

Summary of Recent ICI Research on First-Mover Advantage, Dilution, and Systemic Risk in Open-End Funds

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Executive Summary

Policymakers have raised concerns about a structural vulnerability in open-end funds (OEFs) stemming from a liquidity mismatch between investors' redemptions and OEFs' underlying assets. These concerns are based on the theory that funds suffer from a first-mover advantage that *may* cause their investors to redeem heavily during a crisis to avoid dilution. (Dilution occurs when fund investors buy or sell fund shares, and the transaction costs of meeting those purchases or redemptions are borne by nontransacting fund investors as a reduction in the fund's return.) The theory further posits that fund redemptions could lead OEFs to "fire-sell" securities, which would amplify stress throughout the financial system.

In response to recent consultations from various regulators and policymakers globally, ICI undertook a unique research program to gauge fund dilution and the potential for a first-mover advantage among investors in US mutual funds and European UCITS.

In short, ICI Research finds estimated dilution is typically very small and is, on average, *not economically significant* enough to motivate the heavy redemptions that the first-mover advantage hypothesis envisions—even during periods of market stress.

During periods of market stress, such as March 2020, estimated daily dilution for US bond mutual funds and fixed-income UCITS rises but remains small, especially in comparison to market returns and volatility. For example, ICI Research estimates that the average daily dilution for US bond mutual funds in March 2020 was only 1 to 5 basis points. Fixed-income UCITS funds had an estimated average daily dilution in roughly a similar range during March 2020.

These average levels of dilution are unlikely to motivate investors to redeem heavily, as they are trivial compared to funds' returns and variability of returns. For example, while high-yield bond mutual funds experienced a maximum daily dilution of around 5 basis points on several days in March 2020, daily returns varied 23 to 150 times more than the dilution estimates. This suggests that fund investors were more likely focused on the steep losses and volatility spikes in bond markets—due to a rapid deterioration in global macroeconomic conditions—than on the dilutive effects of redemptions.

Further work by ICI Research staff found that OEF investors and direct owners of bonds react similarly to changes in market conditions. This suggests that investors are not primarily motivated by dilution when they redeem their shares in OEFs.

Finally, it is worth noting that OEFs play an important role in the financial system by providing investors with an effective way to achieve a wide range of market returns to build their financial wealth. They also have robust liquidity risk management practices and tools that help them meet shareholder redemptions, even amid market stress.

A.1 Introduction

Policymakers have frequently expressed concerns that there may be a structural vulnerability arising from a liquidity mismatch in open-end funds (OEFs) that could become a systemic risk. This concern is primarily based on the theory that there is a *first-mover advantage* in funds, which may cause investors to redeem heavily during a crisis to avoid dilution, and, in turn, could lead OEFs to “fire-sell” securities, thereby potentially amplifying stress throughout the financial system.

Given the critical importance of dilution as a motivating factor for the further policy work of both IOSCO and the FSB, it is worth defining, right from the outset, what we mean by dilution for the purposes of this technical appendix. Dilution occurs when fund investors buy or sell fund shares and the transaction costs of meeting those purchases or redemptions, such as bid-ask spreads or market impact costs from the fund having to buy or sell portfolio securities, are borne by non-transacting fund investors as a reduction in the fund’s return. However, dilution goes beyond a mere calculation of transactions costs. Importantly, any assessment of dilution needs to consider the effects of net flows to the fund. While a fund may transact in the marketplace, incurring, for example, the bid-ask spread or execution fees, a fund that simultaneously experiences zero net flows (*i.e.*, gross outflows are covered by gross inflows) cannot, given the above definition, have experienced any dilution since transactions costs do not relate to returning or receiving shareholder capital.

In this appendix, we provide a synopsis of academic and recent ICI research on topics directly related to first-mover advantage, dilution, and financial stability in OEFs, using data from US mutual funds, US separately managed accounts, and fixed-income UCITS (Section A.2). We show that:

- » Estimated dilution among US mutual funds and fixed-income UCITS is too small, even during periods of financial stress, to be an incentive for the vast redemptions that regulators and academics posit (Section A.3);
- » If the first-mover hypothesis as applied to OEFs is valid, OEF investors should react much more strongly to changes in market conditions than do direct investors, but that does not appear to be the case. In March 2020, investors who held bonds directly were just as likely to sell as those who held bonds indirectly through mutual funds (Section A.4); and
- » Irrespective of potential dilution, US bond mutual funds’ portfolio transactions did not meaningfully amplify bond market stresses in March 2020 (Section A.5).

In short, the evidence is weak that dilution, first-mover advantage, or funds’ portfolio transactions pose financial stability concerns.

A.2 The Academic Literature on Dilution and First-Mover Advantage Remains Divided¹

Direct evidence of a first-mover effect in the academic literature is lacking. Instead, studies tend to provide evidence that mutual fund flows track market returns (or fund returns). One study which is often cited as documenting a first-mover effect is Goldstein, Jiang, and Ng (2017).² The paper examines the relationship between monthly fund flows and performance and argues that the authors found evidence that bond fund “outflows are sensitive to bad performance more than their inflows are sensitive to good performance,” a so-called “concave performance-to-flow relationship.” Goldstein et al. (2017), however, does not claim to have found evidence of a first-mover advantage. Instead, as the paper’s abstract states, its findings “**may** [*emphasis added*] generate a first-mover advantage among investors in corporate bond funds,” leaving open the possibility that their results also **may not** imply a first-mover advantage.

Another study by Feroli, Kashyap, Schoenholtz, and Shin (2014)³ claims to have found evidence of a first-mover advantage in bond mutual funds. Research by Collins and Plantier (2014),⁴ however, challenges the findings in Feroli et al (2014). Collins and Plantier (2014) discuss the econometric identification problems in Feroli et al (2014) and show that the posited evidence of a first-mover advantage in their results vanishes once variables proxying for changes in monetary policy are introduced into the analysis.

Choi, Kronlund, and Oh (2022) argues that stale NAV pricing in bond mutual funds creates an opportunity for fast-moving investors to redeem from overvalued funds, exacerbating the risk of fund runs, diluting returns of buy-and-hold investors.⁵ The paper finds some dilution, but it varies across fund type, and is quite modest even for less liquid funds.

In addition, Woodlaw (2020) calls into question much of the existing literature on dilution and flow-induced sales.⁶ This paper shows that many papers on asset fire sales and price pressures suffer from a design flaw in that price pressures attributed to funds’ portfolio sales are due to fundamental market pressures for which those other studies failed to account. Further, proxies for funds’ forced sales do not capture actual sales or market fundamentals. Once these problems are corrected for, Woodlaw (2020) finds no evidence of a link between funds’ portfolio sales and price pressures.

¹ An annotated bibliography outlining the often-cited academic literature and alternative views can be found at www.ici.org/system/files/2023-05/23-fund-liquidity-dynamics-bibliography.pdf.

² “Investor flows and fragility in corporate bond funds,” *Journal of Financial Economics*, 126(3):592–613.

³ “[Market Tantrums and Monetary Policy](#),” Chicago Booth Research Paper no.14-09.

⁴ “[Are Bond Mutual Fund Flows Destabilizing? Examining the Evidence from the Taper Tantrum.](#)”

⁵ “[Sitting bucks: Stale pricing in fixed income funds.](#),” *Journal of Financial Economics*, 145(2): 296-317.

⁶ “[Measuring Mutual Fund Flow Pressure as Shock to Stock Returns.](#),” *Journal of Financial Economics* 75(6): 3221-3243.

A.3 Empirically Estimated Dilution Is Far Too Small to Motivate Mass Redemptions

ICI has long disputed the first-mover hypothesis for two reasons. First, the theoretical models that produce this result do not consider real world factors such as taxes, reinvestment risk, long investment horizons, and other features that undoubtedly influence investor behavior and can make redeeming less appealing.⁷ Second, for the first-mover hypothesis to be credible, dilution must be highly predictable, immediately visible, and so substantive that it provides an incentive for investors to redeem to try to avoid dilution. If dilution is economically small, there is little cost to investors remaining in funds, and, indeed, the costs to investors of redeeming could far exceed anticipated dilution. Finally, any assessment of the magnitude of dilution needs to go beyond a calculation of transactions costs to also include the impact of net flows to the fund. As mentioned previously, a fund that experiences zero net flow cannot have experienced dilution.

To provide an evidential base, we estimate average dilution for various types of US mutual funds and for fixed-income UCITS using two prominent approaches from the academic literature, Zitzewitz (2003) and Choi et al. (2022),⁸ and a third approach developed by ICI research staff.⁹ Net flows to the fund are a key component in all three approaches.

Overall, we estimate that daily dilution for US mutual funds and for fixed-income UCITS is on average too small to motivate the heavy redemptions that the first-mover hypothesis envisions. Estimated dilution is typically in the order of tenths or hundredths of a basis point and a few basis points per day during periods of stress for certain types of funds.¹⁰ The daily estimates accumulate to higher levels at an annual rate, but they are still quite small.

For example, for US core bond mutual funds, estimated dilution ranges from 0.2 to 2 basis points at an annual rate.¹¹ Estimates for high-yield bond mutual funds and municipal bond mutual funds, which some regulators and academics have characterized as “illiquid”, are still quite marginal, average 3 to 6 basis points and 0.4 to 4 basis points at an annual rate, respectively (Figure 1a).

⁷ See Sean Collins, “First-Mover Advantage: The Theory Is Only as Good as its Assumptions,” *ICI Viewpoints*, June 7, 2023.

⁸ See Zitzewitz (2003), “Who Cares about Shareholders? Arbitrage-Proofing Mutual Funds,” *Journal of Law and Economics*, October, 19(2), 245-280; Choi, Kronlund, and Oh (2022), “Sitting bucks: Stale pricing in fixed income funds,” *Journal of Financial Economics*, 145, 296–317.

⁹ For a description of the internal ICI methodology, see Appendix B. This methodology is used in the estimation of dilution of UCITS fixed-income funds only. Due to data and time limitations, the current UCITS analysis is focused on fixed-income only.

¹⁰ We emphasize that these are estimates of fund dilution. In our analysis, a positive number for estimated dilution suggests redeeming investors may be gaining at the expense of non-redeeming investors. Negative dilution estimates indicate that redeeming investors would have been better off not redeeming today because the fund’s net asset value rose in coming days.

¹¹ We define core bond mutual funds as those funds classified under ICI’s investment grade and multisector bond mutual fund categories. In aggregate, core bond mutual funds invest a significant majority of their assets in investment grade debt, of which US Treasuries and agencies are their largest holdings. Investment grade corporate debt accounts for less than 30 percent of their overall assets. See Figure 4 in Shelly Antoniewicz and Sean Collins, “Policymakers Need to Focus on Economic Fundamentals and Not Blame Bond Mutual Funds: Examining the Evidence of Investment Grade Corporate Bond Yield Spreads in March 2020,” *ICI Viewpoints* (July 2022).

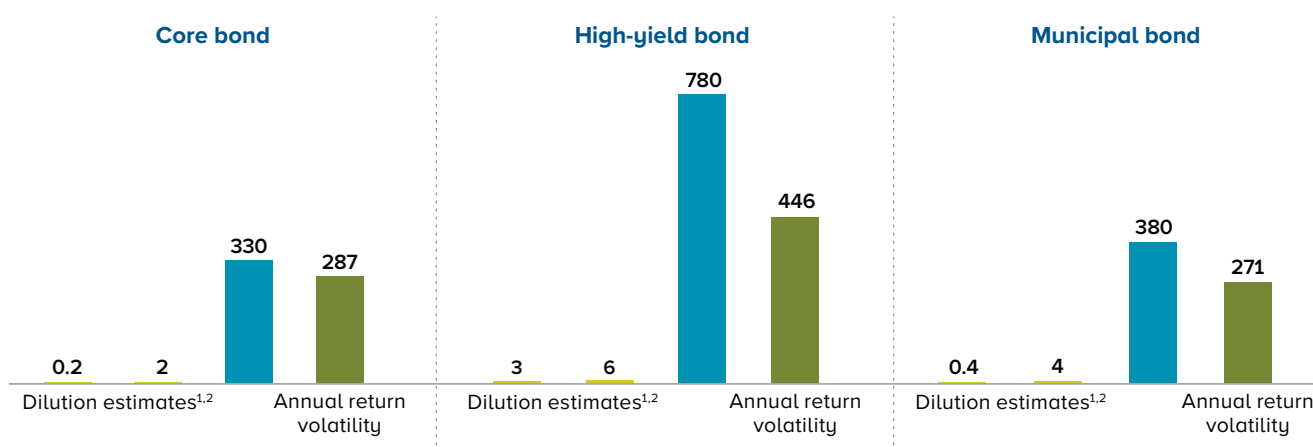
Estimates for fixed-income UCITS funds tell a similar story. The estimated annual rate of dilution for fixed-income UCITS funds is between 0.5 and 3.4 basis points. Estimates for highyield UCITS funds are similarly small, ranging from 1.3 to 9.4 basis points per annum (Figure 1b).¹²

It seems quite unlikely that such levels of dilution could motivate investors to redeem heavily. Although dilution estimates can vary across individual funds and day-to-day for a given fund, any potential dilution must be set in context. As seen in Figure 1a and 1b, the dilution estimates are miniscule compared to annual returns on these funds and the average annual variability of fund returns. Consequently, the most salient pricing signals investors are likely to base their decisions on are broad changes in market returns and volatility.

FIGURE 1A

Hard to See that Dilution Is a Factor Motivating Investors to Redeem from US Bond Mutual Funds...

Annual average in basis points, 2009 to 2022



¹ Left dilution bar represents ICI estimate for US bond funds based on model from Zitzewitz (2003).

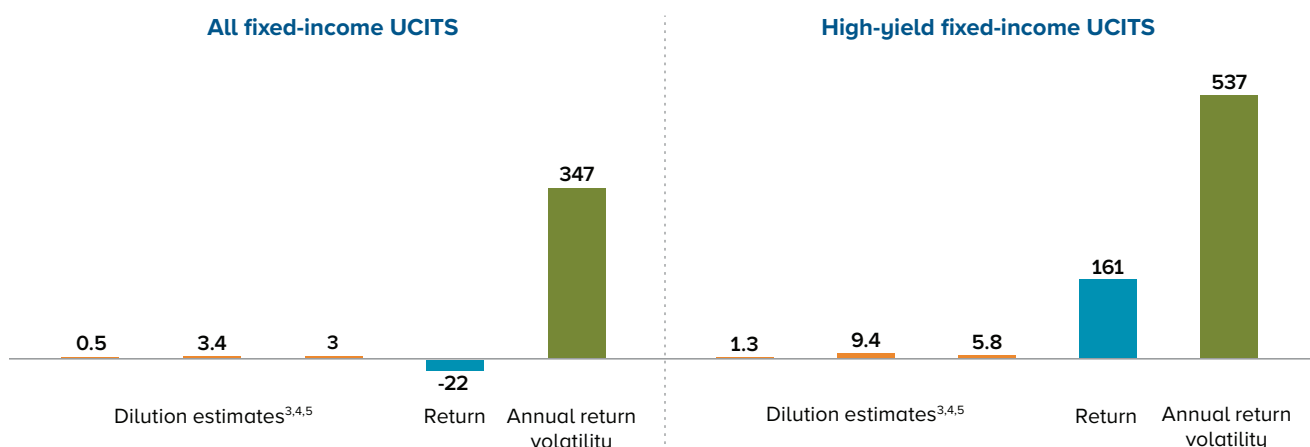
² Right dilution bar represents ICI estimate for US bond funds based on model from Choi, Kronlund, and Oh (2022).

¹² Swing pricing is a well-established liquidity management tool used regularly by some UCITS in some jurisdictions, and many ICI Global members use it as a way to mitigate the effects of investors' redemptions on remaining investors. But the effectiveness cannot be quantified from our results. For example, it would be inappropriate to assume that dilution estimates should be lower for UCITS (which often use swing pricing) than for US funds (which do not currently use swing pricing). Although we use similar methodologies to estimate dilution for UCITS and US funds, owing to differences in the availability of data from Morningstar, our estimates for the US and UCITS use different sample periods, have differing levels of fund coverage, and use fund categories that can be dissimilar. For example, high-yield UCITS focus importantly on emerging market debt, whereas high-yield US bond mutual funds focus more predominantly on US debt, and this may affect dilution estimates. Moreover, funds, whether UCITS or US funds, may use a range of approaches to manage dilution. For instance, UCITS have available a range of tools besides swing pricing that they may use to help manage dilution. In the US, where, for operational reasons, swing pricing is currently not feasible, US funds can adjust by managing liquidity to address dilution if it is economically material.

FIGURE 1B

... and also for Fixed-Income UCITS

Annual average in basis points, 2018 to 2022



³ Left dilution bar: ICI estimate for fixed-income UCITS based on model from Zitzewitz (2003).

⁴ Middle dilution bar: ICI estimate for fixed-income UCITS based on model from Choi, Kronlund, and Oh (2022).

⁵ Right dilution bar: ICI estimate for fixed-income UCITS based on internal ICI model (see appendix B for a description).

Sources: ICI calculations based on Morningstar and Refinitiv data

Of course, investors could be more concerned about dilution during periods of market stress. To assess this, ICI estimated daily dilution for US bond mutual funds and fixed-income UCITS for each day in March 2020, a period of broad market stress stemming from pandemic-related developments.¹³

For US mutual funds, as seen in Figure 2a below, even in March 2020, estimated dilution was small. It is most sizable for high-yield and municipal bond funds, but even then, with ranges only from 1 to 5 basis points per day depending on the model used. For fixed-income UCITS (top left panel of Figure 2b), estimated dilution is also small, with ranges between 0-1 basis point(s), depending on the model used. In fact, on only five days in March 2020 did estimated dilution rise slightly above 1 basis point. As might be expected, high-yield UCITS experienced higher estimated daily dilution (between 1–7 basis points depending on the model), but given the stresses in March 2020, that still seems relatively small (top right panel of Figure 2b).

Given the small size of estimated dilution, it is natural to ask, “Was dilution of a magnitude to really factor into fund investors’ decisions to redeem during that time?” A comparative analysis of price volatility and overall market return provides unique insights to this question.

For both US mutual funds and fixed-income UCITS, the effect of estimated daily dilution is swamped by both market volatility and returns.¹⁴ For example, for US high-yield bond mutual funds, the highest day of estimated dilution in March 2020 might be about 5 basis points (depending on the model used), but high-yield returns on average varied *daily* by 150 basis points that month. A similar story also unfolds for high-yield UCITS in March

¹³ See Shelly Antoniewicz, Sean Collins, and Hammad Qureshi, “Setting the Record Straight on Dilution, First-Mover Advantage, and Financial Stability Risk,” *ICI Viewpoints*, June 5, 2023.

¹⁴ This point is clearly illustrated in the bottom two panels of Figure 2b. In these panels the daily return of a fixed-income index and high-yield index are charted with the daily estimated dilution results. Daily returns far outweigh any dilution results by order of magnitudes.

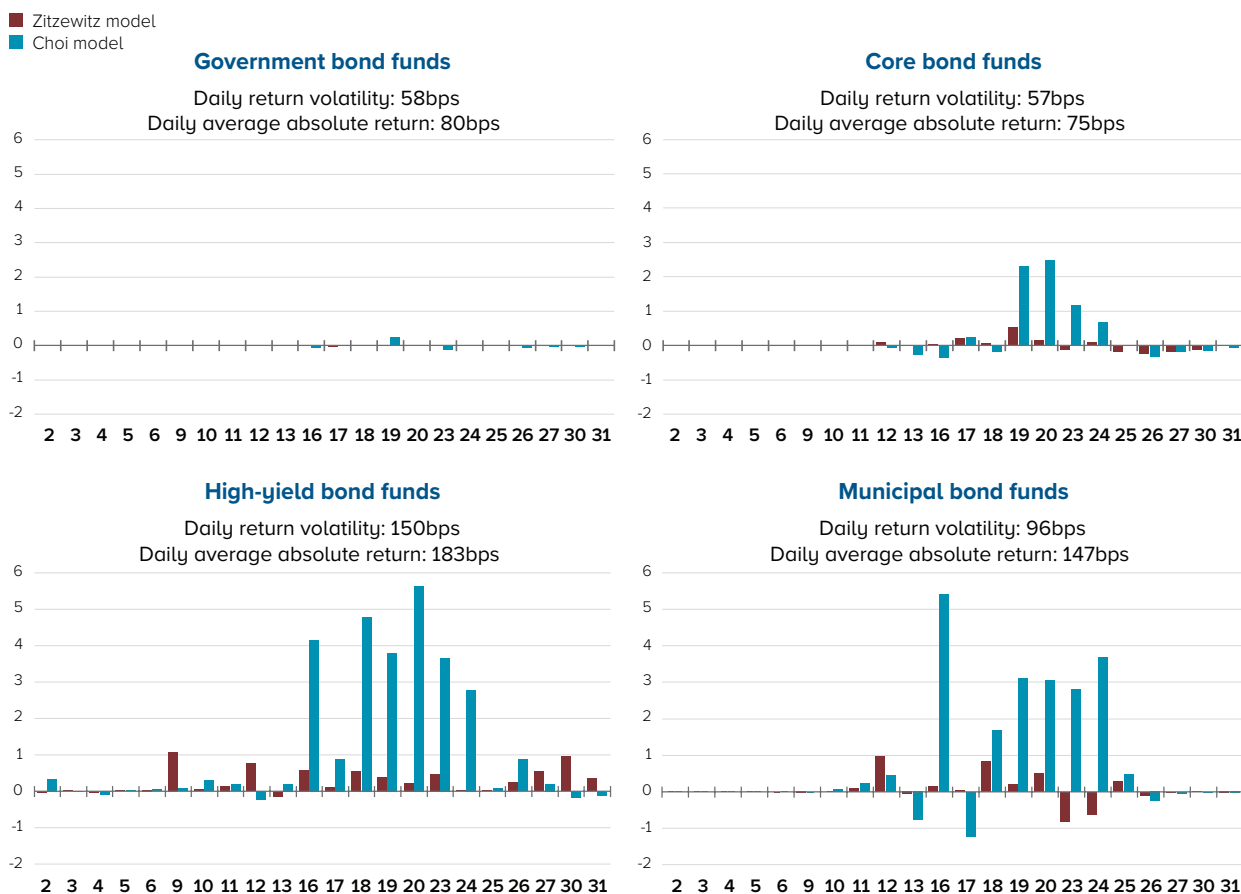
2020. Estimated dilution peaks at 5 basis points on one day, but that same day (March 16), high-yield bond prices fell nearly 400 basis points.

In other words, daily returns varied 23 to 150 times more than the dilution estimates, suggesting that fund investors, like all other investors, whether in pooled investment vehicles or not, were likely focusing on the steep losses on bonds and the spikes in bond return volatility stemming from a rapid deterioration in global macroeconomic conditions, and not any potential dilution.¹⁵

FIGURE 2A

Estimated Daily Dilution for Selected Types of US Mutual Funds in March 2020

Basis points



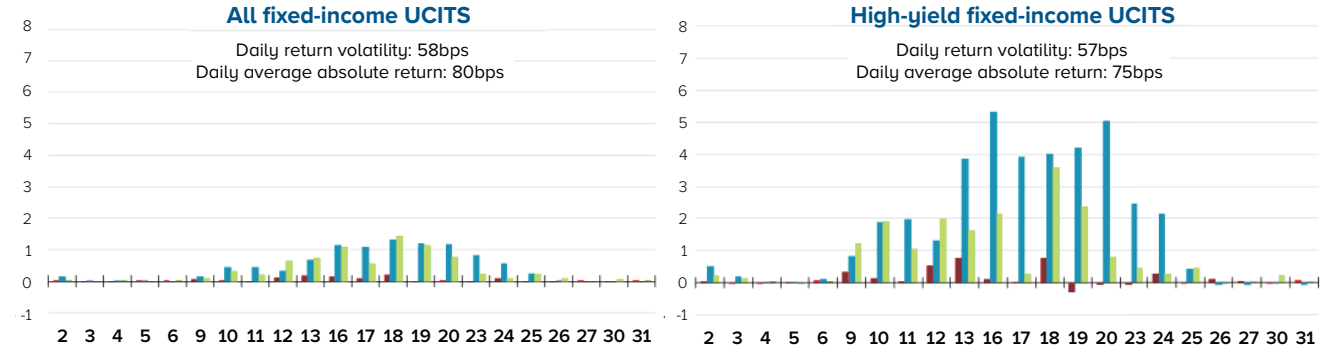
¹⁵ See "The Impact of COVID-19 on Economies and Financial Markets," Investment Company Institute, October 2020.

FIGURE 2B

Estimated Daily Dilution for Selected Types of Fixed Income UCITS in March 2020

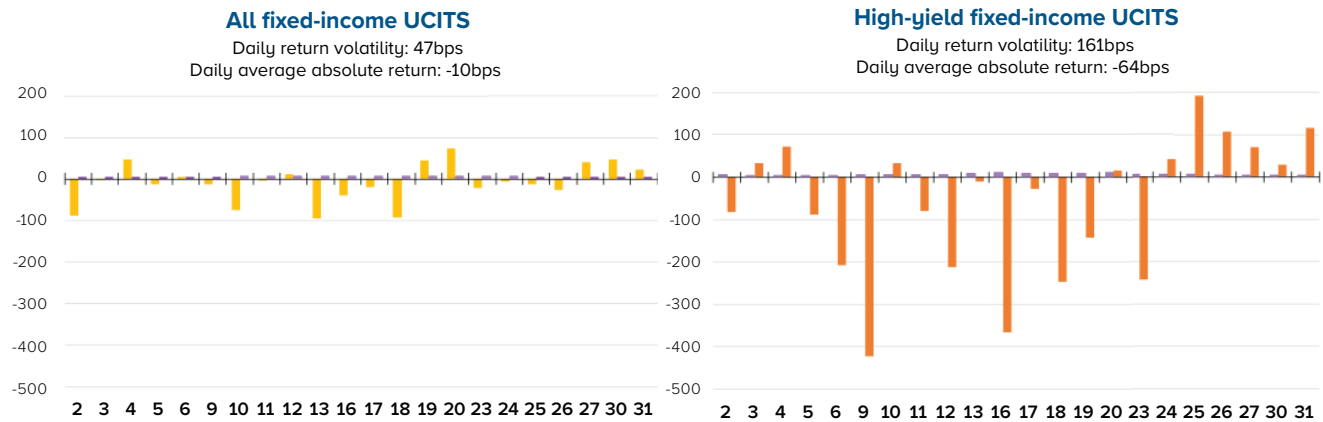
Estimated dilution, bps, daily, March 2020

- Zitzewitz model
- Choi model
- ICI model



Estimated dilution compared to returns, bps, daily, March 2020

- Bloomberg Global Aggregate Total Return Index (expresses in euros) returns
- Bloomberg Global High Yield Total Return Index (expresses in euros) returns
- Daily maximum dilution across models*



*Calculated as the maximum daily value of either Zitzewitz, Choi, and ICI models.

Sources: ICI calculations of Morningstar and Refinitiv data.

A.4 The OEF Structure is Not an Incentive for OEF Investors to Behave Uniquely

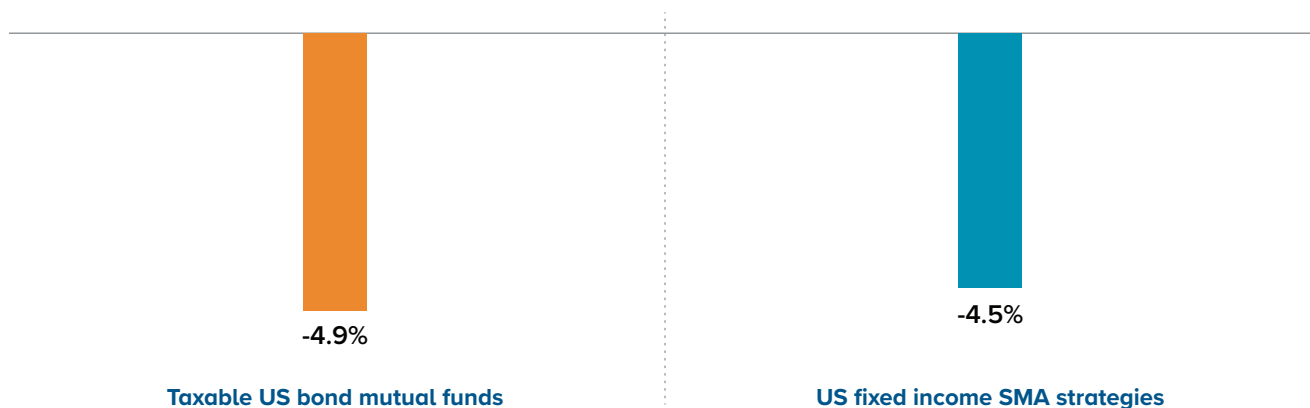
In addition, new research challenges the theory that there is something about the structure of OEFs that generates a unique and strong incentive for fund investors to redeem heavily when asset prices are tumbling.

Academic theory asserting a first-mover advantage unique to OEFs implies that investors in OEFs and direct investors in stocks and bonds should behave differently during market downturns. The first-mover hypothesis, being the assumed motivation of results in often-cited academic literature, asserts that the shared liquidity of investors in OEFs creates an incentive for fund investors to redeem heavily during market downturns since liquidity costs are absorbed by the remaining fund investors. But direct investors have no such incentive because they bear the full liquidity cost of selling securities. Thus, if the first-mover hypothesis as applied to OEFs is correct, fund investors should react much more strongly to changes in market conditions than do direct investors.

FIGURE 3

If the First-Mover Hypothesis Is Correct, Bond OEF Investors Should React Much More Strongly to Market Changes than Do Direct Investors in Bonds—But that Doesn't Appear to Be True

Outflows as a percentage of net assets, March 2020



Sources: ICI calculations of ICI and Morningstar Direct data

That does not appear to be the case, however. Stahel (2022) suggests that OEF investors and direct owners react similarly to changes in market conditions.¹⁶ The author reports that the so-called “concave performanceflow” relationship (*i.e.*, flows react more strongly to price declines than they do for price increases), which some academics have argued is evidence of a first-mover advantage in bond OEFs, is also found in performance and flow data in the US for fixed income separately managed accounts (SMAs). SMAs are accounts in which investors directly own portfolios of securities and thus bear the full liquidity costs of selling. As one striking example, we estimate that percentage outflows from taxable bond mutual funds and fixed income SMAs in the US were nearly identical in March 2020 (Figure 3), 4.9 percent versus 4.5 percent, respectively.¹⁷

A.5 No Evidence that US Mutual Funds Amplified Bond Market Stresses in March 2020

Some policymakers have repeatedly voiced concerns that during a market downturn a first-mover advantage might cause OEFs to fire-sell assets, amplifying liquidity strains and transmitting shocks through the financial system. However, such policymakers typically provide no hard evidence to support these claims. Some of these policymakers vaguely cite the so-called “dash for cash” during March 2020 as evidence, claiming that US mutual funds were among the largest recorded sellers of Treasuries during that period.

ICI has documented hard evidence that should allay concerns about OEFs amplifying liquidity strains.¹⁸ We collected from bond mutual funds in the US their actual daily portfolio purchases and sales during March 2020¹⁹ and found no evidence that bond mutual funds significantly amplified market stresses during that tumultuous month.

Policymakers frequently cite certain academic studies as suggesting that mutual funds’ sales of portfolio securities amplify stresses in financial markets. These studies typically provide evidence that selling by mutual funds has a *statistically* significant effect on market prices (or yields), but upon closer examination those effects are not *economically* meaningful.²⁰ In addition, these studies do not have data on funds’ actual sales of bonds.

¹⁶ See Christof W. Stahel (2022), “[Strategic Complementarity among Investors with Overlapping Portfolios](#),” working paper, Investment Company Institute.

¹⁷ Although some might be tempted to argue that the modestly higher outflows from bond mutual funds compared to fixed income SMAs in Figure 3 are evidence of a first-mover incentive in mutual funds, that would be incorrect. Stahel (2022) formally tests whether investors in mutual funds behave differently (*e.g.*, redeem more heavily) than investors in comparable SMAs. Stahel’s results show there is no statistical difference between mutual fund investors’ responses and those of SMA investors. In other words, the differences in Figure 3 are within statistical margins of error. This implies that any difference in aggregated outflows shown in Figure 3 is attributable to other factors, such as sampling error arising from variations in data sources, data definitions, breadth of data coverage, and other data related issues, rather than from fund investor behavior.

¹⁸ See Shelly Antoniewicz and Sean Collins, “[Setting the Record Straight on Bond Mutual Funds’ Sales of Treasuries](#),” *ICI Viewpoints*, February 24, 2022; Shelly Antoniewicz and Sean Collins, “[Policymakers Say Bond Mutual Funds Contributed Significantly to Treasury Market Stress but...](#),” *ICI Viewpoints*, March 24, 2022; Sean Collins and Shelly Antoniewicz, “[Policymakers Need to Focus on Economic Fundamentals and Not Blame Bond Mutual Funds: Examining the Evidence of Investment Grade Corporate Bond Yield Spreads in March 2020](#),” *ICI Viewpoints*, July 6, 2022; Sean Collins and Shelly Antoniewicz, “[Core Bond Mutual Funds Had Little Impact on the Investment Grade Corporate Bond Market](#),” *ICI Viewpoints*, August 4, 2022.

¹⁹ See Shelly Antoniewicz and Sean Collins, “[ICI Bond Mutual Fund Survey Brings Facts to the Debate](#),” *ICI Viewpoints*, February 24, 2022.

²⁰ See [LRM Comment Letter](#), Appendix A at 33 to 35 for a detailed discussion on the lack of economic significance in the results reported in several research papers recently cited by the Securities and Exchange Commission. These papers include Coval and Stafford (2007), “Asset fire sales and purchases in equity markets,” *Journal of Financial Economics*, 86, 479–512; Yiming Ma, Kairong Xiao, and Yao Zeng (2022), “Mutual fund liquidity transformation and reverse flight to liquidity,” *The Review of Financial Studies*; and Haddad, Moreira, and Muir (2021) “When Selling Becomes Viral: Disruptions in Debt Markets in the COVID-19 Crisis and the Fed’s Response,” *The Review of Financial Studies*, 34, 5309–5351.

Instead, the authors attempt to infer funds' bond sales from funds' month- or quarter-end holdings, fund returns, and estimated fund flows—all of which could introduce imprecision into their analyses.

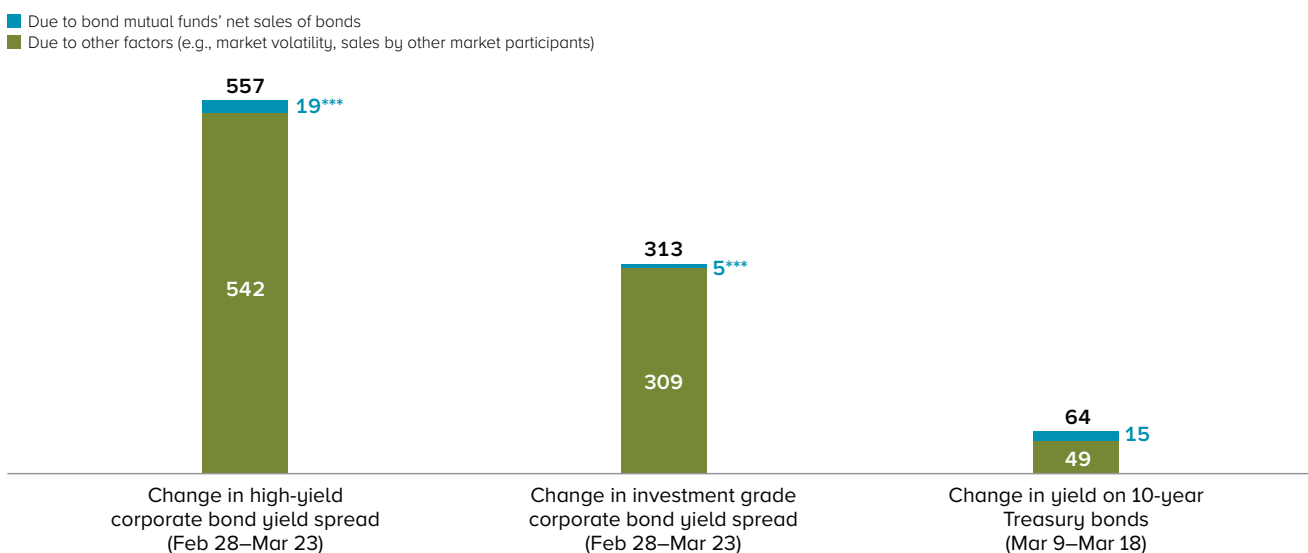
To more precisely analyze whether bond mutual funds had a significant impact on the bond markets during March 2020, we estimated the contribution of their *actual* daily net sales of bonds on the increase in high-yield and investment-grade corporate credit spreads and the increase in the yield on the 10-year Treasury bond.

We find that, while there is a *statistically* significant effect of mutual funds' net sales of highyield bonds on their yield spreads to Treasuries,²¹ the *economic* effect in March 2020 was very small. The \$11 billion in high-yield bonds that bond mutual funds sold on net from February 28 to March 23, 2020, accounted for only an estimated 19 basis points of the 557 basis point increase in high-yield credit spreads over the same period (Figure 4).

FIGURE 4

Mutual Funds' Net Sales of Bonds in March 2020 Had Little Effect on US Bond Markets

Change in yield spread (high-yield and investment grade) or change in yield (Treasuries)
Basis points



*** Indicates that the influence of bond funds' net sales of high-yield and investment grade corporate bonds are statistically significant at the 1 percent level. In the regression for the 10-year Treasury bond, the influence of bond funds' net sales of Treasury bonds is not statistically significant.

Note: In the figure, the heights of the bars for high-yield and investment grade bonds are changes in yield spread. For high-yield bonds, the yield spread is the difference between the ICE BofA US High-Yield Index yield and the yield on 7-year Treasury bonds from February 28, 2020, to March 23, 2020. Bond mutual funds sold \$11 billion on net in high-yield bonds over the period. For investment grade corporate bonds, the yield spread is the difference between the yield on the ICE BofA BBB US Corporate Index and the yield on 10-year Treasury bonds from February 28, 2020, to March 23, 2020. Bond mutual funds sold \$10 billion on net in investment grade corporate bonds over the period. For Treasury bonds, the height of the bar is the change in the yield on US Treasury securities at 10-year constant maturity from March 9, 2020, to March 18, 2020—the period when the Treasury market was dislocated. Bond mutual funds sold \$62 billion in Treasury notes and bonds over the period.

Sources: ICI calculations of ICI bond mutual fund survey, Refinitiv, TRACE, and Federal Reserve Bank of St. Louis FRED data

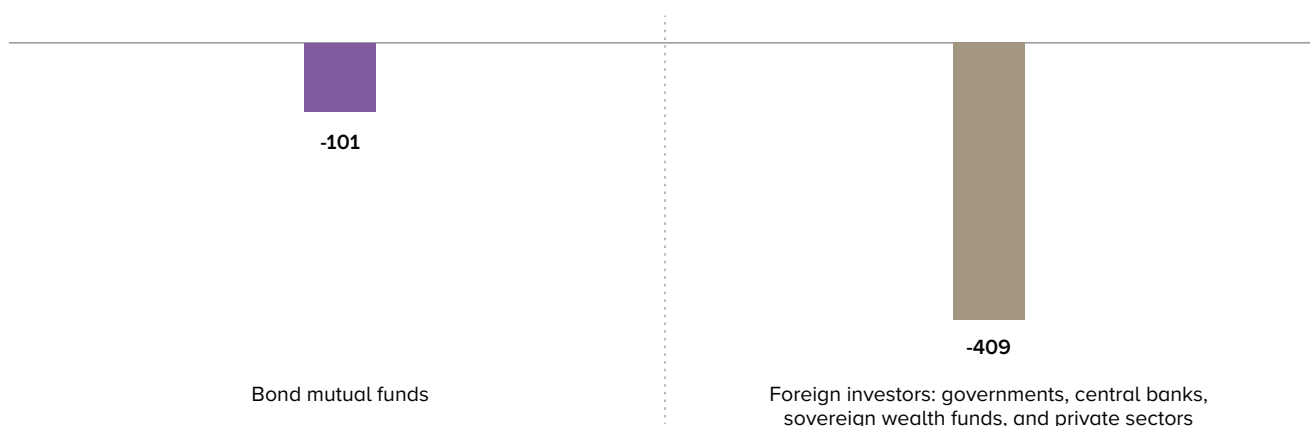
²¹ See LRM Comment Letter, Supplemental Appendix on Asset Market Stress Amplification, Figure A3.1 for the detailed results of the regression models estimating the relationship between the change in high-yield and investment grade credit spreads/Treasury yields and mutual funds' net purchases/sales of these securities.

In addition, foreign investors—which includes non-US banks, foreign central banks, sovereign wealth funds, and others—sold far more Treasury notes and bonds in March 2020 (an estimated \$409 billion) than did US bond mutual funds. These foreign investors sold heavily despite owning their securities directly and thus having to bear their own liquidity costs.

FIGURE 5

Foreign Investors Sold Four Times More Treasuries Than US Bond Mutual Funds

Net sales of Treasury notes and bonds, billions of dollars, March 2020



Sources: ICI calculations of ICI bond mutual fund survey and Weiss (2022)²²

A.6 Conclusion

The empirical evidence presented in this appendix raises serious doubts about the validity of the first-mover advantage and stress amplification hypotheses underpinning some policymakers' perception of the behavior of OEF investors.

ICI's work on estimating dilution in US mutual funds and in fixed-income UCITS shows that even during stressed markets dilution is economically too small to credibly motivate investors to redeem heavily. Other research by ICI shows that investors who hold fixed-income securities directly respond virtually the same as bond mutual fund investors when there is a downturn in the market. Such evidence legitimately contests the theory that mutual funds' pooled structure creates a unique first-mover incentive. Taken together, this seriously calls into question the cogency of the firstmover theory as applied to OEFs.

Also, ICI's analysis showing that bond mutual's net sales during March 2020 had a negligible impact on the corporate bond and Treasury markets in the United States disputes the theory that OEFs are an inherent source of asset market stress amplification.

²² See Colin R. Weiss, "Foreign Demand for US Treasury Securities During the Pandemic," FEDS Notes, Federal Reserve Board (January 28, 2022).



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