven by redemptions in bond *b* in month *t* across all funds, normalized by the bond's issue size. Only redemptions from funds experiencing flows in the bottom decile (largest outflows, pooled sort) of the sample are considered to trigger fire sales. $$FIFS(b,t) = \frac{\sum_f Flow(f,t) \times \mathbb{1}_{(Flow(f,t)\ in\ bottom\ decile)} \times H(f,b,t\text{-}1)}{IssueSize(b)}$$

Variable	Definition
	where *Flow(f,t)* is the percentage flows of fund *f* in month *t*, $\mathbb{1}_{(Flow(f,t)\ in\ bottom\ decile)}$ is a dummy variable that equals 1 if *Flow(f,t)* is in the bottom decile of the sample, and zero otherwise, *H(f,b,t-1)* is the par amount (in dollars) of bond *b* held by fund *f* at the end of month *t-1*, and *IssueSize(b)* is the issue size (in dollars) of bond *b*. 0.01 means 1%.
Fragility, SQRT(Fragility)	Expected variance of flow-induced fund trading, calculated as in equation (8) of Greenwood and Thesmar (2011). The covariance matrix of dollar flows is calculated using percentage flows in the last 24 months, exclusive of the current month, and fund TNA at the end of the previous month. Only mutual funds with at least 6 months of past flows are included. Weights of funds' portfolios in the bond are as of the end of the previous month. Issue size is used as the scaling factor. SQRT(Fragility) is the square root of fragility. A value of 0.01 means 1%.
Investment grade	Dummy variable that equals one if the bond is an investment-grade bond, and zero otherwise. An investment-grade bond is a bond whose credit rating is an equivalent of BBB- or better. The credit ratings are from Moody's, S&P, and Fitch. If the ratings are available from all three agencies, the middle rating is used. If the ratings are available from two agencies, the worse rating is used.
Largest 10 families' ownership	Ownership in a particular bond of the largest 10 mutual fund families by TNA (sum of TNA of all taxable bond mutual funds in the family), computed as of the previous report date, as a fraction of the bond issue size. 0.01 means 1%.
ln(1 + Bond age)	Natural log of 1 plus the bond age in years. For each bond, age is the time between the offering date and a particular date. For the position level tests, the bond age is as of the previous report date. For the bond level tests, the bond age is as of the end of the previous month.
ln(1 + Bond issue size)	Natural log of 1 plus bond issue size in $1,000. For each bond, issue size is the offering amount as reported by Mergent FISD.
Matched index level range	Maximum minus minimum levels in the current month of Bank of America Merrill Lynch's Investment Grade Corporate Bond Index or Bank of America Merrill Lynch's High Yield Corporate Bond Index, depending on the credit rating of the matched bond, as a fraction of index level at the end of the previous month. The matched index level range is measured over the exact same trading days used to measure the bond price range. 0.01 means 1%.
Matched index return	Current month return, calculated as the percentage change in Bank of America Merrill Lynch's Investment Grade Corporate Bond Index or Bank of America Merrill Lynch's High Yield Corporate Bond Index, depending on the credit rating of the matched bond. The matched index return is measured over the exact same trading days used to measure the bond return. 0.01 means 1%.
Mutual fund ownership	Ownership in a particular bond of all taxable bond mutual funds in Morningstar database, as of the previous report date, computed as a fraction of the bond issue size. 0.01 means 1%.
Price range	Maximum minus minimum daily volume weighted average price (VWAP) of the bond in the current month, as a fraction of VWAP on the last day on which there were transactions in the previous month. For the price range to

Variable	Definition
	be measurable, the bond must trade at least once in the current month and within the last 10 days of the previous month. 0.01 means 1%.
Return	Current month return, calculated as the percentage change in VWAP of the bond from the last day on which there are transactions in the previous month to the last day on which there are transactions in the current month. Only returns calculated from VWAP that lie in the last 10 days of each month are used. 0.01 means 1%.
Top fund ownership, Top family ownership	Ownership in a particular bond of the mutual fund, or of the mutual fund family, that owns the largest amount of the bond, as of the previous report date, computed as a fraction of the bond issue size. 0.01 means 1%.
Upgrade	Dummy variable that equals one if the bond is upgraded from non-investment to investment grades within plus and minus two months from the current month, and zero otherwise.

Table 1

Summary Statistics

This table presents summary statistics for fund-level (Panel A), position-level (Panel B), and bond-level (Panel C) variables. The data on fund holdings and characteristics are from Morningstar and Morningstar Direct, the data on bond characteristics are from Mergent FISD, and the data on corporate bond transactions, which we use to calculate bond prices and returns, are from FINRA's Enhanced TRACE. The main sample covers the period from 1/2003 to 12/2019. The COVID sample covers the period from 9/2019 to 9/2020. The fund sample includes only open-ended taxable bond mutual funds that hold at least 50% of the total net assets under management (TNA) in corporate bonds. All share classes that share the same master portfolio count as one fund, and the number of unique funds is 1,016. The bond sample includes only non-puttable U.S. Corporate Debentures and U.S. Corporate Bank Notes (bond type CDEB or USBN) that are held by at least one fund on the latest report date, and the number of unique bond CUSIPs is 32,006. The position sample includes only the positions of sample funds in sample bonds. In Panel A (B), the observation frequency is fund-month (fund-bond-month) or coarser in the time dimension depending on each fund's reporting frequency. In Panel C, the observation frequency is bond-month. All variables are defined in the Appendix.

Panel A: Fund-Level Variables

	Main Sample (42,251 Fund-Periods)					COVID Sample (3,665 Fund-Periods)		
Variable	Mean	Standard Deviation	PCT 10	PCT 50	PCT 90	Mean 9/19-2/20	Mean 3/20	Mean 4/20-9/20
Total net assets (TNA) ($ Mil.)	1,246	2,681	26	334	3,103	1,712	1,888	1,723
Family TNA ($ Mil.)	26,150	61,522	176	8,400	57,801	53,286	52,534	56,458
Fund age (year)	12.330	9.992	1.837	9.706	27.088	15.439	16.061	16.201
Institutional share class fraction	0.506	0.394	0.000	0.508	1.000	0.668	0.647	0.672
Avg. maximum rear load (x100)	0.375	0.638	0.000	0.013	1.747	0.247	0.215	0.116
Flow (x100)	0.603	3.362	-3.017	0.071	5.207	0.152	-4.550	0.318
Return (x100)	0.476	1.268	-1.034	0.473	1.979	0.366	-9.205	1.811
Alpha (%)	-0.053	0.807	-0.599	-0.019	0.529	-0.034	-0.634	0.023
Broker affiliation	0.074	0.262	0.000	0.000	0.000	0.057	0.038	0.039
Cash as % of portfolio	6.640	9.641	0.629	4.996	15.369	6.055	5.079	5.850
Government bonds as % of portfolio	5.601	11.298	0.000	0.000	19.347	4.860	5.145	4.383
Corporate bonds as % of portfolio	77.485	18.465	50.978	84.255	95.370	80.730	80.825	80.998
Portfolio avg. bond issue size ($ Mil.)	872	307	484	855	1,265	1,016	1,021	1,037

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Table 1 *-continued*

Variable	Main Sample (42,251 Fund-Periods) Mean	Standard Deviation	PCT 10	PCT 50	PCT 90	COVID Sample (3,665 Fund-Periods) Mean 9/19-2/20	Mean 3/20	Mean 4/20-9/20
Portfolio avg. bond age (year)	2.818	1.284	1.516	2.563	4.490	3.798	3.857	3.852
Portfolio avg. coupon rate	6.568	1.925	3.966	6.569	8.910	5.424	5.350	5.584
Portfolio avg. credit rating (1 = AAA)	12.877	3.787	7.000	15.000	16.000	12.682	12.702	12.678
Portfolio Effective duration (year)	4.321	2.043	2.344	3.985	6.566	4.530	4.718	4.645
Top dec. positions/TNA (LARGEFRAC)	0.174	0.272	0.000	0.009	0.665	0.143	0.153	0.130

Panel B: Position-Level Variables

Variable	Main Sample (11,312,852 Fund-Bond-Periods) Mean	Standard Deviation	PCT 10	PCT 50	PCT 90	COVID Sample (750,832 Fund-Bond-Periods) Mean 9/19-2/20	Mean 3/20	Mean 4/20-9/20
Position size/Bond issue size (x100)	0.636	1.535	0.017	0.200	1.525	0.624	0.688	0.611
Family position size/Bond issue size (x100)	1.584	3.589	0.042	0.592	4.173	1.727	1.792	1.777
Position change/Beginning position (x100)	-4.611	27.927	-5.656	0.000	0.000	-6.085	-11.522	-6.107
Position increase	0.063	0.243	0.000	0.000	0.000	0.087	0.089	0.097
Position decrease	0.109	0.312	0.000	0.000	1.000	0.132	0.220	0.142

Panel C: Bond-Level Variables

Variable	Main Sample (1,514,632 Bond-Months; 1,063,873 with Return/Range) Mean	Standard Deviation	PCT 10	PCT 50	PCT 90	COVID Sample (126,294 Bond-Months; 94,299 with Return/Range) Mean 9/19-2/20	Mean 3/20	Mean 4/20-9/20
Bond maturity (year)	8.699	8.301	1.498	5.916	24.287	9.283	9.377	9.645
Bond issue size ($ Mil.)	593	504	200	450	1,250	752	752	767

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Table 1 *-continued*

Panel C: Bond-Level Variables

Variable	Main Sample (1,514,632 Bond-Months; 1,063,873 with Return/Range) Mean	Standard Deviation	PCT 10	PCT 50	PCT 90	COVID Sample (126,294 Bond-Months; 94,299 with Return/Range) Mean 9/19-2/20	Mean 3/20	Mean 4/20-9/20
Bond maturity (year)	8.699	8.301	1.498	5.916	24.287	9.283	9.377	9.645
Bond issue size ($ Mil.)	593	504	200	450	1,250	752	752	767
Bond age (year)	4.466	4.144	0.550	3.274	9.621	5.185	5.272	5.191
Investment grade	0.666	0.471	0.000	1.000	1.000	0.759	0.762	0.770
Upgrade	0.021	0.142	0.000	0.000	0.000	0.018	0.017	0.029
Downgrade	0.010	0.082	0.000	0.000	0.000	0.012	0.029	0.009
Mutual fund ownership	0.100	0.097	0.007	0.068	0.244	0.106	0.107	0.107
Top fund ownership	0.035	0.037	0.004	0.022	0.080	0.034	0.035	0.034
Top family ownership	0.046	0.044	0.005	0.033	0.100	0.052	0.053	0.053
Largest 10 families' ownership	0.054	0.061	0.000	0.035	0.139	0.066	0.069	0.067
Flow-induced fire sales (FIFS) (x100)	0.036	0.077	0.000	0.000	0.084	0.031	0.329	0.032
SQRT(Fragility) (x100)	0.121	0.130	0.015	0.073	0.297	0.109	0.102	0.149
Return (x100)	0.293	2.723	-2.036	0.231	2.766	0.459	-7.413	1.829
Return on matched IG bond index (x100)	0.269	1.421	-1.314	0.391	1.848	0.696	-7.329	1.798
Return on matched HY bond index (x100)	0.464	2.175	-1.972	0.682	2.437	0.302	-12.310	2.547
Price range (x100)	3.141	3.765	0.580	2.095	6.195	2.262	18.617	4.842
Price range of matched IG index (x100)	1.721	0.869	0.859	1.536	2.820	1.763	15.493	3.031
Price range of matched HY index (x100)	2.249	1.896	0.754	1.697	4.135	1.371	20.474	4.089

Table 2

Fund Trading during Periods of Financial Turmoil as a Function of the Fund's Position Size

This table reports OLS estimates for panel regressions of fund position changes in turmoil periods on fund position size. In columns (1) – (3), financial turmoil is measured using aggregate flows to all taxable bond mutual funds during a month, and the sample includes only position changes (inclusive of zeros) during the periods in which the aggregate flows are in the bottom decile during 1/2003 – 12/2019. In columns (4) – (6), financial turmoil is measured using individual fund flows. The sample includes only position changes (inclusive of zeros) associated with fund-period observations for which the flows are in the bottom quintile, based on pooled sorting across all fund-period observations. The dependent variable, position change, is measured as a fraction of the position on the previous report date, and hence the observations in both turmoil samples include only existing positions. All other variables are defined in the Appendix. All columns include fund-reporting period fixed effects. Standard errors, double-clustered by fund family and reporting period, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	Turmoil = Periods with Aggregate Flows in Bottom Decile (≤ -0.854%, average = -1.388%)			Turmoil = Fund-Periods with Individual Flows in Bottom Quintile (≤ -1.620%, average = -3.482%)		
	(1)	(2)	(3)	(4)	(5)	(6)
	ALL	IG	HY	ALL	IG	HY
Top decile of fund position size	0.0145**	0.0059	0.0213**	0.0083**	0.0069	0.0114**
	(0.006)	(0.006)	(0.008)	(0.004)	(0.006)	(0.005)
Bond controls						
ln(1 + Bond maturity)	0.0293***	0.0302***	0.0328***	0.0328***	0.0283***	0.0371***
	(0.005)	(0.008)	(0.005)	(0.003)	(0.004)	(0.003)
ln(1 + Bond issue size)	-0.0040***	-0.0060***	-0.0022	-0.0079***	-0.0123***	-0.0057***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
ln(1 + Bond age)	-0.0013	0.0045	-0.0056***	0.0003	0.0126***	-0.0046***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)	(0.001)
Investment grade	-0.0177*			-0.0315***		
	(0.009)			(0.005)		
Upgrade	-0.1521***		-0.1535***	-0.1061***		-0.1076***
	(0.051)		(0.052)	(0.017)		(0.017)
Downgrade	-0.2395***	-0.2324***		-0.0529*	-0.0624**	
	(0.056)	(0.055)		(0.028)	(0.029)	
Fund x Period fixed effects	YES	YES	YES	YES	YES	YES
Observations	718,259	250,691	467,073	1,282,129	319,826	961,188
R-squared	0.099	0.135	0.106	0.127	0.179	0.124

Table 3

Fund Trading during Periods of Financial Turmoil – Robustness Checks

This table presents two robustness checks for the relationships between fund position changes during turmoil periods and position size. The dependent variable, position change, is measured as a fraction of the position on the previous report date, and therefore the observations include only existing positions. In Panel A, fund position changes are regressed on family position size, instead of fund position size. In Panel B, bond-level control variables are replaced by bond-reporting period fixed effects. Financial turmoil is measured using aggregate flows to all taxable bond mutual funds during a month. The sample includes only position changes (inclusive of zeros) during the periods in which the aggregate flows are in the bottom decile during 1/2003 – 12/2019. All columns in both panels include fund-reporting period fixed effects. All other variables are defined in the Appendix. Standard errors, two-way clustered by fund family and reporting period, are in parentheses. ∗, ∗∗, and ∗∗∗ refer to statistical significance at 10%, 5%, and 1% levels.

Panel A. Family Position Size

	(1) ALL	(2) IG	(3) HY
Top decile of family position size	0.0147**	0.0073	0.0254***
	(0.005)	(0.006)	(0.006)
<u>Bond controls</u>			
ln(1 + Bond maturity)	0.0293***	0.0303***	0.0327***
	(0.005)	(0.008)	(0.005)
ln(1 + Bond issue size)	-0.0043***	-0.0061***	-0.0019
	(0.001)	(0.002)	(0.002)
ln(1 + Bond age)	-0.0013	0.0045	-0.0058***
	(0.002)	(0.003)	(0.002)
Investment grade	-0.0172*		
	(0.009)		
Upgrade	-0.1521***		-0.1536***
	(0.051)		(0.052)
Downgrade	-0.2392***	-0.2323***	
	(0.056)	(0.055)	
Fund x Period fixed effects	YES	YES	YES
Observations	718,259	250,691	467,073
R-squared	0.099	0.135	0.106

Table 3 *-continued*

Panel B: Bond Controls Replaced by Bond x Period Fixed Effects

	(1) ALL	(2) IG	(3) HY
Top decile of fund position size	0.0122**	0.0038	0.0171**
	(0.005)	(0.004)	(0.006)
Fund x Period fixed effects	YES	YES	YES
Bond x Period fixed effects	YES	YES	YES
Observations	696,600	233,382	463,218
R-squared	0.360	0.425	0.354

Table 4

Fund Trading in Non-Turmoil Periods as a Function of the Fund's Position Size

This table reports OLS estimates for panel regressions of fund position changes in in non-turmoil periods on fund position size. The sample includes only position changes (inclusive of zeros) associated with fund-period observations for which both the individual fund flows and the aggregate flows to all taxable bond mutual funds are positive. The dependent variable, position change, is measured as a fraction of the position on the previous report date, and therefore the observations include only existing positions. All other variables are defined in the Appendix. All columns include fund-reporting period fixed effects. Standard errors, two-way clustered by fund family and reporting period, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	(1) ALL	(2) IG	(3) HY
Top decile of fund position size	0.0040	-0.0004	0.0058*
	(0.003)	(0.006)	(0.003)
Bond controls			
ln(1 + Bond maturity)	0.0305***	0.0283***	0.0346***
	(0.004)	(0.008)	(0.003)
ln(1 + Bond issue size)	-0.0008	-0.0022	0.0003
	(0.001)	(0.002)	(0.001)
ln(1 + Bond age)	-0.0026*	0.0007	-0.0048***
	(0.001)	(0.003)	(0.002)
Investment grade	-0.0188***		
	(0.005)		
Upgrade	-0.0378***		-0.0373***
	(0.010)		(0.010)
Downgrade	-0.0736*	-0.0732*	
	(0.037)	(0.038)	
Fund x Period fixed effects	YES	YES	YES
Observations	2,131,811	699,089	1,431,214
R-squared	0.100	0.130	0.101

Table 5

Bond Returns and Ownership Concentration

This table reports average bond returns in turmoil and non-turmoil periods for bond portfolios in different deciles of ownership by the top fund. For each bond-month observation, return is calculated as the percentage change in the volume-weighted average price (VWAP) of the bond from the last day on which there are transactions in the previous month to the last day on which there are transactions in the current month. Only returns calculated from VWAP that lie in the last 10 days of each month are used. In Panel A, the sample includes all bond-month observations, and the turmoil indicator equals 1 if flow-induced fire sales (FIFS) are in the top decile based on the pooled sorting of the sample. In Panel B, the sample includes only bond-month observations for which mutual fund ownership is in the top quintile based on monthly sorting, and the turmoil indicator equals 1 to capture months in which aggregate flows to all taxable bond mutual funds are in the bottom decile during 1/2003 – 12/2019. Deciles of top fund ownership are calculated by (independently) sorting bonds by the top one fund ownership during each month. All variables are defined in the Appendix. All columns include fund-reporting period fixed effects. Tests of differences are conducted using standard errors clustered by month. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

Panel A: Turmoil = Flow-Induced Fire Sales in the Top Decile

	Decile of Top Fund Ownership										
Turmoil	1 (Lowest)	2	3	4	5	6	7	8	9	10 (Highest)	10 - 1
All bonds											
1	-0.927%	-0.529%	-0.470%	-0.393%	-0.389%	-0.397%	-0.392%	-0.385%	-0.364%	-0.314%	0.613%***
0	0.127%	0.118%	0.123%	0.132%	0.135%	0.135%	0.147%	0.152%	0.126%	0.130%	0.002%
1-0											0.611%***
Investment-grade bonds											
1	-0.290%	-0.104%	-0.092%	-0.081%	-0.064%	-0.066%	-0.050%	-0.043%	-0.042%	-0.027%	0.262%***
0	0.032%	0.050%	0.050%	0.050%	0.057%	0.049%	0.059%	0.051%	0.050%	0.052%	0.020%
1-0											0.242%***
High-yield bonds											
1	-1.485%	-1.062%	-0.807%	-0.729%	-0.772%	-0.702%	-0.713%	-0.714%	-0.607%	-0.537%	0.948%***
0	0.311%	0.308%	0.285%	0.284%	0.312%	0.318%	0.335%	0.331%	0.334%	0.320%	0.009%
1-0											0.939%***

Table 5 *-continued*

Panel B: Turmoil = Aggregate Flows to All Taxable Bond Funds in the Bottom Decile

	Decile of Top Fund Ownership										
Turmoil	1 (Lowest)	2	3	4	5	6	7	8	9	10 (Highest)	10 - 1
All bonds											
1	-2.329%	-2.233%	-2.142%	-2.200%	-2.125%	-2.197%	-2.132%	-1.986%	-1.999%	-1.936%	0.392%***
0	0.204%	0.218%	0.185%	0.201%	0.202%	0.188%	0.195%	0.176%	0.198%	0.181%	-0.023%
1-0											0.416%***
Investment-grade bonds											
1	-0.865%	-0.818%	-0.773%	-0.592%	-0.614%	-0.855%	-0.893%	-0.848%	-0.607%	-0.568%	0.297%***
0	0.091%	0.094%	0.079%	0.082%	0.080%	0.080%	0.079%	0.087%	0.092%	0.092%	0.001%
1-0											0.296%***
High-yield bonds											
1	-2.619%	-2.541%	-2.493%	-2.570%	-2.626%	-2.634%	-2.612%	-2.375%	-2.458%	-2.199%	0.421%***
0	0.241%	0.240%	0.212%	0.233%	0.235%	0.230%	0.230%	0.227%	0.233%	0.214%	-0.027%
1-0											0.448%***

Table 6
The Cross-Section of Bond Returns during Financial Turmoil

This table reports OLS estimates for panel regressions of bond returns on proxies for market turmoil, top fund ownership, and their interaction. For each bond-month observation, the dependent variable, bond return, is calculated as the percentage change in VWAP of the bond from the last day on which there are transactions in the previous month to the last day on which there are transactions in the current month. Only returns calculated from VWAP in the last 10 days of each month are used. In Panel A, the degree of turmoil is captured by FIFS. In Panel B, the degree of turmoil is captured by an indicator variable that equals one for calendar months in which aggregate flows to all taxable bond mutual funds are in the bottom decile during 1/2003 – 12/2019. All variables are defined in the Appendix. All columns include month and issuer fixed effects. Standard errors, clustered by month, are in parentheses. ∗, ∗∗, and ∗∗∗ refer to statistical significance at 10%, 5%, and 1% levels.

Panel A: Turmoil Captured by Flow-Induced Fire Sales

	(1) ALL	(2) ALL	(3) IG	(4) HY
Flow induced fire sales (FIFS)	-1.3458***	-1.7341***	-0.7591*	-1.6972***
	(0.224)	(0.351)	(0.399)	(0.272)
Top fund ownership		-0.0016	-0.0012	-0.0022
		(0.003)	(0.003)	(0.004)
FIFS x Top fund ownership		5.1882**	3.5602*	6.2394***
		(2.416)	(2.157)	(2.287)
<u>Market controls</u>				
Matched index return	-0.1828***	-0.1827***	-0.3629***	0.1730***
	(0.051)	(0.051)	(0.061)	(0.039)
Matched index return	0.3748***	0.3748***	0.4906***	0.1596***
x ln(1 + Bond maturity)	(0.042)	(0.042)	(0.038)	(0.029)
<u>Bond controls</u>				
Mutual fund ownership	0.0001	0.0004	0.0017	-0.0017
	(0.001)	(0.002)	(0.002)	(0.002)
ln(1 + Bond maturity)	0.0007**	0.0007**	0.0007**	0.0007*
	(0.000)	(0.000)	(0.000)	(0.000)
ln(1 + Bond issue size)	-0.0002*	-0.0002*	-0.0002**	-0.0001
	(0.000)	(0.000)	(0.000)	(0.000)
ln(1 + Bond age)	-0.0006***	-0.0006***	-0.0006***	-0.0005*
	(0.000)	(0.000)	(0.000)	(0.000)
Investment grade	-0.0020***	-0.0020***		
	(0.000)	(0.000)		
Upgrade	0.0007***	0.0007***	0.0007***	0.0009
	(0.000)	(0.000)	(0.000)	(0.001)
Downgrade	-0.0063***	-0.0063***	-0.0130***	0.0042**
	(0.002)	(0.002)	(0.002)	(0.002)

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Table 6 *–continued*

	(1) ALL	(2) ALL	(3) IG	(4) HY
Month fixed effects	YES	YES	YES	YES
Issuer fixed effects	YES	YES	YES	YES
Observations	1,056,244	1,056,244	737,045	319,118
R-squared	0.349	0.349	0.439	0.294

Panel B: Turmoil Defined as Periods with Aggregate Flows to All Taxable Bond Funds Being in the Bottom Decile

	(1) ALL	(2) ALL	(3) IG	(4) HY
Top fund ownership		0.0006	0.0026	-0.0026
		(0.003)	(0.003)	(0.002)
Aggregate flow D1 (AFD1) x Top ownership		0.0248**	0.0155	0.0318***
		(0.014)	(0.019)	(0.010)
AFD1 x Mutual fund ownership	-0.0153**	-0.0195**	-0.0179*	-0.0348***
	(0.006)	(0.008)	(0.010)	(0.009)
<u>Market controls</u>				
Matched index return	-0.1840***	-0.1841***	-0.3631***	0.1715***
	(0.051)	(0.051)	(0.061)	(0.040)
Matched index return x ln(1 + Bond maturity)	0.3747***	0.3746***	0.4905***	0.1605***
	(0.042)	(0.042)	(0.038)	(0.029)
<u>Bond control</u>				
Mutual fund ownership	-0.0007	-0.0013	-0.0035	0.0037*
	(0.001)	(0.002)	(0.002)	(0.002)
ln(1 + Bond maturity)	0.0007**	0.0007**	0.0007**	0.0007*
	(0.000)	(0.000)	(0.000)	(0.000)
ln(1 + Bond issue size)	-0.0002*	-0.0002*	-0.0002**	-0.0001
	(0.000)	(0.000)	(0.000)	(0.000)
ln(1 + Bond age)	-0.0006***	-0.0006***	-0.0006***	-0.0005*
	(0.000)	(0.000)	(0.000)	(0.000)
Investment grade	-0.0018***	-0.0019***		
	(0.000)	(0.000)		
Upgrade	0.0007***	0.0007***	0.0007***	0.0009*
	(0.000)	(0.000)	(0.000)	(0.001)
Downgrade	-0.0063***	-0.0063***	-0.0129***	0.0042**
	(0.002)	(0.002)	(0.002)	(0.002)
Month fixed effects	YES	YES	YES	YES
Issuer fixed effects	YES	YES	YES	YES
Observations	1,056,244	1,056,244	737,045	319,199
R-squared	0.349	0.349	0.440	0.293

Table 7

Bond Price Volatility as a Function of Ownership Concentration

This table reports OLS estimates for panel regressions of bond price volatility, measured using the bond price range, on the bond's top one fund ownership. For each bond-month observation, the dependent variable, bond price volatility, is calculated as the maximum minus minimum VWAP of the bond in the current month, as a fraction of VWAP on the last day on which there were transactions in the previous month. For the price range to be measurable, the bond must trade at least once in the current month and within the last 10 days of the previous month. All other variables are defined in the Appendix. All columns include month and issuer fixed effects. Standard errors, clustered by month, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ALL	IG	HY	ALL	IG	HY	ALL Excluding Top Fund Ownership Q5
Top fund ownership	-0.0484***	-0.0181***	-0.0544***	-0.0507***	-0.0163***	-0.0585***	-0.0490***
	(0.003)	(0.002)	(0.004)	(0.003)	(0.002)	(0.004)	(0.005)
SQRT(Fragility)				0.0075***	0.0025*	0.0140***	0.0104***
				(0.001)	(0.001)	(0.002)	(0.002)
Largest 10 families' ownership				0.0058***	0.0018	0.0067***	0.0037
				(0.002)	(0.002)	(0.002)	(0.003)
<u>Market controls</u>							
Matched index level range	-0.0485	-0.2238**	0.3283***	-0.0502	-0.2236**	0.3270***	-0.1038***
	(0.037)	(0.086)	(0.062)	(0.038)	(0.086)	(0.063)	(0.039)
Matched index level range	0.2597***	0.4202***	0.0932***	0.2603***	0.4202***	0.0937***	0.2903***
x ln(1 + Bond maturity)	(0.033)	(0.038)	(0.023)	(0.033)	(0.038)	(0.023)	(0.033)
<u>Bond controls</u>							
Mutual fund ownership	0.0127***	0.0053***	0.0149***	0.0151***	0.0087***	0.0164***	0.0170***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)

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Table 7 *-continued*

	(1) ALL	(2) IG	(3) HY	(4) ALL	(5) IG	(6) HY	(7) ALL Excluding Top Fund Ownership Q5
ln(1 + Bond maturity)	0.0097***	0.0074***	0.0136***	0.0097***	0.0074***	0.0137***	0.0094***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln(1 + Bond issue size)	-0.0008***	-0.0024***	0.0026***	-0.0009***	-0.0024***	0.0024***	-0.0011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(1 + Bond age)	0.0031***	0.0024***	0.0060***	0.0030***	0.0024***	0.0058***	0.0028***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Investment grade	-0.0058***			-0.0060***			-0.0066***
	(0.000)			(0.000)			(0.001)
Upgrade	-0.0018***	-0.0018***	-0.0045***	-0.0017***	-0.0018***	-0.0046***	-0.0017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Downgrade	0.0170***	0.0227***	0.0097***	0.0170***	0.0227***	0.0096***	0.0181***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Month fixed effects	YES	YES	YES	YES	YES	YES	YES
Issuer fixed effects	YES	YES	YES	YES	YES	YES	YES
Observations	1,054,647	736,286	318,276	1,054,647	736,286	318,276	849,500
R-squared	0.576	0.640	0.519	0.576	0.640	0.520	0.592

Table 8

Bond Returns from Six Months Before to Six Months After the COVID19 Shock in 3/2020

This table reports OLS estimates for panel regressions of bond returns on month dummies. For each bond-month observation, the dependent variable, bond return, is calculated as the percentage change in VWAP of the bond from the last day on which there are transactions in the previous month to the last day on which there are transactions in the current month. Only returns calculated from VWAP that lie in the last 10 days of each month are used. Bonds are Fed eligible if they meet the criteria for purchase by the Fed under the Secondary Market Corporate Credit Facility (SMCCF). White's heteroskedasticity robust standard errors are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)
	ALL	Fed Eligible	Fed Ineligible IG	Fed Ineligible HY
9/2019	-0.0079***	-0.0019***	-0.0126***	-0.0067***
	(0.000)	(0.000)	(0.000)	(0.002)
10/2019	0.0002	0.0011***	0.0009***	-0.0041
	(0.001)	(0.000)	(0.000)	(0.004)
11/2019	0.0015***	-0.0014***	0.0042***	-0.0007
	(0.000)	(0.000)	(0.000)	(0.003)
12/2019	0.0038***	0.0007***	0.0010***	0.0205***
	(0.000)	(0.000)	(0.000)	(0.002)
1/2020	0.0180***	0.0039***	0.0239***	0.0331
	(0.003)	(0.000)	(0.000)	(0.024)
2/2020	0.0004	0.0016***	0.0083***	-0.0320***
	(0.000)	(0.000)	(0.000)	(0.003)
3/2020	-0.0915***	-0.0383***	-0.1022***	-0.1841***
	(0.001)	(0.001)	(0.002)	(0.006)
4/2020	0.0535***	0.0264***	0.0685***	0.0631***
	(0.001)	(0.001)	(0.001)	(0.009)
5/2020	0.0223***	0.0116***	0.0140***	0.0737***
	(0.001)	(0.000)	(0.001)	(0.009)
6/2020	0.0189***	0.0079***	0.0258***	0.0188***
	(0.001)	(0.000)	(0.000)	(0.003)
7/2020	0.0278***	0.0039***	0.0413***	0.0343***
	(0.001)	(0.000)	(0.001)	(0.003)
8/2020	-0.0069***	0.0001	-0.0201***	0.0218***
	(0.001)	(0.000)	(0.000)	(0.005)
9/2020	-0.0070***	-0.0029***	-0.0057***	-0.0197***
	(0.001)	(0.000)	(0.000)	(0.005)
Observations	98,948	33,624	50,045	14,309
R-squared	0.084	0.338	0.482	0.050

Table 9

Fund Trading during the Covid19 Pandemics

This table reports OLS estimates for panel regressions of fund position changes on fund position size in the period when the COVID shock hit markets in March 2020 (columns (1) – (4)) and in the subsequent period when the Fed intervened (columns (5) – (9)). The sample includes only fund-period observations for which the flows are in the bottom quintile, based on pooled sorting across all fund-period observations during 9/2019 – 9/2020. The COVID shock period in columns (1) – (4) is 3/2020, and the samples include only fund-period observations with report date 3/31/2020. We consider different subsets of bonds as indicated on top of each column. The Fed's intervention period in columns (5) – (9) spans 4 – 9/2020, and the samples includes only fund-period observations that are associated with report dates during the Fed's intervention period. Also in this case, we consider different subsets of bonds as indicated on top of each column. Bonds are Fed eligible if they meet the criteria for purchases by the Fed under the Secondary Market Corporate Credit Facility (SMCCF). The dependent variable, position change, is measured as a fraction of the position on the previous report date, and hence the observations include only existing positions. All other variables are defined in the Appendix. All columns include fund-reporting period fixed effects. Standard errors, clustered by fund family in columns (1) – (4) and double-clustered by fund family and reporting period in columns (5) – (9), are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	3/2020				4/2020 - 9/2020			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ALL	Fed Eligible	Fed Ineligible IG	Fed Ineligible HY	ALL	Fed Eligible	Fed Ineligible IG	Fed Ineligible HY
Top decile of fund position size	0.0229	0.0209***	0.0236*	0.0231**	0.0193**	-0.0108*	0.0310***	0.0294***
	(0.014)	(0.005)	(0.014)	(0.010)	(0.007)	(0.006)	(0.006)	(0.009)
<u>Bond controls</u>								
ln(1 + Bond maturity)	0.0267***	-0.0027*	0.0843***	0.0715***	0.0355***	-0.0030	0.1177***	0.0561**
	(0.006)	(0.002)	(0.024)	(0.012)	(0.008)	(0.002)	(0.013)	(0.016)
ln(1 + Bond issue size)	-0.0265***	-0.0053***	-0.0270***	-0.0163***	-0.0157**	-0.0042	-0.0086	-0.0129*
	(0.004)	(0.002)	(0.005)	(0.005)	(0.004)	(0.003)	(0.004)	(0.006)
ln(1 + Bond age)	0.0024	0.0041***	-0.0032	-0.0158**	0.0128**	-0.0028**	0.0132**	-0.0167*
	(0.003)	(0.001)	(0.007)	(0.006)	(0.004)	(0.001)	(0.005)	(0.008)

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Table 9 *-continued*

	3/2020				4/2020 - 9/2020			
	(1) ALL	(2) Fed Eligible	(3) Fed Ineligible IG	(4) Fed Ineligible HY	(5) ALL	(6) Fed Eligible	(7) Fed Ineligible IG	(8) Fed Ineligible HY
Investment grade	-0.0017				-0.0230			
	(0.015)				(0.014)			
Upgrade	-0.0826*			-0.0760	-0.0635			-0.0304
	(0.042)			(0.082)	(0.041)			(0.031)
Downgrade	-0.2393***	-0.0095	-0.1724*		-0.1376**	-0.0815**	-0.1143	
	(0.081)	(0.020)	(0.102)		(0.047)	(0.030)	(0.070)	
Fund x Period fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	71,244	17,985	40,599	12,300	63,292	14,666	34,207	13,781
R-squared	0.112	0.047	0.220	0.147	0.106	0.115	0.213	0.173

Table 10

The Cross-Section of Bond Returns during the Covid19 Pandemics

This table reports OLS estimates for panel regressions of bond returns on flow-induced fire sales, top fund ownership, and their interaction in the period when the COVID shock hit markets in March 2020 (columns (1) – (4)) and in the subsequent period when the Fed intervened (columns (5) – (9)). The sample includes 3,933 investment-grade eligible bonds, 6,070 investment-grade ineligible bonds, and 4,734 high-yield bonds. Eligible fallen angels, that is, 696 bonds that were downgraded from investment grade to below investment grade after March 2020, are excluded from the sample. For each bond-month observation, the dependent variable, bond return, is calculated as the percentage change in VWAP of the bond from the last day on which there are transactions in the previous month to the last day on which there are transactions in the current month. Only returns calculated from VWAP that lie in the last 10 days of each month are used. The COVID shock period in columns (1) – (4) is 3/2020, and the Fed's intervention period in columns (5) – (9) spans 4 – 9/2020. In both cases, we consider different subsets of bonds as indicated on top of each column. All variables are defined in the Appendix. Columns (1) – (4) include issuer fixed effects, with White's heteroskedasticity robust standard errors in parentheses. Columns (5) – (9) include month and issuer fixed effects, with standard errors, clustered by month, in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	3/2020				4/2020 - 9/2020			
	(1) ALL	(2) Fed Eligible	(3) Fed Ineligible IG	(4) Fed Ineligible HY	(5) ALL	(6) Fed Eligible	(7) Fed Ineligible IG	(8) Fed Ineligible HY
Flow induced fire sales (FIFS)	-1.3446***	-1.2392**	-1.2780**	-1.7490	-3.1904***	-1.0430	-4.5108***	-3.6132*
	(0.360)	(0.510)	(0.580)	(1.102)	(0.646)	(0.643)	(1.170)	(2.029)
Top fund ownership	0.0554	0.0574	0.0601	0.0116	-0.0096	0.0035	-0.0100	-0.0298
	(0.049)	(0.057)	(0.083)	(0.085)	(0.006)	(0.004)	(0.010)	(0.028)
FIFS x Top fund ownership	27.7650*	25.0327*	27.3580*	25.1635	24.9556***	4.9440	45.1853**	39.0157*
	(14.686)	(12.967)	(15.028)	(16.192)	(9.173)	(8.619)	(20.927)	(22.781)
<u>Market controls</u>								
Matched index return	0.4082***	0.2700**	0.2360**	-0.0456	-0.3614***	-0.1701***	-1.3696***	-0.2368
	(0.056)	(0.134)	(0.094)	(0.357)	(0.024)	(0.044)	(0.054)	(0.257)
Matched index return x ln(1 + Bond maturity)	-0.0966***	-0.0104	-0.0298	-0.0210	0.4425***	0.2677***	0.5916***	0.3718***
	(0.017)	(0.089)	(0.028)	(0.122)	(0.006)	(0.010)	(0.012)	(0.039)

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Table 10 *-continued*

	3/2020				4/2020 - 9/2020			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ALL	Fed Eligible	Fed Ineligible IG	Fed Ineligible HY	ALL	Fed Eligible	Fed Ineligible IG	Fed Ineligible HY
Bond controls								
ln(1 + Bond maturity)	-0.0225***	-0.0234***	-0.0086***	-0.0130	-0.0034***	0.0037***	-0.0095***	-0.0028*
	(0.001)	(0.007)	(0.002)	(0.015)	(0.000)	(0.000)	(0.000)	(0.002)
ln(1 + Bond issue size)	0.0027***	0.0053***	0.0009	0.0019	-0.0001	-0.0009***	-0.0003	-0.0016
	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.002)
ln(1 + Bond age)	0.0010**	0.0018**	-0.0002	-0.0012	-0.0011***	-0.0004*	-0.0003	-0.0004
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Investment grade	-0.0056*				-0.0007			
	(0.003)				(0.002)			
Upgrade	0.0034*	0.0060*	0.0030	0.0112	0.0016***	0.0035***	0.0024***	0.0109
	(0.002)	(0.004)	(0.002)	(0.040)	(0.001)	(0.001)	(0.001)	(0.013)
Downgrade	-0.0072	-0.0189*	-0.0042**	-0.0046	-0.0064***	-0.0029	-0.0078	-0.0195***
	(0.007)	(0.010)	(0.002)	(0.007)	(0.002)	(0.002)	(0.007)	(0.004)
Month fixed effects	NO	NO	NO	NO	YES	YES	YES	YES
Issuer fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	6,653	2,168	3,372	740	44,302	14,876	22,912	6,023
R-squared	0.703	0.781	0.658	0.718	0.487	0.527	0.594	0.318

Table 11

Fund Performance as a Function of Position Size

This table reports OLS estimates for panel regressions of fund alpha (in percent) on the fraction of fund positions, in market value terms, that are in the top decile of position size (LARGEFRAC). For each fund i in month t, the dependent variable, alpha, is calculated by subtracting benchmark return from actual fund return:

$$R_{i,t} - R_{f,t} = \alpha_t + [\beta_{i,STK} STK_t + \beta_{i,BOND} BOND_t + \beta_{i,DEF} DEF_t + \beta_{i,OPTION} OPTION_t],$$

where STK is the excess return on the CRSP value-weighted stock index, BOND is the excess return on the U.S. aggregate bond index, DEF is the return spread between the high-yield bond index and the intermediate government bond index, and OPTION is the return spread between the GNMA mortgage-backed security index and the intermediate government bond index. All bond indices are from Bank of America Merrill Lynch and are downloaded from DataStream. The parameters, β_{STK}, β_{BOND}, β_{DEF}, and β_{OPTION}, are estimated on a rolling basis. For alpha in month t, the estimation period is from months t-18 to t. All of the independent variables, including LARGEFRAC, are as of the end of month t-1. Columns (1) – (3) are for the full sample period. The subsample in columns (4) – (6) includes only months in which aggregate flows to all taxable bond mutual funds are in the bottom decile during 1/2003 – 12/2019. The subsample in columns (7) – (9) includes only fund-month observations in which individual fund flows are in the bottom quintile, based on pooled sorting across all fund-month observations. All variables are defined in the Appendix. All columns include Morningstar's fund category-month fixed effects. Standard errors, double-clustered by fund family and month, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	Full Sample Period			Bottom Decile of Aggregate Flows			Bottom Quintile of Individual Flows		
	(1) ALL	(2) IG Focused	(3) HY Focused	(4) ALL	(5) IG Focused	(6) HY Focused	(7) ALL	(8) IG Focused	(9) HY Focused
Top decile positions/TNA	0.0747***	0.0709	0.1064***	0.2425*	0.1829**	0.3230**	0.0428	-0.0829	0.0678
(LARGEFRAC)	(0.026)	(0.054)	(0.034)	(0.125)	(0.073)	(0.157)	(0.080)	(0.167)	(0.086)
<u>Fund controls</u>									
Flow	-0.2796	-0.0143	-0.3939*	0.3634	-0.7635	0.9250**	0.3574	-0.0605	0.3736
	(0.211)	(0.131)	(0.235)	(0.400)	(0.809)	(0.376)	(0.257)	(0.372)	(0.320)
Alpha	0.6031***	0.6554***	0.5953***	0.5726***	0.7794***	0.4820*	0.3458*	-0.0099	0.3962**
	(0.165)	(0.204)	(0.213)	(0.183)	(0.136)	(0.237)	(0.187)	(0.058)	(0.197)
Cash as % of portfolio	0.0003	0.0004	0.0001	0.0052*	0.0042	0.0024	0.0022***	0.0001	0.0040***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.004)	(0.003)	(0.001)	(0.001)	(0.001)

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Table 11 *-continued*

	Full Sample Period			Bottom Decile of Aggregate Flows			Bottom Quintile of Individual Flows		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ALL	IG Focused	HY Focused	ALL	IG Focused	HY Focused	ALL	IG Focused	HY Focused
Government bonds as %	-0.0001	-0.0008	-0.0004	0.0008	0.0019	-0.0022	-0.0003	-0.0028*	0.0025
of portfolio	(0.001)	(0.001)	(0.002)	(0.003)	(0.005)	(0.005)	(0.001)	(0.002)	(0.003)
Corporate bonds as %	-0.0004	-0.0004	-0.0003	-0.0004	0.0004	-0.0018	-0.0000	-0.0014	0.0012
of portfolio	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.005)	(0.001)	(0.001)	(0.002)
Portfolio avg. coupon rate	0.0003	-0.0048	0.0002	-0.0102	-0.0346	-0.0063	-0.0020	-0.0039	-0.0024
	(0.007)	(0.013)	(0.007)	(0.021)	(0.050)	(0.025)	(0.013)	(0.026)	(0.014)
Portfolio avg. credit rating	-0.0048*	-0.0090*	-0.0004	-0.0097	-0.0005	-0.0241	-0.0163***	-0.0136	-0.0103
	(0.003)	(0.005)	(0.004)	(0.012)	(0.021)	(0.017)	(0.006)	(0.012)	(0.007)
Portfolio effective duration	-0.0013	0.0007	-0.0014	0.0320	0.0427	-0.0073	0.0015	0.0022	-0.0084
	(0.005)	(0.006)	(0.005)	(0.020)	(0.029)	(0.015)	(0.007)	(0.010)	(0.008)
ln(1 + Port. avg. bond	-0.0446	0.0176	-0.0681*	0.1520*	0.1775	0.1280	-0.0035	-0.0467	0.0144
issue size)	(0.037)	(0.034)	(0.035)	(0.086)	(0.126)	(0.101)	(0.043)	(0.075)	(0.048)
ln(1 + Port. avg. bond	-0.0328**	-0.0115	-0.0357	-0.0176	0.0356	-0.0763	-0.0874**	-0.0818	-0.0857*
age)	(0.017)	(0.016)	(0.024)	(0.052)	(0.083)	(0.074)	(0.041)	(0.058)	(0.051)
ln(1 + Fund age)	-0.0227	0.0027	-0.0344**	-0.0189	0.0015	-0.0235	-0.0241	-0.0087	-0.0270
	(0.014)	(0.004)	(0.016)	(0.025)	(0.031)	(0.032)	(0.020)	(0.014)	(0.024)
ln(1 + Fund TNA)	0.0012	-0.0027	0.0041	-0.0269*	-0.0039	-0.0387*	0.0067	0.0089	0.0038
	(0.004)	(0.003)	(0.006)	(0.013)	(0.017)	(0.019)	(0.009)	(0.013)	(0.011)
ln(1 + Family TNA)	0.0002	-0.0005	0.0022	0.0076	0.0022	0.0160	0.0038	-0.0034	0.0064
	(0.002)	(0.003)	(0.003)	(0.009)	(0.011)	(0.011)	(0.005)	(0.006)	(0.006)

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Table 11 *-continued*

	Full Sample Period			Bottom Decile of Aggregate Flows			Bottom Quintile of Individual Flows		
	(1) ALL	(2) IG Focused	(3) HY Focused	(4) ALL	(5) IG Focused	(6) HY Focused	(7) ALL	(8) IG Focused	(9) HY Focused
Broker affiliation	0.0106	-0.0080	0.0136	0.0430	0.0141	0.0542	0.0275	0.0075	0.0298
	(0.010)	(0.007)	(0.012)	(0.037)	(0.059)	(0.043)	(0.026)	(0.024)	(0.030)
Institutional share class	-0.0192	-0.0175	-0.0244	-0.0220	-0.0069	-0.0298	-0.0070	0.0106	-0.0159
fraction	(0.020)	(0.020)	(0.030)	(0.027)	(0.038)	(0.042)	(0.036)	(0.028)	(0.042)
Avg. maximum rear load	-0.3554	-1.9521*	-0.1756	-1.4378	-2.5601	-1.2065	0.6203	3.2671	0.0592
	(0.401)	(1.028)	(0.356)	(1.314)	(4.484)	(1.425)	(0.825)	(2.061)	(0.969)
Fund category x Month fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	53,045	16,640	36,405	4,954	1,524	3,430	10,835	2,542	8,293
R-squared	0.500	0.580	0.494	0.514	0.684	0.473	0.429	0.578	0.430

Table 12

Fund Flows Following Periods of Financial Turmoil

This table reports OLS estimates for panel regressions of fund flows on the lagged fraction of a fund's positions, in market value terms, that are in top decile of position size (LARGEFRAC) and the interactions of lagged LARGEFRAC and dummies for periods of financial turmoil. For each fund-month observation, the dependent variable, Flow, is computed at month t, while all of the independent variables, including LARGEFRAC, are as of the end of month t-1 or prior. In columns (1) – (3), the turmoil indicator equals one if the aggregate flows to all taxable bond mutual funds in that month are in the bottom decile during 1/2003 – 12/2019. In columns (4) – (6), turmoil indicator equals one if in that month, the individual fund experiences flows t in the bottom quintile, based on pooled sorting across all fund-month observations. All other variables are defined in the Appendix. All columns include Morningstar's fund category-month fixed effects. Standard errors, double-clustered by fund family and month, are in parentheses. ∗, ∗∗, and ∗∗∗ refer to statistical significance at 10%, 5%, and 1% levels.

	Turmoil = Bottom Decile of Aggregate Flows			Turmoil = Bottom Quintile of Individual Flows		
	(1)	(2)	(3)	(4)	(5)	(6)
	ALL	IG Focused	HY Focused	ALL	IG Focused	HY Focused
LARGEFRAC(t - 1)	0.0012	-0.0178	0.0033	0.0024	-0.0130	0.0039
	(0.008)	(0.018)	(0.009)	(0.008)	(0.020)	(0.009)
LARGEFRAC(t - 2)	0.0031	0.0240	0.0022	0.0020	0.0238	-0.0003
	(0.009)	(0.023)	(0.011)	(0.009)	(0.025)	(0.011)
LARGEFRAC(t - 3)	-0.0068	-0.0127	-0.0072	-0.0075	-0.0155	-0.0066
	(0.006)	(0.014)	(0.007)	(0.006)	(0.014)	(0.007)
LARGEFRAC(t - 1) x Turmoil(t - 1)	0.0160***	0.0280***	0.0109**	-0.0032	0.0206	-0.0052
	(0.006)	(0.012)	(0.005)	(0.007)	(0.016)	(0.007)
LARGEFRAC(t - 2) x Turmoil(t - 2)	-0.0008	-0.0033	0.0027	0.0044	-0.0158	0.0075
	(0.007)	(0.013)	(0.007)	(0.004)	(0.018)	(0.005)
LARGEFRAC(t - 3) x Turmoil(t - 3)	0.0017	0.0028	0.0003	0.0051	-0.0021	0.0036
	(0.006)	(0.011)	(0.007)	(0.005)	(0.022)	(0.005)
Fund controls						
Flow	0.3848***	0.3730***	0.3755***	0.3928***	0.3728***	0.3867***
	(0.016)	(0.021)	(0.019)	(0.017)	(0.024)	(0.021)
Alpha	0.0008	0.0011**	0.0007	0.0008	0.0010**	0.0007
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)

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Table 12 *-continued*

	Turmoil = Bottom Decile of Aggregate Flows			Turmoil = Bottom Quintile of Individual Flows		
	(1)	(2)	(3)	(4)	(5)	(6)
	ALL	IG Focused	HY Focused	ALL	IG Focused	HY Focused
Cash as % of portfolio	0.0001**	0.0000	0.0001	0.0001*	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Government bonds as % of portfolio	-0.0000	-0.0000	-0.0001	-0.0000	-0.0000	-0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Corporate bonds as % of portfolio	-0.0000	0.0000	-0.0001***	-0.0000	0.0000	-0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio avg. coupon rate	-0.0008***	-0.0003	-0.0009***	-0.0006**	-0.0003	-0.0007**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Portfolio avg. credit rating	0.0004**	0.0000	0.0003	0.0004***	0.0002	0.0004*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portfolio effective duration	0.0001	0.0001	-0.0003	0.0001	0.0001	-0.0004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(1 + Portfolio avg. issue size)	-0.0033***	-0.0066***	-0.0013	-0.0030***	-0.0058***	-0.0013
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
ln(1 + Portfolio avg. bond age)	-0.0028**	-0.0016	-0.0053***	-0.0024**	-0.0016	-0.0043***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
ln(1 + Fund age)	-0.0042***	-0.0050***	-0.0033***	-0.0038***	-0.0047***	-0.0029***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
ln(1 + Fund TNA)	0.0002	0.0006	-0.0001	0.0001	0.0004	-0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(1 + Family TNA)	0.0001	0.0005*	-0.0003	0.0001	0.0006**	-0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

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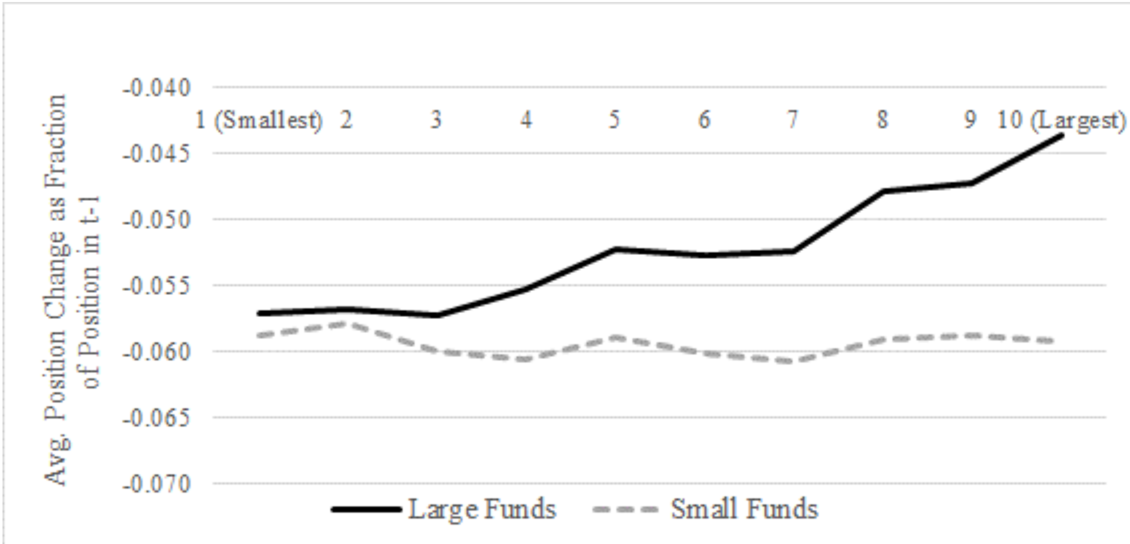
Table 12 *-continued*

	Turmoil = Bottom Decile of Aggregate Flows			Turmoil = Bottom Quintile of Individual Flows		
	(1)	(2)	(3)	(4)	(5)	(6)
	ALL	IG Focused	HY Focused	ALL	IG Focused	HY Focused
Broker affiliation	-0.0017***	-0.0018	-0.0011	-0.0014**	-0.0013	-0.0009
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Institutional share class fraction	0.0011	-0.0008	0.0023**	0.0010	-0.0007	0.0021**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Avg. maximum rear load	-0.0335	-0.0493	-0.0062	-0.0260	-0.0347	-0.0028
	(0.035)	(0.084)	(0.041)	(0.031)	(0.070)	(0.036)
Fund category x Month fixed effects	YES	YES	YES	YES	YES	YES
Observations	52,570	16,496	36,074	52,570	16,496	36,074
R-squared	0.338	0.341	0.353	0.352	0.353	0.367

Panel A: Periods with Aggregate Fund Flows in Bottom Decile



Panel B: Fund-Periods with Individual Fund Flows in Bottom Quintile

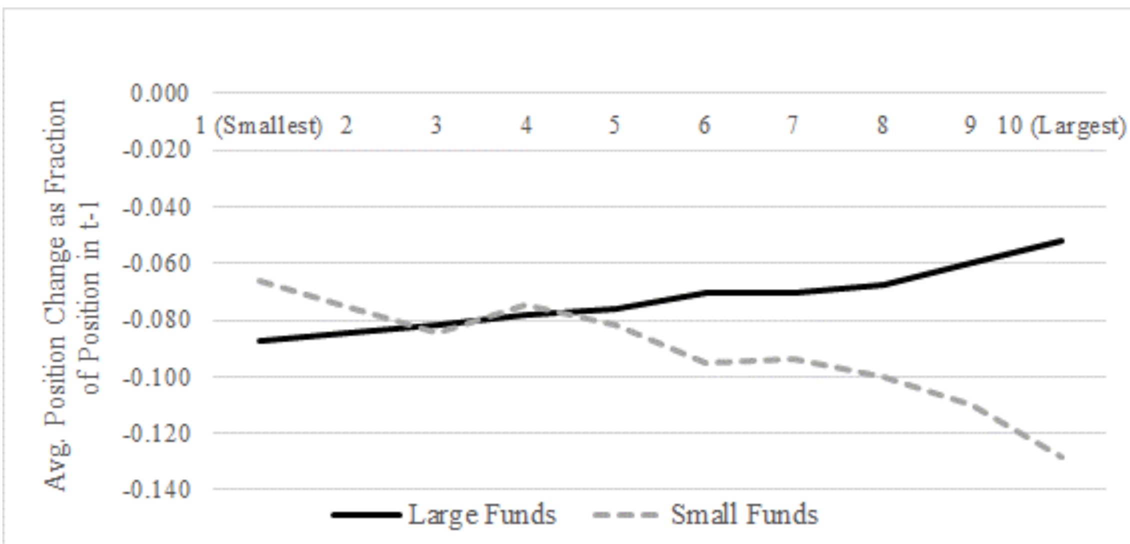
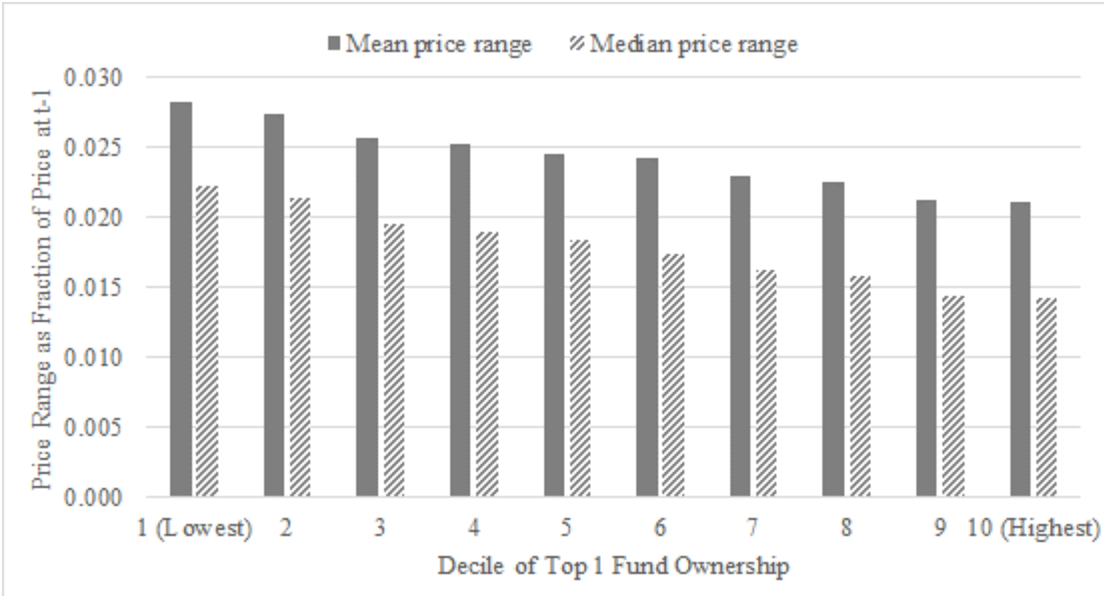


Figure 1. Fund position changes in turmoil periods by deciles of fund position size. This figure presents average fund position changes, as a fraction of the position on the previous report date, by deciles of fund position size. Panel A includes only position changes (inclusive of zeros) during the periods in which the aggregate flows to all taxable bond mutual funds are in the bottom decile during 2003 – 2019. Panel B includes only position changes (inclusive of zeros) associated with fund-period observations for which the individual fund flows are in the bottom quintile, based on pooled sorting across all fund-period observations. For each fund in each reporting period, corporate bond positions on the previous report date are sorted into deciles by the ratio of position size to the bond issue size, with decile 1 (10) being the smallest (largest). Solid black lines represent position changes for large funds, defined as funds whose TNA is in the top quintile on each report date. Dashed gray lines represent position changes for small funds, defined as funds whose TNA is in the bottom quintile on each report date. Detailed variable definitions are in the Appendix.

Panel A: Investment-Grade Bonds



Panel B: High-Yield Bonds

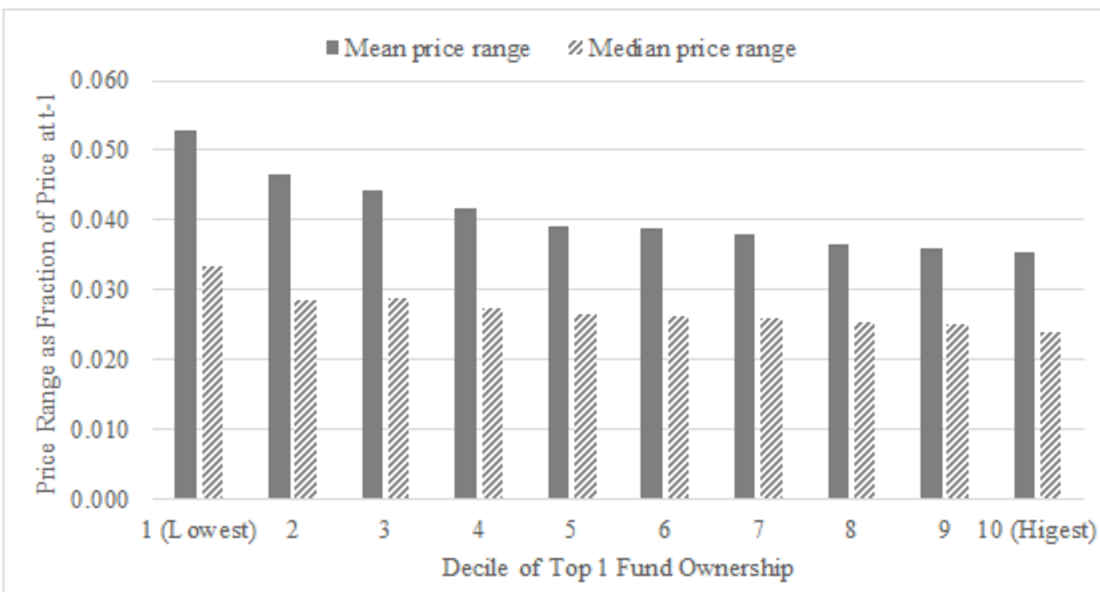


Figure 2. Bond price range by decile of top fund ownership. This figure presents the average monthly bond price range, as a fraction of the price at the end of previous month, by deciles of the top fund ownership. In each month, corporate bonds with available price range data are sorted into deciles by top fund ownership, with decile 1 (10) being the lowest (highest). Panel A includes only investment-grade corporate bonds. Panel B includes only high-yield corporate bonds. Solid gray bars represent the means. Patterned gray bars represent the medians. Detailed variable definitions are in the Appendix.