Institutional Synergies and the Fragility of Loan Funds

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This Draft: November 2022

Abstract

There are two major institutional investors in the syndicated loan market: collateralized loan obligations (CLOs) and bank loan mutual funds. CLOs are closed-end funds while bank loan mutual funds are open-end funds that issue claims that are redeemable on demand. In this paper, we examine whether CLOs provide arbitrage capital that contributes to the resilience of loan funds. We find that CLOs provide liquidity through par building trades when loan funds experience large outflows. CLO-provided liquidity limits redemption-induced fire-sale discounts but only for loans that are par build eligible.

Keywords: Leveraged loan, Mutual fund, CLO, Fire sale, Fragility.

JEL Classification: G23, G38

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"These [illiquid investment] funds are built on a lie, which is that you can have daily liquidity for assets that fundamentally aren't liquid." -- Mark Carney, the former governor of the Bank of England

"When the stock market gets the flu, high yield catches a cold and bank loans get the sniffles …That's the cosmic order of things." -- Christopher Remington, Eton Vance

1. Introduction

There are two major institutional investors in institutional loans: collateralized loan obligations (CLOs) and loan mutual funds. According to S&P, the market share of CLOs is about 65 percent while loan funds have around a 20 percent share.[1] Like banks, but unlike CLOs, loan mutual funds engage in liquidity transformation, by investing in presumably illiquid loans financed by redeemable on-demand claims on the underlying loan portfolio. Thus, over the past decade, bank loan funding has been replaced, in part, by loan mutual funds with potentially greater exposure to liquidity shocks.

The growth of open-end mutual funds investing in relatively illiquid corporate bonds and loans has raised concerns that this growth may adversely affect financial sector stability (as the first quote by Governor Carney illustrates). While arguably all open-end bond funds engage in some degree of liquidity transformation, at first glance loan funds appear to represent an extreme form of liquidity transformation. Unlike publicly traded corporate bonds, there are no reporting requirements for trades in the institutional loan market, most borrowers in the loan market are not publicly traded, and settlement times are longer for loans than for bonds. Moreover, loans are not considered to be securities and thus are exempt from Securities Act of 1933 disclosure requirements.[2] These differences suggest that the leveraged loan secondary market may be less liquid than the corporate bond market, leading to greater vulnerability to runs due to redemption-induced fire-sale discounts (See Goldstein, Jiang, and Ng (2017) (hereafter GJN), and more recently Falato, Hortacsu, Li, and Shin (2021) (hereafter FHLS).

[1] From 2018 through January 2020 there was a net outflow from loan funds. Since March 2020 there has been a net inflow to loan funds. Analysts attribute these outflows to declines in credit risk spreads and the subsequent inflows to concerns about rising interest rates. See https://www.morningstar.com/articles/1040270/bank-loan-funds-are-back-here-are-2-to-consider

[2] For a description of Securities Act of 1933 disclosure requirements see https://fas.org/sgp/crs/misc/IF11256.pdf

The variability of investment flows into and out of loan funds suggests that concerns over greater vulnerability of loan funds to liquidity shocks may be justified. As shown in Figure 1, aggregate flows into and out of loan funds are substantially more volatile than the flows of corporate bond funds generally and high yield bond funds (which, like loan funds, invest primarily in less than investment grade credits). However, despite a greater flow volatility, as seen in Figure 2, return volatility is significantly *lower* for loan funds than high yield bond and corporate bond funds generally. For example, the weighted average volatility in monthly returns was 0.39 percent for high yield funds versus only 0.23 percent for loan funds over the period 2010 through 2020 (the difference is statistically significant at the 1% level).[3] While the greater return stability of loan funds in the presence of volatile investment flows suggests greater resilience of loan funds to investment outflows (as the second quote suggests), other factors such as less exposure to interest rate risk and the secured nature of bank loans may also explain the resilience.[4]

In this paper, we examine the extent to which open-end loan funds exhibit the same type of strategic complementarities and accompanying fragility as documented for open-end corporate bond funds (see, for example, GJN, 2017). Strategic complementarities arise when investor concerns with potential fire-sale discounts lead to large outflows in anticipation of redemptions which depress the value of portfolio holdings. The mechanism leading to fire-sale discounts is downward sloping demand for loans arising from slow moving arbitrage capital. As Shleifer and Vishny (1997) and Coval and Stafford (2007) argue, limits to arbitrage are more likely to arise when investors hold concentrated positions in assets with limited breath of ownership.

The narrow investment focus of open-end loan funds would appear to make them particularly vulnerable to fire-sale discounts from large investment outflows. However, we argue that CLOs have the ability and incentive to supply arbitrage capital during periods of large outflows from loan mutual funds which mitigates the effect of redemptions on loan prices. As Cordell, Roberts and Schwert (2021) (hereafter CRS) explain, CLOs are closed-end funds so that capital inflows and outflows are limited. In addition, CLOs are actively managed with managers

[3] One potential explanation for the lower return volatility is that loan fund managers engage in return smoothing (See Emin and James, 2022). While return smoothing may contribute to lower return volatility, as discussed later, the discrete change in return volatility around the par eligibility threshold is difficult to explain in the context of return smoothing.

[4] Most leveraged loans have a floating rate structure tied to 90-day LIBOR or other short term interest rate indices and thus their value is less sensitive to fluctuations in the level of interest rates.

buying and selling loans during most of the life of a CLO. More importantly, as explained later, CLO managers have an incentive (subject to certain limitations) to acquire loans trading at modest discounts from par. These features potentially make CLOs a provider of arbitrage capital to loan funds under selling pressure, resulting in loan funds being less susceptible to redemption-induced fire-sale discounts than corporate bond funds.

We begin by examining the incidence of outflow-induced fire-sale discounts and spillover effects among loan funds. We compare the incidence of fire-sale discounts in loan funds to that for high yield bond funds because both invest in less than investment grade credits but differ in terms of how they trade and active investing by CLOs. We identify fire-sale discounts by examining the relationship between changes in prices and mutual fund investment flow pressure. Specifically, we follow Coval and Stafford (2007) and measure flow pressure as changes in holdings of a given loan or bond by funds experiencing large redemptions or investor inflows. Sales of assets by funds with large outflows are more likely to be forced sales and thus result in fire-sale discounts.

We also examine flow-induced spillover effects using FHLS's (2021) measure of fire-sale spillovers. They measure spillover effects by identifying peer funds whose asset sales are likely to impact funds holding the same assets. Specifically, FHLS's measure of flow-induced asset sales or purchases is the weighted sum for each fund of asset-specific flow pressures emanating from peer funds with large redemptions/inflows. A fund with high exposure to fire-sale spillovers is defined as a fund with a high proportion of assets that are fire sold by other funds.

If investment in leveraged loans exposes bank loan funds to a greater fire-sale risk, we would expect a larger impact of sell flow and peer flow pressure on loan fund returns than on returns of high yield bond funds. Consistent with the findings of Coval and Stafford (2007), using holdings data we find a negative and significant impact of fire-sale pressure induced by outflows on loan prices. Consistent with FHLS (2021), at the fund level we also find a negative relationship between fire-sale pressure exerted by peer funds and fund performance. However, we find that flow and peer flow pressures have a significantly *smaller* impact on loan prices and fund returns than on high yield bond prices and fund returns. Moreover, the difference in the impact of sales pressure on loan and bond prices (and fund returns) is economically large. For example, a one standard-deviation increase in sell pressure is associated with on average a 2.5 times greater impact on high yield bond prices than loan prices.

We next explore potential explanations for why loan mutual funds appear to be less susceptible to flow-induced fire-sale discounts and spillover effects. First, we examine the composition of loan fund assets and how it varies over time. Specifically, we examine whether loan fund resiliency arises from large cash holdings serving as a buffer against adverse liquidity shocks. However, we find that on average cash holdings as a percentage of assets under management are similar for loan, high yield, and corporate bond funds generally. We also examine whether loan funds avoid holding potentially illiquid loans by taking positions in highly rated senior tranches of CLOs. However, we find that loan funds hold, on average, only about one percent of their assets in asset backed securities. In contrast, they hold about 90 percent of their assets in either bank loans (66%) or short-term high yield floating rate notes (21%).

Another potential explanation for smaller fire-sale discounts and spillover effects is that, despite the lack of transparency, trading by CLOs and other institutional investors in leveraged loans leads to greater liquidity and lower costs of arbitrage than in the corporate bond market. Aggregate trading statistics suggest that this may be the case. For example, according to the Loan Syndications and Trading Association (LSTA), the trading volume in the first six months of 2021 totaled $412 billion relative to approximately $1.2 trillion in institutional loans outstanding at year end 2020. In contrast, according to the Securities Industry and Financial Markets Association (SIFMA) aggregate trading volume in corporate bonds over the same period was only $180 billion relative to approximately $10.4 trillion outstanding at year end 2020.[5]

Unfortunately, transaction prices for loan trades are not available, so it is difficult to directly compare trading costs of bank loans to those of bonds. Thus, we construct an indirect measure of liquidity and arbitrage costs based on differences between transaction prices and net asset values (NAVs) of shares of loan and high yield bond ETFs. For an ETF, trading by authorized participants (APs) is intended to align the trading price of shares in the ETF with the NAV of the shares. The average premium (or discount) in the share price relative to the NAV therefore

[5] See https://www.lsta.org/news-resources/2q21-secondary-trade-data-study-executive-summary for institutional loan trading volume. For corporate bond trading volume see https://www.sifma.org/resources/research/us-fixed-income-securities-statistics/

provides a measure of the cost of arbitrage for the APs. If the cost of trading the underlying loans is significantly greater than the cost of trading high yield bonds, we expect the average premium for loan funds to be significantly greater than the average premium for high yield ETFs. However, we find that the average premium for loan ETFs is significantly *less* than the average premium for high yield bond ETFs (and corporate bond ETFs generally). For example, we find the mean (median) premium relative to NAV for loan funds is about 15 (33) percent of the average (median) premium for high yield bond funds. More importantly, we find that loan fund share creations/redemptions are significantly more sensitive to premiums/discounts than for high yield bond funds. The difference in the marginal effects of premiums on share redemptions is economically large, with the marginal probability of share redemption being almost 10 times larger for loan funds than for high yield bond funds. These findings suggest that the cost of arbitrage in the loan market is significantly less than that in the high yield bond market.

One potential explanation for the apparent resilience of loan funds is that CLOs have the ability and incentive to provide arbitrage capital when loan funds experience large redemption-induced outflows. Specifically, the structural features of CLOs may enable them to sell liquidity during periods of market stress by engaging in par building activity. Par building refers to CLOs purchasing loans at a discount relative to par value but using the par value of these loans when performing overcollateralization tests. As discussed later, par building is subject to ratings restrictions but is generally permitted for loans selling at prices above 85 (although CLO may concentrate on purchasing discount loans above this threshold to avoid losing par in the event that the loan is downgraded or the price declines).[6] Par building transactions loosen overcollateralization constraints and thus make purchasing loans at a discount attractive to CLOs. As a result, par building may increase the demand for loans that have recently declined in value, reducing fire-sale discounts arising from mutual fund sell pressure.

To explore whether par building contributes to loan mutual fund resiliency, we examine the relation between investment flows into and out of loan funds and par building activity of CLOs. For this analysis, we obtain transaction prices and the volume of CLO purchases and sales of leveraged loans from CLOi. Following CRS (2021), we define par building buy transactions as

[6] CLOs are required to perform monthly overcollateralization (OC) tests. These tests require a CLO's loan portfolio relative to the principal value of notes outstanding to exceed a certain threshold. See Section 2 and Loumioti and Vasvari (2019) for a discussion of OC tests and their implications for loan valuation.

loans CLOs purchase at a discount from par and CLO par building sales transactions as sales of loans at above par value. We match CLO loan trades with CRSP mutual funds' loan holdings to identify CLO and mutual fund trades in the same loan.

To investigate synergies between CLOs buying activity and flow-induced redemptions, we examine the relationship between par building and mutual fund flow pressure. Lower (higher) values for the pressure measure indicate loan selling (buying) by mutual funds induced by investor outflows (inflows). We also calculate separately buy and sell pressure. We find a negative and significant relationship between par building activity by CLOs and the flow-driven pressure. More importantly, we find that the relationship between CLO par building activity and mutual fund flow pressure is asymmetric. Specifically, par building purchases by CLOs are positively related to flow-induced sales by loan mutual funds. In addition, we find that par building activity is greatest when there are aggregate net outflows from loan funds.

Finally, and perhaps most interesting, we find a significant difference in the relationship between the loan price changes and mutual fund sales pressure for par build eligible and par build ineligible loans. As shown in Figure 3, we find the impact of sales pressure is negligible for par build eligible loans. In sharp contrast, we find the impact of sales pressure on loan prices is negative and significant for par *ineligible* loans. We perform a placebo test by comparing the impact of sales pressure on loan and high yield bonds prices. We find sales pressure has a significantly greater impact on high yield bond prices than loan prices but only for loans priced above 90. For prices below 90, we find either no difference or a larger negative impact of sales pressure on loan prices than bond prices. Overall, these findings suggest that the resilience of loan funds is state contingent. For large adverse economic shocks that lead to loan prices decreasing below the par eligibility threshold, arbitrage capital from CLOs will not be available to mitigate sales-induced declines in loan prices, leading to greater fragility of loan funds than bond funds.

To our knowledge, our study is the first to examine the institutional synergies and the flow of arbitrage capital in the loan market. Specifically, we provide novel evidence of synergies among institutional investors in the loan market and find that fire-sale discounts among loan mutual funds vary with the availability of arbitrage capital from outside the mutual fund sector. Overall, we find that CLOs' loan buying activity serves to mitigate outflow-induced sales pressure among mutual funds, contributing to the appearance of less fragility among loan funds than corporate bond funds.

More important, we find that CLO covenants provide an incentive to provide arbitrage capital but only for loans selling at modest discounts from par. In the absence of par building purchases, we find evidence of potentially greater fragility among loan funds than bond funds.

The rest of the paper is organized into six sections. In section 2, we provide institutional background on trading of syndicated loans. Section 3 provides a description of our data sources, variable construction, and summary statistics concerning the funds in our sample. In section 4, we examine the relationship between loan fund outflows and contemporaneous returns. In section 5 we examine spillover effects of forced loan and high yield bond sales. In section 6, we compare the costs of arbitrage in the syndicated loan and high yield bond markets. In section 7 we examine the relationship between CLO par building transactions and mutual fund flow pressure. We also examine whether the impact of sell pressure on loan prices varies around the par build price threshold. Section 8 provides concluding comments.

2. Institutional Background on Loan Trading and CLO Par Building Activity

Concern with the potentially greater fragility of loan funds stems in part from differences in the way loans and bonds trade. Unlike corporate bonds, traders in the loan market cannot generally observe dealer quotes in a centralized location or on a computer screen. Instead, as described in Taylor and Sansone (2007), indicative quotes are obtained from originating banks. More recently, indicative quotes from broker-dealers are assembled and distributed by loan pricing services such as LSTA and IHS Markit (Markit). Nevertheless, loan trading lacks the transparency the Financial Industry Regulatory Authority (FINRA) Trade Reporting and Compliance Engine (TRACE) provides for bond trading.

Loan trading differs from bond trading along two additional dimensions. First, because loans are not securities, loan sales contracts require more extensive documentation and take longer to settle. Most par or near par trades (typically at a price of 90% or more) use LSTA or Loan Market Association (LMA) documentation forms and settlement procedures. LSTA settlement procedures allow seven days to settle in contrast to the two-day settlement for most corporate bonds. In addition, because loans are not securities and most borrowers are not publicly held, loan transactions are not governed by securities laws and borrowers are not subject to the same disclosure requirements as SEC registered firms. Finally, loan contracts are often bespoke with borrower specific covenants.[7] Given the potential information asymmetry between the original lender and the purchaser of the loan in the secondary market, LSTA and LMA loan trade documents contain so called "Big Boy" language concerning non-reliance and lack of liability if one party possesses material information unknown to the other.[8]

A second way in which loan trading differs from bond trading is that loan sales can be structured as either an assignment or a participation. Assignment sales are more common and are true sales in the sense that the assignee obtains an ownership interest in the loan or in the part assigned. In a participation, on the other hand, the original lender maintains ownership over the loan and the participant has only a contractual right against the leading participant, not a credit relationship with the borrower (see Taylor and Sansone, 2017). As a result, with loan participations, the buyer generally has no right to enforce compliance with the terms of the credit agreement against the borrower, and the buyer is subject to the credit risk of both the borrower and the seller. Loan mutual funds acquire loans under both assignment and participations although participations are typically used when acquiring relatively small (under $5 million) interests.

The prospectuses for the loan funds in our sample warn investors that illiquidity and valuation risk is a principal risk associated with investing in loan funds. For example, the Shareholder Report for Fidelity Floating Rate High Income Fund states:

> *Floating rate loans generally are subject to restrictions on resale. Floating rate loans sometimes trade infrequently in the secondary market. As a result, valuing a floating rate loan can be more difficult, and buying and selling a floating rate loan at an acceptable price can be more difficult or delayed, including extended trade settlement periods.*

While the lack of transparency and complexity of trading loans may impede the movement of arbitrage capital in a way that makes loans more susceptible to fire-sale discounts than bonds, CLOs' purchase and sale activity may serve to mitigate those impediments. As we mentioned earlier, CLOs are closed-end funds and are therefore not subject to redemption-induced sales

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[7] For evidence of heterogeneity among syndicated loan contracts see Ivashina and Vallee (2022).

[8] Trades in the United States are conducted using LSTA documentation while trades in the UK and Europe are conducted using LMA. Settlement typically occurs within seven days (as opposed to two days for corporate bonds in the United States). For differences between LMA and LSTA trading, see https://www.cadwalader.com/uploads/media/CWT_-_LMA_vs_LSTA_loan_trading_2015-12_(3).pdf

pressure. Moreover, CLO managers may have an incentive to acquire loans at a discount from par, creating a supply of arbitrage capital for loans under flow-induced sales pressure from mutual funds.

The incentive to acquire loans at a discount from par arises from the way CLO covenant compliance is determined. As Kundu (2022) explains, CLOs are subject to coverage and quality covenants that are intended to limit CLO leverage and to ensure adequate interest coverage on the CLO's debt tranches. The overcollateralization covenant (OC) is designed to limit leverage while interest diversion covenants (ID) are designed to ensure adequate coverage of the CLO's interest obligations. A breach of either of these covenants leads to a diversion of cash flows away from the equity tranche (as well as payment of management fees) and is therefore costly to the CLO manager.

When calculating covenant compliance, most loans are valued at *par* and not at market value. The exceptions to par value accounting are so called "discount obligations," loans that have been downgraded to CCC+ or below and loans that are in default. Discount obligations are loans that are purchased at below 80-85 percent of par. Discount obligations are carried at the purchase price (if rated above CCC+) but cease to be considered as discount obligations if their market value rises above 90 percent of par for 30 consecutive days or more.[9] Defaulted assets are marked at the lower of market value or recovery value (typically as estimated by S&P or Moody's). Assets rated CCC+ or below are carried at market value except when the covenant limit on CCC+ holdings is breached, in which case, CCC+ loans must be carried at the *lowest* market value of any loan in the CCC bucket.

[9] Whether or not a loan purchased at a deep discount is considered as a discount obligation is based on a number of factors, including the credit rating at the time of purchase. For example, the offering memorandum for Apidos CLO XXXI contains the following definition of a discount obligation. "Discount Obligation": Any Collateral Obligation… that was purchased (as determined without averaging prices of purchases on different dates) for less than (1) in the case of Senior Secured Loans, (a) 80.0% of its principal balance, if such Collateral Obligation has (at the time of the purchase) an S&P Rating of "B-" or higher and a Moody's Rating of "B3" or above, or (b) 85.0% of its principal balance, if such Collateral Obligation has (at the time of the purchase) an S&P Rating of "CCC+" or lower or a Moody's Rating of below "B3," … *provided* that such Collateral Obligation will cease to be a Discount Obligation at such time as the Market Value (expressed as a percentage of the par amount of such Collateral Obligation) determined for such Collateral Obligation on each day during any period of 30 consecutive days since the acquisition by the Issuer of such Collateral Obligation equals or exceeds 90.0% (in the case of Senior Secured Loans) or 85.0% (in the case of Collateral Obligations that are not Senior Secured Loans) on each such day.

CLO managers can build par value for covenant compliance in several ways. First, buying loans in the secondary market above 80 or 85 percent of par value can build par since purchasing loans at a discount adds to par by the difference between par value of the loan and the loans acquisition price. Second, selling loans with market prices above par builds par by the difference between the sales price and par value. Third, as Kundu (2022) explains, CLOs that hold CCC+ loans in excess of limit on such holdings can build par by selling loans with the highest market value in the CCC+ bucket.

CLOs buying par build eligible loans reduces the likelihood of a covenant violation as well as allows the CLO to operate at higher levels of leverage, which may in turn, increase the returns to equity.[10] Par building buy activity may also generate a positive externality by providing arbitrage capital that is used to buy loans selling at a discount due to sell pressure by mutual funds. However, the par building externality is likely to be limited to loans selling at prices above 85 to 90 percent of par. Indeed, CLO managers are likely to limit par building buys to loan selling well above the 85 price threshold to avoid losing par in the event of a ratings downgrade or a decrease in price subsequent to purchase. In addition, CLOs subject to leverage constraints may be forced to sell loans downgraded to CCC or below (Elkamhi and Nozawa, 2022). Consistent with this conjecture, as we show later, net par buying activity is concentrated in loans selling at 90 percent of par or more.

3. Data and Sample Description

3.1 Sample construction

Our main data source is the Center for Research in Security Prices (CRSP) Survivor-Bias-Free Mutual Fund Database. We supplement the CRSP data with information from the Morningstar Mutual Funds, Markit, TRACE, and CLOi databases. Our empirical analysis focuses on active funds for the period running from 2003 to 2020.[11] Our sample period starts from 2003

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[10] Cordell et al. (2021) find a positive relation between the returns to equity and CLO par building.

[11] In the Appendix, we show analyses through 2019 to exclude liquidity shocks associated with the COVID-19 pandemic. A number of government programs designed to shore up the corporate bond market were implemented beginning in March of 2020 (for a description of these programs see Falato, Goldstein, and Hortacsu, 2021), the programs targeted bonds and not leveraged loans and thus may distort differences in the liquidity of loans and bonds. However, as shown in the Appendix, our main findings are similar if we exclude observations from 2020.

because (1) there are few loan funds in the CRSP database prior to 2002, and (2) we use 12 months of data to estimate the alpha of individual funds for the flow-performance tests. Our initial set of loan funds are those with a Lipper classification code "LP". We then read fund names and prospectuses and drop loan funds that mainly invest in mortgage assets. For our main tests, we also exclude exchange traded funds/notes (ETFs). For most of our analyses, we compare the behavior of investors in loan funds to high yield bond funds. We use high yield funds as a benchmark since previous work by Goldstein and Hotchkiss (2020) finds that bond liquidity varies inversely with credit risk. We identify general corporate and high yield bond funds using Lipper, Strategic Insights, Wiesenberger, and CRSP Objective Code identifiers in the CRSP database.

Fund-specific variables are obtained from the CRSP database, including returns, total net assets, age, expense ratio, and rear load. Our sample starts with 79 loan funds and 1,497 bonds funds. After requiring non-missing alphas, our final sample includes 78 loan funds as well as 1,422 bond funds (of which 359 are classified as high yield funds).

We examine liquidity in the loan market by investigating (1) the difference between closing prices of loan ETFs and reported net asset values, and (2) quoted bid-ask spreads for loans trading in the secondary market. We obtain information on ETF net asset values and closing prices from CRSP. As a benchmark, we compare our measures of loan liquidity to the liquidity of high yield bonds.

3.2 Performance- flow analysis

To motivate our analysis of loan fund resilience, we begin by examining the relationship between fund returns and contemporaneous investment flows. This analysis is motivated by recent work by GJN (2017) and FHLS (2021) that find, consistent with strategic complementarities, a positive relation between returns on corporate bond funds and contemporaneous investment flows during periods of market stress.[12]

For this analysis, we follow the standard practice in the literature and define a fund's net flow in month *t* as:

$$Flow_t = \frac{TNA_t - TNA_{t-1}(1 + R_t)}{TNA_{t-1}} \tag{1}$$

[12] We also examine, in the appendix, the flow-performance relationship for loan funds and corporate bond funds.

where TNA_t is the fund's total net asset value at the end of month *t* and R_t is the fund return during month *t*. We winsorize fund flows and alphas at the 1% and 99% levels to mitigate the influence of outliers.

We use three measures of aggregate market liquidity: (1) the Chicago Board Options Exchange's (CBOE) VIX index, (2) the option adjusted BB bond spread, and (3) the percentage of banks tightening their lending standards as reported in the Federal Reserve Board's Senior Loan Officer Survey.

3.3 Flow pressure and spillover measures

We measure fire-sale pressure on loan prices induced by investor redemptions in mutual funds, using the flow pressure measure proposed by Coval and Stafford (2007). Because the CRSP dataset does not classify asset types in fund holdings (e.g., loan or bond), we first obtain loan classifications from Markit by merging the CRSP holdings into Markit's loan database.[13] We rely on CUSIP as the identifier when it is available. For holdings without CUSIPs, we utilize issuer name, security name, and maturity date and then manually check each match for accuracy. In this step, we identify 6,078 unique institutional loans. Information on issue size is obtained from Markit.

We follow Coval and Stafford (2007) and compute flow pressure for loan l (or bond b) in month t as:

$$Flow\ Pressure_{l,t} = \frac{Flow\ Induced\ Buys_{l,t} - Flow\ Induced\ Sales_{l,t}}{Mutual\ Fund\ Trade\ Volume_{l,t}} \qquad (2)$$

where $Flow\ Induced\ Buys_{l,t} = \sum_i \max(0, \Delta Holdings_{l,i,t}) | flow_{i,t} > Percentile(75th)$, $Flow\ Induced\ Sales_{l,t} = \sum_i (\max(0, -\Delta Holdings_{l,i,t}) | flow_{i,t} < Percentile(25th)$, and $Mutual\ Fund\ Trade\ Volume_{l,t}$ represents the aggregate trade volume by mutual funds. $\Delta Holdings_{l,i,t}$ is fund *i*'s change in holdings of loan *l* from month *t*-1 to *t*. To calculate the pressure measure, we require a loan to have at least three trades by mutual funds in a given month. Unlike

[13] In addition to holding institutional loans (e.g., term loans B, C, D), loan mutual funds may also hold cash, floating rate notes, and other securities (e.g., derivatives, agency securities, and equity), letters of credit, bank-held loans (revolver/term loan A), mezzanine loans, and CLO notes. However, as shown in Table 1, these account for only a small portion of loan fund holdings.

Coval and Stafford (2007), who use cutoff points of 10th and 90th percentiles of cross-sectional flows, we use cutoff points based on quartiles. This is because of a smaller sample size of loan mutual funds than equity or corporate bond mutual funds.[14]

In contrast to flow pressure, fire-sale spillover effects are measured at the fund rather than holdings level. Fire-sale spillover effects arise from outflow pressure experienced by other mutual funds holding similar positions. We calculate the spillover measure used in FHLS (2021). For each fund *j* in month *t*, we take the weighted sum of price pressure from *other* funds' flow-related trading in each loan (bond) it holds,

$$Peer\ Flow\ Pressure_{j,t} = \sum_{l} Flow\ Pressure_{l,t}^{j \neq i} * \ \omega_{j,l,t-1} \qquad (3a)$$

where $Flow\ Pressure_{l,t}^{j \neq i}$ is calculated by using the holdings and flow information of other funds (i.e., $i \neq j$) and $\omega_{j,l,t-1}$ is the portfolio percentage share holdings of each fund *j* in loan *l* in month *t*-1. To examine potential asymmetric effects of peer flow pressure, we also calculate peer buy (sell) pressure as follows:

$$Peer\ Buy\ (Sell)\ Pressure_{j,t} = \sum_{l} \frac{Flow\ Induced\ Buys\ (Sales)_{l,t}^{j \neq i}}{Mutual\ Fund\ Trade\ Volume_{l,t}} * \omega_{j,l,t-1} \qquad (3b)$$

For comparison purposes, we also standardize flow pressure and peer flow pressure measures for loan and high yield funds. We identify high yield bonds through matching CRSP holdings to the TRACE database and require the "grade" variable to be "H," which indicates high yield bonds.

3.3 Loan liquidity measures

Since we do not observe loan trading volume or prices, we cannot calculate traditional measures of liquidity, such as effective bid-ask spreads (Roll, 1984), price impact (Amihud, 2002) or other bond liquidity measures based on trading activity (see Feldhutter, 2012; Dick-Nielsen et al., 2012). Instead, we construct an indirect measure of loan and bond liquidity based on the observed premium for loan and bond ETFs.

[14] Our findings are qualitatively similar when cutoff points based on deciles are used.

Our ETF-based measure of loan liquidity compares the closing price for loan and high yield ETFs with the net asset value of the funds at close. Unlike equity ETFs, the underlying holdings of loan and bond ETFs trade infrequently. As a result, the convention for loan and bond ETFs is to calculate NAV based on quoted bid or ask prices (see Fulkerson, Jordan, and Riley, 2013). ETFs allow APs to create or exchange shares to minimize the difference between trading prices of the ETF and the NAV. APs have an incentive to arbitrage price differences that exceed the cost of trading. For example, if an ETF sells consistently at a premium relative to the NAV, the AP will have an incentive to acquire the underlying loan or security and issue additional shares so long as the premium is greater than the value of the underlying portfolio based on the ask price. The arbitrage profit is the difference between the bid price of the ETF and the ask price associated with the underlying portfolio. APs will have an incentive to buy shares and redeem them for underlying portfolio when the ETF shares sell at a discount and the ask price of the ETF is less than the NAV of the underlying portfolio (valued at the bid price). We compute average daily differences between the ETF closing prices and the NAV for our sample of loan ETFs and compare these differences to those of bond ETFs. In addition, we estimate the relation between share creations/redemptions and the premium/discount associated with the ETF price. If the cost of arbitrage is less for loans than for corporate bonds, we expect the sensitivity of share creations and redemptions to changes in premium/discount to be greater for loan ETFs than for bond ETFs.

3.4 Par building analysis

We hypothesize that CLO par building activity mitigates the impact of flow pressure on loan prices. The idea is that loan fund flow pressure may create downward pressure on loan prices, but what offsets this pressure is CLOs' ability to sell liquidity due to their structure and incentives to buy loans selling at a discount from par. For this analysis, we match CRSP mutual funds' loan holdings to CLO holdings data from CLOi. Since most loans do not have CUSIP identifiers and CLOi does not provide CUSIP identifiers, we match loans between the CLOi and Markit databases by issuer name, security name, and maturity date. Our final sample contains 1,032 distinct loans that are held by loan mutual funds and CLOs during the period running from 2010 to 2020.[15] From

[15] When a company issues multiple classes of term loans with the same maturity date, it is generally difficult to determine which classes of loans mutual funds or CLOs hold. To avoid mismatches involving such loans, we exclude them from our sample.

CLOi, we obtain information on CLOs' loan trades, including transaction date, amount, price, and an indicator as whether a trade is a buy or sell trade.

For each loan *l* in month *t*, we calculate par building activity by CLOs as follows:

$$Par_{l,t} = \frac{\sum_c Par\ Buy_{l,c,t} + \sum_c Par\ Sell_{l,c,t}}{CLO\ Dollar\ Trade\ Volume_{l,t}} \qquad (4)$$

where $Par\ Buy_{l,c,t} = \frac{(100 - Trade\ Price_{l,c,t})}{100} * Face\ Amount_{l,c,t}$ for buy trades of CLO *c* and $Par\ Sell_{l,c,t} = \frac{(Trade\ Price_{l,c,t} - 100)}{100} * Face\ Amount_{l,c,t}$ for sell trades of CLO *c*.[16] In equation (4), $CLO\ Dollar\ Trade\ Volume_{l,t}$ denotes the face value of CLOs' aggregate trade volume in loan *l* in month *t*. $Trade\ Price_{l,c,t}$ is the transaction price paid or received for CLO *c* and $Face\ Amount_{l,c,t}$ is the face value of CLO *c*'s trade on loan *l* in month *t*. In addition, we separately calculate the par built from loan acquisitions and sales. *Par from Buy* refers to the first component of equation (4) relative to CLO trading volume, while *Par from Sell* refers to the second component relative to CLO trading volume.

To study the role of CLOs selling liquidity in the leveraged loan market, we examine the relationship between par building activity and fund flow pressure. If par building serves to mitigate fire-sale discounts, we would expect a positive relationship between *Par Buy* and contemporaneous *Flow Pressure*.

3.5 Descriptive statistics: Comparing loan funds to corporate bond funds

Fund-level summary statistics for our sample of loan and bond funds are reported in Table 1. Our sample includes 78 loan funds and 1,422 bond funds (359 of which are high yield bond funds) from CRSP during the period from 2003 through 2020. The return-flow analysis is based on the entire sample period. However, due to data availability, our analyses of fire-sale discounts, spillover effects, and par building activity are based on the period from 2010 through 2020. Specifically, there is little information on loan fund holdings before 2010.

[16] We exclude CLO trades executed at prices below 80 in our main analysis since purchases below 80-85 do not build par and for sales it is not clear whether these trades add or destroy par since we do not know the original purchase price. Our results are robust to including these trades but setting the par build for these buy trades at zero and conservatively setting par for sales at zero (since, as explained in Section 2, depending on the rating, sales at below 80 may build par).

As shown in Table 1, loan funds are on average much younger than bond funds, reflecting the increased participation of mutual funds in the loan market. Indeed, the oldest loan fund in our sample was 24 years old, compared to 96 years for the oldest bond fund.[17] Given the rapid growth of loan funds over the past decade, it is perhaps not surprising that loan funds have on average higher percentage inflows than bond funds. The volatility of investment flows is also significantly higher for loan funds than bond funds, even though loan funds are significantly larger on average than corporate or high yield bond funds.

Interestingly, despite greater variability in investment flows, loan funds hold on average about the same percentage of their assets in cash as bond funds. The need for cash buffers may be less for loan funds because of the higher frequency with which they impose redemption fees and rear end loads. GJN (2017) provide evidence that institutional investors may internalize strategic complementarities thus making runs on funds with a larger share of institutional investors less likely. However, the percentage of fund shares held by institutional investors (as measured by institutional share class holdings) is similar for loan and bond funds.

Regardless of the benchmark used to evaluate performance, loan funds appear to be less volatile while maintaining a similar level of average performance. Corporate bond fund performance is significantly better based on alpha estimated using the BofA ICE US Corporate Bond Index (hereafter the BofA index) as the bond market factor.

Finally, as shown in Table 1, Panel A, loan and high yield bond funds hold a much narrower set of assets than general corporate bond funds. Specifically, loan funds hold on average 66% of their portfolio in leveraged loans and about 20% in floating rate notes. Only 0.4% of the assets are held in government bonds and 3.3% are held in other assets, which consist mostly of asset-backed and mortgage-backed securities. High yield bond funds hold a similarly narrow set of assets (84% in bonds, 1.4% in government bonds, and 4% in other assets). In sharp contrast, corporate bond funds hold on average only about 50% of their portfolio in corporate bonds. As shown, corporate bond funds hold a substantial portion of their portfolio in government bonds and assets classified as Other. Finally, despite the average loan fund being larger than the average bond fund, loan funds hold slightly fewer positions. In addition, the mean (median) Herfindahl-Hirschman index (HHI)

[17] The name of the oldest loan fund in our sample is "AIM Counselor Series Trust (Invesco Counselor Series Trust): Invesco Floating Rate ESG Fund" and the oldest bond fund in our sample is "Nicholas High Income Fund," which was first offered in 1924.

of fund holdings is 158 (81) versus 311 (135) for loan funds and general corporate bond funds, respectively (we find no difference in the concentration of holdings between loan and high yield bond funds).

Panel B provides descriptive statistics concerning fund returns, flow and peer flow pressure measures for loan and high yield bond funds for 2010-2020.[18] As shown, the mean (median) sell pressure is higher for loan funds than for high yield bond funds. The average (median) loan sell pressure is 22 (2.1) percent compared to 17 (1.4) percent for high yield bonds. These differences are consistent with the greater flow volatility for loan funds relative to bond funds as shown in Figure 1.

Finally, we note that prices for loans are tightly distributed around a mean (median) of 97.4 (99.8) percent of par. Loan funds hold very few loans with prices below 85 or above 100 percent of par. In contrast, high yield bonds have a wider distribution of prices. There are several potential explanations for these differences. First, loans are relatively short-term floating rate instruments and are typically prepayable. The average maturity of loans held by the funds in our sample is 4.95 years compared to an average maturity for high yield bonds of 6.72 years. Second, while the average rating for holdings of both loans and bonds is B1, high yield funds have on average a higher percentage of holdings rated B3 or below (10%) than loan funds (7%). Third, high yield bonds are typically unsecured while leveraged loans are secured. Collateral is associated with higher recovery rates in default and expected recovery rates are likely to serve as a floor on loan and bond prices. For example, Badoer, Dudley, and James (2020) find mean recovery rates for secured loans of 95 percent, compared to recovery rates of between 56 and 40 percent for senior unsecured and subordinated bonds. Finally, if, as we hypothesize, CLO par building activity enhances loan market liquidity, funds may concentrate their holdings in par build eligible loans.

In the empirical tests that follow, we attempt to control for differences in the prices of loans and high yield bonds by examining the impact of outflow-induced selling pressure for loan and high yield bonds in narrow price bins around the par eligibility threshold.

[18] This sample starts from 2010 because holdings information on loan mutual funds are mostly populated after 2010. Prior to 2010, there are fewer than four loan funds in CRSP that have non-missing holdings information.

4. Motivating Evidence: Are Loan Returns Less Sensitive to Outflows?

A first mover advantage arises when investor outflows lead to lower contemporaneous fund returns. To examine potential differences in first-mover advantage between loan and bond funds we investigate the relationship between excess fund returns and contemporaneous flows.[19] We define excess returns as the difference between fund returns and returns on the S&P LLI index for loan funds, the BofA bond fund index for bond funds, and the S&P high yield corporate bond index for high yield funds, respectively. If fund flows influence the price at which a fund can purchase or sell loans or bonds, we expect a positive relation between excess returns and flows. We examine whether the excess return-flow relationship is more pronounced during periods of market stress by estimating the following regression:

$$EReturn_{i,t} = \alpha + \beta_1 Flow_{i,t} + \beta_2 Flow_{i,t} \cdot I(Illiquid\ Period_t)$$

$$+\beta_3\ I(Illiquid\ Period_t) + \beta_4 Alpha_{i,t-1} + \gamma' X_{i,t} + \theta_t + \varepsilon_{i,t} \qquad (5)$$

where $EReturn_{i,t}$ is fund i's return net of the benchmark return in month *t*. $Flow_{i,t}$ is fund i's net flow in month *t*, as defined in equation (1). $Alpha_{i,t-1}$ is fund i's monthly performance measure for the past year. For loan funds, we measure performance using a two-factor model, where the two factors are the S&P LLI index and the BofA ICE US Corporate Bond Index. We compare the flow-performance relationship of loan funds to that of both corporate bond funds generally and high yield bond fund. For bond funds, we follow GJN (2017) and estimate alpha using a two-factor model where the two factors are the BofA index and HY bond index. We include in the matrix ***X*** fund-level controls including lagged investment flows, the natural log of fund net assets, the fund's expense ratio and whether the fund has a rear end load or redemption fee. The parameter θ_t represents time fixed effects. Standard errors are clustered at the fund level.

[19] We also estimate the relationship between fund flows and performance using a specification similar to the one used in GJN (2017). However, as GJN (2017) point out, flow-performance concavity provides only indirect evidence of outflow-induced fire-sale discounts. In a recent paper, Cetorelli, La Spada, and Santos (2022) (hereafter CLS) find evidence that the flow-performance relationship for loan funds is more concave than for bond funds. As shown in Appendix A1, we find no evidence of a concave flow-performance relationship among loan funds. Using CLS's (2022) specification, we find that loan fund flow-performance relationship is more concave than that for bond funds, but as shown in Appendix A1, this is because bond fund flows are less sensitive to overall performance than loan funds (as figures 1 and 2 suggest). In addition, while CLS (2022) measure performance using lagged raw returns, we find no evidence of a concave flow-performance relationship using $Alpha_{i,t-1}$ as a measure of performance.

If fund-specific selling pressure leads to a positive return-flow relationship, we expect funds with larger outflows to have poorer relative performance. However, as shown in columns (1)-(3) of Table 2, the sensitivity of loan funds to outflows is *less* than that for both bond funds and high yield funds during periods of market stress, with two of the three illiquidity measures being insignificantly different from zero.[20] Consistent with the findings of GJN (2017), we find for corporate bond funds a positive and significant relation between excess returns and fund flows during periods of market stress using all three illiquidity measures. The findings reported in Table 2 provide indirect evidence of strategic complementarities during periods of market illiquidity adversely affecting the returns on corporate bond funds but not the returns on loan funds. However, as discussed earlier, the regressions in Table 2 focus on cross-sectional differences among funds. If all returns to loan funds respond similarly to outflows and there is little variation across funds in investment flows during periods of market stress, then the tests reported in Table 2 may fail to detect fragility. Given these concerns, in the next section we directly test for differences in flow-induced sales on loan and high yield bond prices.

5. Fire-Sale Discounts and Spillover Effects

5.1 Loan and bond price impact of flow-induced trading

We begin by examining price impact of loan and bond fund sales by investigating the relationship between monthly changes in prices and the Coval and Stafford (2007) measure of flow pressure. Coval and Stafford (2007) argue that sales by funds experiencing large outflows represent distressed sales. In addition, a necessary condition for fire-sale spillover is for distressed sales to lead to a decrease in loan or bond prices. We calculate changes in the prices of loans and bonds as follows. For each loan-month in our sample, we calculate the average bid price and ask price from daily quotes by dealers from Markit. We then take the average of bid and ask prices as the mid-price for each loan-month and calculate its percentage change from the prior month. For each bond-month, we calculate the value-weighted average sell price and buy price from Enhanced

[20] The estimates reported in Table 2 are based on a sample period that includes the sharp decline in loan and bond prices at the start of the COVID-19 period and the subsequent government intervention in the bond market. As shown in Appendix Table A2, if we end the sample at year end 2019, we find even larger differences between loan and bond funds.

TRACE and then calculate the average of buy and sell prices to obtain the mid-price. Flow pressure measures are standardized for ease of interpretation.

The results of our loan/bond price impact analysis are reported in Table 3. We include loan/bond fixed effects so that identification is through within loan/bond variation in prices due to changes in flow pressure. As shown in Table 3, consistent with the findings of Coval and Stafford (2007) and FHLS (2021), we find a positive and significant relation between prices and flow pressure for both loans and high yield bonds. The positive coefficient on the flow pressure indicates that sales by loan or bond funds experiencing large outflows are associated with a decrease in loan and bond prices. Interestingly, we find that bond prices are significantly *more* sensitive to flow pressure than loan prices. The difference in price sensitivity is economically large, with the impact of flow pressure on loan prices being only about one quarter of that on bond prices. As shown in columns (5) and (6), the difference in price sensitivity to flow pressure for loans is significantly less than bonds at the one percent level.

One potential explanation for the difference in price sensitivity between loans and high yield bonds is that the distribution of loan prices is more closely clustered around par than bond prices (as shown in Table 1). Since liquidity may be increasing in credit quality, the differences in the price sensitivity of loans and bonds may be driven more by deeply discounted holdings among high yield bond holdings. To address this concern, we restrict both the bond and loan samples to holdings with prices above 80. As shown in columns (8) and (10), we find that the impact of sell pressure on bond prices is significantly greater than the impact on loan prices. Indeed, the absolute value of the price effect on high yield bonds is almost twice as large as the price impact on loans.[21]

5.2 Fund performance and spillover effects

FHLS (2021) find that a mutual fund's performance in fixed income markets is adversely affected by outflows of its peer funds. We assess fire-sale spillover effects for loan funds by estimating the relationship between monthly returns (flows) and peer flow pressure. Recall that peer flow pressure is the weighed sum of peers' flow pressure with the weights based on the asset allocation of a given fund. Funds with greater peer flow pressure hold a larger proportion of their

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[21] Another potential explanation for the smaller pressure-induced price changes for loans than high yield bonds is that loan prices may adjust more slowly due to stale pricing. However, we find no significant autocorrelation in monthly returns for loan or high yield bond funds.

portfolio subject to net flow pressure. We examine the relationship between fund performance and peer flow pressure by estimating the following regression:

$$Y_{i,t} = \alpha + \beta_1\ Peer\ Flow\ Pressure_{i,t} + \mu_i + \theta_t + \varepsilon_{i,t} \quad (6)$$

where $Y_{i,t}$ is a measure of fund i's performance at time and μ_i and θ_t are fund and time fixed effects.

In Table 4, we report estimates of equation (6) separately for loan and high yield bond funds as well as estimates based on a pooled sample of funds. In Panel A, we report estimates of the relationship between fund returns and peer flow pressure while in Panel B we report estimates of the relationship between investor flows and peer flow pressure.

Consistent with the findings of FHLS (2021), we find that for both loan funds and high yield bond funds a positive and highly significant relationship between fund returns and peer flow pressure. As shown, peer buy pressure is associated with an increase in fund performance while peer sell pressure depresses fund returns. However, the impact of flow pressure on fund returns is significantly less for loan funds than for high yield bond funds. Comparing the coefficient estimates reported in columns (2) and (4), we see that the impact of sell pressure on loan fund returns is about half the impact on high yield bond funds. In terms of economic magnitude, a one standard-deviation increase in sell pressure reduces loan fund returns by about 24 basis points (about 77 percent of the average monthly return) while for high yield funds it is associated with a 58-basis point decline in returns (about 107 percent of the average monthly returns).

We test for differences in spillover effects by pooling loan and high yield funds and then interacting the fund pressure measures with a dummy variable that indicates whether the fund is a loan fund or not. As shown in column (5), the coefficient on the interaction variable is negative and significant at the 1% level. More importantly, focusing on peer sell pressure, we find that the effect of sell pressure is significantly less for loan funds than for high yield bond funds. Thus, while both loan and high yield bond funds experience significant spillover effects, the effects and the associated fire-sale discounts are significantly less for loan funds than bond funds.

Panel B of Table 4 provides estimates of the impact of peer flow pressure on own fund flows. Consistent with the findings of FHLS (2021), we find a strong positive relation between fund flows and peer flow pressure for both loan and high yield funds. Like the return analysis, loan funds appear to be more resilient than high yield funds. Overall, the findings reported in Table 4 suggest that loan funds are less exposed to strategic complementarities than high yield bond funds.

5.3 Do price impacts vary with par build eligibility? Preliminary evidence

As we discuss later, CLO par building buy activity is concentrated in loans trading between 90 and 100 percent of par. To preview the potential impact of par buying on fire-sale discounts in the loan market, we divide the sample of loans into two groups, those with transactions prices of 90 or above and those selling at below 90 percent of par. We then examine whether the impact of distressed sales on loan prices varies depending on whether the loan is trading in the price range where par building activity is concentrated. We refer to the loans selling at prices of 90 or above as par build loans and loans priced below 90 as non-par build loans. To isolate the potential impact of par buying activity, we also divide the sample of high yield loans into similar groups based on trading prices.

Figure 3 presents the coefficient estimates for sell pressure for loans and high yield bonds. To ensure comparability, we present estimates for the sample of loans and bonds trading at prices between 85 and 95. For par build loans, we find that the impact of sell pressure on loan prices is relatively small and statistically insignificant. The impact of sell pressure on high yield bonds is much larger in absolute value and significantly different from zero at the 1% level. The difference in the magnitude of sell pressure on prices is economically large as well with a one standard-deviation increase in sell pressure leading to more than a seven times larger (in absolute value) price impact on bonds than loans.

If par building mitigates the impact of flow-induced sell pressure, we expect sell pressure to have a similar or greater effect on non-par build loans than on high yield bonds in the same price range. As shown in Figure 3, that is exactly what we find. Specifically, as expected, the magnitude of fire-sale discounts is much greater for both deeply discounted loans and bonds. However, unlike trades in the par build price range, loan prices are significantly *more* sensitive to sell pressure than bond prices in the non-par building range. Indeed, in the non-par build price range, the impact of sales pressure is about 26% larger (in absolute value) for loans than for bonds. These findings are consistent with CLO par building activity mitigating the impact of fire-sale discounts induced by loan fund outflows. In Section 7, we examine par building activity and its potential impact on prices in more detail. Specifically, we examine whether par build loans are the same loans under sell pressure from loan mutual funds.

6. Differences in Loan and Bond Market Liquidity

Our analysis in the previous sections provides evidence of a surprising degree of resilience among loan funds, particularly given the presumed lack of loan market liquidity. To better understand the source of this resiliency, in this section we examine various proxies for the cost of arbitrage in the loan and bond markets. We proceed by first examining the premium associated with loan ETFs and compare it with the premium of High Yield bond ETFs. Second, we examine the relationship between share creations/redemptions and premiums/discounts for loan and high yield ETFs to gauge the cost of arbitrage.

Like mutual funds, ETFs are required to estimate the net asset value of their holdings daily. Calculating NAVs for loan and bond funds is challenging because unlike equity funds, many of the underlying holdings of loan and bond funds do not trade daily. For loans, calculating NAVs is particularly challenging because unlike most corporate bonds, there is no post-trade transparency for loan trades.

Given that bonds trade infrequently and loan trades lack transparency, the convention for loan and bond funds is to calculate the portfolio NAV using bid prices for bond and loan holdings. As explained by Fulkerson et al. (2013), bond ETFs typically sell at a premium relative to the reported NAV. The size of the premium reflects the authorized participants' (APs) cost of arbitraging differences between the value of the ETF and the value of underlying holdings.[22] Because shares of bond and loan ETFs are more liquid than the underlying holdings, the bid-ask spread for bond and loan ETFs is much lower than the bid-ask spread for bonds and the quoted half spread for loans.[23]

APs have an incentive to engage in arbitrage for ETFs selling at a premium, i.e., when the prices of ETF shares are above the value of the holdings calculated at the ask price. In this case, the APs can profit by buying the underlying (at the ask) and creating new shares. For ETFs selling

[22] In the case of cash redemptions/creations, ETFs with more illiquid holdings have higher fees for creations than redemptions. The higher fees for redemptions may contribute to bond ETFs selling at persistent premiums.
[23] The average quoted half spread from Markit for loans held by funds in our sample is 40 basis points.

at a discount, arbitrage opportunities exist when the ask price of the ETF falls below the value of the fund's holdings based on bid prices. As a result, arbitrage opportunities are limited by the cost of trading the underlying portfolio. Funds with less liquid holdings, all else equal, will sell at larger premiums (discounts). As a result, an indirect measure of the relative liquidity of loans and bonds is the size of the premium (discount) of loan and bond ETF prices relative to their reported NAVs. More importantly, if arbitrage costs in the loan market are significantly greater than in the bond market, we expect share creations and redemptions for loan ETFs to be significantly *less* sensitive to differences between ETF prices and the portfolio NAV than in the bond market. Alternatively, if arbitrage costs are less in the loan market than in the bond market, we expect the marginal effect of ETF premiums and discounts on redemptions to be larger for loan ETFs than bond ETFs.

Our analysis of ETF premiums focuses on comparing premiums and share creation/redemptions of loan funds to high yield bond funds. Our sample consists of 10 loan ETFs and 68 high yield bond ETFs. As shown in Table 1, loan funds invest in a narrow set of securities and liquidity is likely to vary with the credit risk of the holdings. Table 5 Panel A provides summary statistics for our sample of loan and high yield ETF funds. As shown, the average loan ETF premium is significantly lower than the average premium of high yield ETFs. Premiums are smaller based on either the bid or ask price (significant at the 1% level) and only slightly higher if we use the midpoint of ETF bid-ask spread to calculate the premium. As shown, the volatility in premiums is also lower for loan ETFs than for bond ETFs. Overall, these findings suggest that costs of arbitrage in the loan market are less than in the bond market. [24]

As shown, both creations and redemptions occur in large blocks. For loan ETFs, the median creation is 200,000 shares and the median redemption is 425,000 shares. The smallest creation and redemption are both 50,000 shares. As discussed earlier, an AP has an incentive to create additional shares when the ETF premium exceeds the cost of arbitrage and to redeem shares when the ETF discount is larger than the cost of arbitrage. Since redemptions involve acquiring shares during periods of stress in the loan and bond markets, arbitrage costs are likely to be higher in the case of share redemption than in share creation.[25]

[24] In untabulated analyses we compare loan fund ETFs to corporate bond ETFs and find similar differences between loan and bond fund ETFs.
[25] Some loan and bond ETFs allow full or partial creations and redemptions in cash. However, there are fees associated with cash transactions to cover the fund's transaction costs.

We investigate the relationship between creations (or redemptions) and ETF premiums (or discounts) by estimating a multinomial logit model. We create a categorical variable equal to 1 for days on which shares are created, -1 for days on which shares are redeemed, and 0 otherwise. The last category is deemed as the reference category, "no share issuances," so that interpretation of the coefficient is in relation to days on which there are no share creations or redemptions. In estimating the multinomial logit model, we model the decision to create or redeem shares as a function of lagged premiums (up to three days), asset size of the ETF, as well as the trading volume and bid-ask spread of shares of the ETF.

Estimates of the multinomial logit model are presented in Panel B of Table 5 (for brevity, we report only the estimates of the coefficients for the lagged premia). Not surprisingly, we find a positive relationship between the likelihood of share creation and premiums, and a negative relation between share redemption and premiums. In other words, share creations tend to follow periods of persistent premiums and share redemptions follow periods when ETF shares sell at persistent discounts. More importantly, the propensity for creations and redemptions appears to be more sensitive to changes in premiums for loan funds than for high yield funds.

We also report the marginal effect (evaluated at the mean) associated with a one-unit increase in 3-day cumulative premiums on the propensity of APs to create and redeem shares. As shown, the marginal effect of premiums and discounts are orders of magnitude greater for loan ETFs than for high yield ETFs generally. Specifically, a one percentage-point increase (decrease) in the 3-day cumulative premium is associated with a 0.7 (1.22) percentage-point increase (decrease) in the probability of share creation (redemption). This effect is nontrivial, especially for redemptions, considering that the unconditional probability of creation (redemption) in our sample is 6.4 (3.3) percent. In contrast, for high yield ETFs, a one percentage-point increase (decrease) in the 3-day cumulative premium is associated with only a 0.04 (0.16) percentage-point increase (decrease) in the probability of share creation (redemption), comparing to the unconditional probability of 3.3 (1.2) percent. These findings suggest that the cost of arbitrage in the loan market is substantially less than in the high yield bond market.

7. Does CLO Par Building Mitigate the Impact of Fund Outflows on Loan Values?

7.1 CLO par building and mutual fund flow-induced sales

What explains the lower arbitrage costs in the loan market and the apparent resilience of loan fund returns to investment outflows? One explanation is that CLOs have the ability and incentive to provide liquidity for loans trading at a discount from par. As CRS (2021) explain, CLOs are a resilient source of loan financing due to their long-term funding structure and that OC tests are based primarily on par values instead of market prices. The former feature insulates them from rollover risk and the latter feature implies that market volatility is less likely to require diversion of cash flows to pay down debt tranches.

In this section, we examine whether CLO par building serves to mitigate the fire-sale discounts and spillover effects arising from mutual fund outflow-induced sell pressure. For this analysis, we examine CLOs' purchases and sales of loans held by the loan mutual funds. As shown in Panel C of Table 1, most CLO purchases of loans add par. Specifically, the mean of par from buy is 1%, indicating that on average buy transactions add about 1% of the face value of the trade to par (since CLO trade volume is in terms of face value). Since most CLO sales are below par, the average sale reduces par.

To get some sense of where CLOs concentrate their trading and par building activity for loans held by loan funds, Figure 4 provides average net monthly trade amounts by pricing bin. Pricing bins are based on the reference price defined as the midpoint of monthly average bid and ask prices from Markit. Each bin, except for the lowest and highest price bins, represents the average net amount purchased based on price intervals of 2.50, so the 90 bin is the monthly average face value of loans purchased net of the face amount sold with the reference price between 90 inclusive and 92.50 exclusive. The lowest bin consists of all loans with reference prices below 70 percent of par and the highest bin consists of all loans with prices above 110. As shown, net buying activity is positive for loans priced between 87.5 and 105 and the greatest net buying activity for discounted loans is in the 90 percent of par price bin.

If par building provides a source of liquidity for loan funds, we expect par building activities to be negatively related to the Coval and Stafford (2007) pressure measure at the loan level. The lower the pressure measure, the higher the potential fire-sale pressure on a loan due to outflows from loan mutual funds. We also examine separately the relationship between par building from purchases (sales) and mutual fund sell (buy) pressures.

We examine the relationship between CLO par building and mutual fund buy and sell pressures by estimating the following loan level regression:

$$Par_{l,t} = \alpha + \beta_1\, Flow\ Pressure_{l,t} + \lambda_l + \theta_t + \varepsilon_{i,t} \qquad (7)$$

where $Par_{l,t}$ is CLO par building purchases *net* of sales for loan l at time t, $Flow\ Pressure_{l,t}$ is the net flow pressure by mutual funds for loan l at time t, and λ_l and θ_t are loan and time fixed effects. We estimate equation (7) using net par, defined as in equation (4), and net pressure measures, defined as in equation (2), as well as separately for par buy (sell) activity and sell (buy) pressure for loans by mutual funds, controlling for loan and time fixed effects. Note that we define par build as net par from purchase and sales, so net sales of discounted loans destroy par, whilst net purchases of loans at prices between 80 and 100 add par.

Panel A of Table 6 contains estimates of equation (7). Consistent with CLOs providing liquidity, Column (1) shows that CLOs' par building activity is negatively associated with flow pressure. The lower the pressure measure, the higher the likelihood of fire-sale risk among loans in the secondary markets and the higher the amount of par built by CLOs. Since we include loan and year fixed effects, identification is through par building activity associated with changes in flow pressure for a given loan each year.

We also examine the relationship between par building and flow-induced pressure by focusing on buy and sell activities. Results are reported in columns (2)-(5) of Panel A. As shown in column (2), we find a negative relationship between the par building activity of CLOs from their buy trades and the flow-induced buy pressure from mutual funds. If a loan is sought by mutual funds due to inflows, CLOs are less likely to build par on such a loan. More importantly, the estimate in column (3) indicates that CLOs build par on loans for which there is a flow-induced sale pressure. The relationship between par building buy activity and mutual fund sell pressure is both statistically and economically significant. For example, the coefficient estimate on sell pressure indicates a one standard-deviation increase in sell pressure is associated with a 22% increase in par building purchases by CLOs (relative to the average par from buy trades). As shown in columns (4) and (5), we find no relationship between CLOs sell trades and either mutual fund buy or sell pressure.

Does CLO par building activity vary with market conditions? Specifically, does par building increase during periods of outflows from loan funds and is sell pressure positively associated with more par building activities during these times? To address these questions, we focus on months when there are net outflows from bank loan funds. We then interact the dummy variable with our flow pressure measures. If CLOs' purchase activities mitigate sell pressure, we expect CLOs to engage in more par building in periods when loan funds in aggregate are experiencing net outflows. For brevity, we focus on par building (the results are similar for par building buy activity). As shown in Panel B of Table 6, we find that par building activity is significantly greater in months of net outflows from loan funds. Indeed, as shown in column (4), we find that par building activity is significantly related to flow-driven sell pressure *only* during periods of net outflows from loan funds. This finding is consistent with CLOs providing arbitrage capital to loan mutual funds during periods of large outflows.

Overall, the findings in Table 6 suggest a synergistic relationship between CLO purchases and sales and flow-induced buys and sells by mutual funds. In short, CLOs appear to focus their par building purchases on loans with heavy sell pressure from mutual funds. Par buying activity is also significantly greater when there are net outflows from loan mutual funds.

7.2 Par building and fire-sale-induced discounts

Does the focus of CLO par building activity of loans under sell pressure from mutual funds reduce fire-sale discounts? We investigate this by examining whether the impact of flow-driven sell pressure on loan prices differs based on CLO par building activity. As discussed earlier, while loans purchased by CLOs at discounts of less than 15 or 20 percent of par can in theory build par, CLO managers are unlikely to have much interest in engaging in par building purchases of loans close to the threshold of par build eligibility. There are two reasons for this. First, purchasing a loan close to the par build eligibility threshold puts a manager at risk of losing par if the loan declines further in value or is downgraded by rating agencies. Second, most loans with prices below 90 are rated B3 or less and as a result, purchasing these loans increases the risk that a small downgrade may lead to the CLO breaching the covenant limiting its CCC holdings. For example, the mean (median) rating for loans priced below 90 is 16 (16), which corresponds to a B3 rating.

While Figure 4 suggests that par building is concentrated in discount loans with prices between 90 and 100, it is not clear, a priori, over what range of prices (between 80 and 100) CLO par building activity has the greatest impact, if any, on prices. We investigate various potential break points by estimating the following regression:

$$Return_{l,t} = \alpha + \beta_1 Flow\ Pressure_{l,t} + \beta_2 Flow\ Pressure_{l,t} * I(Price_{l,t} < P) + \lambda_l + \theta_t + \varepsilon_{i,t} \quad (8)$$

where $Return_{l,t}$ is the return on loan l at time t, $Flow\ Pressure_{l,t}$ is the net buy pressure by mutual funds for loan l at time t, and $I(Price_{l,t} < P)$ is an indicator variable equal to one if the monthly average price of loan l is below a threshold price P (but above 80) and zero otherwise. λ_l and θ_t are loan and time fixed effects.

One potential price threshold is 87.5 percent of par since, as shown in Figure 4, this is the lowest price bin with positive net buying activity by CLOs. Another alternative is 90 percent of par, the price bin with greatest net buying activity. To test for a possible break point, we employ Quandt's (1972) switching regression methodology to determine a switching point in the range of discount prices above 80.[26] This procedure indicates a critical value of 90. The results from estimating equation (8) using 90 as the break point are presented in Table 7. As shown in Appendix Table A3, our findings are similar if we use 87.5 as a switching point.

As shown in column (1) of Table 7, the price impact of flow pressure is significantly greater for loans with prices less than 90 percent of par. In column (2), we report the estimates where we break out flow pressure into buy and sell components. As shown, flow pressure and more importantly, sell pressure, has a significantly greater impact on prices for loans priced under 90. Indeed, as shown in column (2), for the full sample we find a positive but statistically insignificant coefficient on sell pressure for loans with prices of 90 or above.

There are very few loans priced under 80 or above 100 percent of par, and as discussed earlier, loan prices tend to be more tightly clustered around par than high yield bond prices. To facilitate a comparison of the response of loan and high yield bond prices to flow pressure, we estimate equation (8) by restricting the sample to loans with prices in the 85 to 95 price range. As shown in columns (5)-(8), as in the full sample, we find a negative and significant impact of sell pressure only for loans priced under 90. For loans in price bins of at or above 90 percent of par

[26] The optimal switching level is the price range that yields the best fit (highest explanatory power). See Quandt (1972).

(where net par building activity is concentrated), we find no evidence of sell pressure having an impact on prices.

One explanation for the lack of any price impact of selling pressure for loans priced above 90 is CLO par building purchases of loans in this price range. An alternative explanation is simply that price sensitivity to sales pressure decreases with credit quality. As Dang, Gorton and Holstrom (2015) and Benmelech and Begman (2018) explain, debt becomes more informationally sensitive and less liquid as the credit risk increases. As a result, the increase in the impact of sales pressure for loan below the 90 percent of par threshold may simply reflect a decrease in liquidity as the discount from par (credit risk) increases. This alternative explanation suggests that we should not find a significant price impact of selling pressure for high yield bonds priced at or above 90 percent of par. However, as shown in columns (4) and (8) of Table 7, we find a negative and statistically significant relation between high yield bond returns and sell pressure for bonds priced at or above 90 percent of par. More importantly, we find that the price impact of sales pressure in this price range is significantly larger for high yield bonds than loans. Comparing the coefficient estimates on sell pressure in columns (2) to (4) and the estimates in columns (6) to (8), the impact of sell pressure is six to nine times larger (in absolute value) for high yield bonds than loans. The comparison for estimates in columns (6) to (8) are also presented graphically in Figure 3.

In sharp contrast to the impact of sell pressure on loans at or above the 90 thresholds, as shown in Table 7, we find the negative impact of sell pressure is *larger* for loans than high yield bonds for loans and bonds selling at just below the par build eligibility threshold. Specifically, as shown in column (6), a one standard-deviation increase in sell pressure is associated with a 1.26% decrease in loan prices versus about a 1% decline for high yield bonds in column (8) (the difference is statistically significant at the 1% level). These findings suggest that the resilience of loan funds is state contingent. Specifically, for large adverse economic shocks that lead to loan prices decreasing below the par eligibility threshold, arbitrage capital from CLOs will not be available to mitigate sales-induced declines in loan prices, leading to greater fragility of loan funds than bond funds.

A final set of concerns is that loans above or below the par eligibility may differ in some way other than price that affects their liquidity, and that flow pressure may reflect negative information shocks that are due to changes in the fundamental values and not fire-sale discounts.

We address these concerns in two ways. First, we compare the characteristics of loans just below and just above the 90 percent of par threshold (i.e., in the 85 to 95 price bin). Virtually all loans (99 percent) in this price bin are secured. Loans below and above the threshold have similar ratings at issue (the mean rating for both is B1), are similar in issue size (mean size of $1.07 billion below the threshold versus $1.01 billion above the threshold) and both groups are priced initially at very close to par (99.74 and 99.9 percent of par). No surprisingly, during the flow pressure month, the two groups differ in terms of their average price and rating (86 and 92 percent of par with the lower priced loans having an average rating of B2 versus B1 for the higher priced loans).

Coval and Stafford (2007) address the concern that the flow pressure may reflect negative information shocks by examining whether the pattern in abnormal returns eventually reverses after sales pressure dissipates. We conduct a similar analysis by examining cumulative average abnormal returns (CAARs) around flow-pressure months and compare the pattern of abnormal returns for par eligible and par ineligible loans. The event month for this analysis is the flow pressure month. Abnormal returns are calculated by subtracting the equally weighted return on loans held by the mutual funds in our sample from the return on loans subject to flow-induced selling pressure. Since par eligibility is determined based on the price of the loan in the event month, we compare the CAAR for loans with similar event month prices by limiting the analysis to loans in the 87.5 to 92.5 price bin. However, the results are similar if we use the entire sample of loans.

As shown in Figure 5, we find for par ineligible loans, which are priced below 90 percent of face value, a pattern of negative (and statistically significant) abnormal returns in the month of forced selling and the month immediately preceding the event month.[27] In addition, we find that the downward trend in returns reverses itself in the months immediately following the forced sale. The return reversal is consistent with fire-sale pressure pushing loan prices down rather than price changes caused by information shocks affecting fundamental values. In contrast, for par eligible loans, we find a small increase in returns in the months preceding the event month and a slight decline following the event month. Overall, the patterns shown in Figure 5 suggest that par ineligible but not par eligible loans sell at fire-sale discounts.

[27] We use the standard deviation of the time series mean return around the event month for loans that are not subject to fire sales to test for statistical significance.

8. Summary and Conclusion

The growth of open-end loan mutual funds over the past decade has raised concerns that these funds may increase the fragility of the financial system. Specifically, because loan funds invest in thinly traded and presumably illiquid loans, while issuing redeemable on-demand claims on the underlying portfolio (albeit at a variable price), they are exposed to the risk of redemption runs that can potentially result in large fire-sale discounts.

In this paper, we examine the resilience of open-end loan mutual funds and the liquidity of their holdings. Surprisingly, despite the lack of transparency of loan trading, using a variety of tests we find little evidence of greater fragility among loan funds than corporate bond funds. Indeed, depending on the measure used, we find evidence of greater resiliency in loan funds than in high yield bond funds. We provide evidence that the source of this greater resilience arises from lower arbitrage costs in the loan market for modestly discounted loans than in the high yield bond. We also provide novel evidence that CLOs' par building activities provide positive externalities for loan funds through purchasing modestly discounted loans under heavy selling pressure from mutual fund outflows. In other words, CLO purchases of loans selling at a discount appear to result in smaller fire-sale discounts for bank loans than high yield bonds arising from redemption-induced sales by mutual funds. However, we also find that, for deeply discounted loans for which CLOs are not able to par build through purchasing, flow-induced fire-sale discounts are at least as large or larger for loans than bonds. This finding suggests loan fund fragility may increase if economic shocks lead to a large portion of loan fund holdings selling at deep discounts. Overall, these finds suggest that the resilience of loan funds is state contingent and that during our sample period the loan market did not receive shocks sufficient to lead to widespread discounts of more than 10% of par.

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Table 1. Summary Statistics

The sample period is from January 2003 to December 2020 for Panel A and January 2010 to December 2020 for Panels B and C. Panel A shows fund-level summary statistics for bank loan, corporate bond, and high yield bond mutual funds. The sample includes observations with non-missing values for past alpha. There are 78 loan, 1,422 corporate bond, and 359 high yield bond mutual funds, respectively. Our main variables are from the CRSP Mutual Fund database. *TNA ($Bil)* is total net assets in billions. *Turnover Ratio (%)* and *Expense Ratio (%)* represent fund average turnover ratio and expense ratio per year in percent, respectively. *Age (Years)* is a fund's age in years since its inception in the CRSP database. *I(Rear Load)* is an indicator that equals one if a fund charges rear loads and zero otherwise. *% Institutional Shares* is the percentage of institutional share classes in a fund. *Monthly Return (%)* is the value-weighted monthly return in percent across all share classes in a fund. *Excess Return Over LLI/BofA/HYBond (%)* represents the difference between the monthly percentage returns of the fund and the S&P/LSTA LL Index (*LLI*) for loan funds, the ICE BofA US Corporate Index (*BofA*) for corporate bond funds, and the S&P Merrill Lynch US High Yield Corporate Bond Index (*HYBond*) for high yield funds. *Flow (%)* is the monthly fund flow in percent, imputed using fund total net assets and fund returns. *Flow Volatility [t-11 : t]* is the rolling standard deviation for the past 12 months inclusive of month *t*, requiring 9 minimum observations. *2-factor Alpha [t-12 : t-1] (BofA + LLI/HYBond, %)* is the intercept from a 12-month rolling regression of excess fund returns on two excess index returns, requiring 9 minimum observations. The first factor is the *BofA* index return in excess of the risk-free rate, and the second factor varies by fund type, i.e., for loan funds, it is the *LLI* index return in excess of the risk-free rate; for general corporate bond funds and high yield funds, it is the *HYBond* index return in excess of the risk-free rate. Flow and alpha measures are winsorized at 1% and 99% levels. *Number of Holdings* are monthly number of holdings positions from CRSP. *Holdings Concentration (HHI)* is calculated by summing the squared percentage weight of each holding of a fund. Categorical holdings data from Morningstar are reported for all funds from CRSP that can be matched to Morningstar. *% in Cash, % in Government, % in Loans, % in Bonds*, and *% in Other* are the percentages of a fund's net assets in cash and cash equivalents, government plus government-related, bank loans, corporate bonds, and other assets (including mortgage- and asset-backed securities, and swaps), respectively. We remove outliers by excluding observations in which the sum of all holdings scaled by total net assets is below the 5^{th} or above the 95^{th} percentile. For loan funds, bond holdings consist primarily of floating rate notes. We report *t*-test results comparing the means of bond funds and loan funds, and high yield funds and loan funds, with ***, **, and * indicating statistical significance at the 1%, 5%, and 10% levels, respectively. In Panel B, we report descriptive statistics on monthly returns and flow pressure measures for loan and high yield funds. We include total flow pressure as well as buy/sell flow pressure measures at the fund level (see equation (3)) and at the security level (see equation (2)). We report these figures in percent. *Loan Price* is the monthly average of daily midpoint of bid and ask prices quoted by dealers from Markit. *Bond Price* is the monthly value-weighted average of transactional prices reported on Enhanced TRACE. *Loan (Bond) Rating* is the enumerated Moody's rating at the beginning of a month, and higher number represents higher credit risk (Aaa = 1, Aa1 = 2, …). In Panel C, we report loan-level par building measures according to equation (4). In all panels, we exclude index funds, exchange-traded funds, and exchange-traded notes.

Panel A: Fund characteristics

	Loan Funds				Bond Funds				High Yield Funds			
	Mean	Median	Std. Dev	Obs.	Mean	Median	Std. Dev	Obs.	Mean	Median	Std. Dev	Obs.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
TNA ($Bil)	1.75	0.71	2.70	7,836	1.61*	0.31	6.95	161,262	1.17***	0.33	2.55	37,337
Turnover Ratio (%)	65.88	58.00	45.68	6,670	135.46***	74.00	197.29	129,824	88.99***	62.00	223.65	29,388
Expense Ratio (%)	1.10	1.11	0.24	6,810	0.89***	0.86	0.39	130,997	1.10*	1.09	0.37	29,616
Age (Years)	7.40	6.33	4.79	7,863	15.87***	14.17	11.13	161,910	15.94***	13.58	12.22	37,490
I(Rear Load)	0.63	1.00	0.48	7,863	0.40***	0.00	0.49	161,914	0.54***	1.00	0.50	37,490
% of Institutional Shares	19.41	16.67	20.35	7,863	19.85	0.00	27.75	161,914	19.03	11.11	25.89	37,490
Monthly Return (%)	0.33	0.38	1.82	7,833	0.38**	0.35	1.81	161,231	0.56***	0.71	2.47	37,331
Excess Return Over LLI/BofA/HYBond (%)	-0.08	-0.06	0.55	7,833	-0.09	-0.11	1.66	161,231	-0.13***	-0.08	1.16	37,331
Flow (%)	0.81	0.05	6.68	7,813	0.23***	-0.15	5.69	160,896	0.08***	-0.30	6.15	37,242
Flow Volatility [t-11 : t]	4.66	3.75	3.63	7,777	3.76***	2.44	3.73	153,605	4.18***	2.85	4.10	35,831
2-factor Alpha [t-12 : t-1] (BofA + LLI/HYBond, %)	-0.04	-0.04	0.15	7,863	-0.02***	-0.01	0.26	161,914	-0.04	-0.03	0.25	37,490
Number of Holdings	315.9	296	165.3	4,687	340.7***	297	220	47,233	294.1***	275	170	15,671
Holdings Concentration (HHI)	158.2	81.4	457.5	4,687	311.1***	135.2	724.5	47,233	151.8	66.1	444.2	15,671
Holdings from Morningstar												
% in Cash	6.22	5.25	7.29	4,590	6.99***	4.88	23.67	78,360	5.78***	4.01	10.73	18,221
% in Government	0.40	0.00	2.18	4,590	15.03***	10.66	17.56	78,360	1.39***	0.00	5.28	18,221
% in Loans	66.37	80.40	31.71	4,590	1.03***	0.00	3.60	78,360	2.59***	0.00	5.07	18,221
% in Bonds	20.51	8.38	27.89	4,590	48.93***	43.45	28.39	78,360	83.75***	87.65	15.13	18,221
% in Other	3.25	0.28	12.11	4,590	26.66***	24.41	30.77	78,360	4.06***	2.13	8.91	18,221

Panel B: Peer flow pressure for loan and high yield bond funds

	Mean	5th Percentile	Median	95th Percentile	Std. Dev.	Obs.
Loan Funds						
Fund-level Variables						
Monthly Return (%)	0.31	-1.37	0.41	2.43	1.77	3,201
Peer Flow Pressure (%)	-0.02	-0.10	-0.01	0.01	0.09	3,201
Peer Buy Pressure (%)	0.01	0	0	0.02	0.03	3,201
Peer Sell Pressure (%)	0.03	0	0.01	0.11	0.09	3,201
Loan-level Variables						
Loan Rating	13.92	11.00	14.00	17.00	1.66	21,202
Loan Price	97.40	85.59	99.81	101.13	7.88	29,731
Flow Pressure (%)	-15.26	-94.03	-1.17	43.79	38.97	32,352
Buy Pressure (%)	6.24	0	0	47.16	18.24	32,352
Sell Pressure (%)	21.51	0	2.07	94.26	31.40	32,352
High Yield Funds						
Fund-level Variables						
Monthly Return (%)	0.54	-2.40	0.62	3.62	2.04	10,009
Peer Flow Pressure (%)	-0.01	-0.05	0	0.04	0.04	10,009
Peer Buy Pressure (%)	0.01	0	0.01	0.05	0.02	10,009
Peer Sell Pressure (%)	0.02	0	0.01	0.06	0.03	10,009
Bond-level Variables						
Bond Rating	14.44	11.00	14.00	18.00	2.13	31,036
Bond Price	100.10	77.65	102.25	113.27	12.67	33,379
Flow Pressure (%)	-1.17	-81.65	0	78.13	42.28	37,184
Buy Pressure (%)	16.21	0	0	80.91	26.51	37,184
Sell Pressure (%)	17.39	0	1.43	82.99	26.96	37,184

Panel C: Par Building Measures for Loans

	Mean	5th percentile	Median	95th percentile	Std. Dev.	Obs.
Par	0.003	-0.029	0.001	0.042	0.035	6,482
Par from Buy	0.010	-0.005	0.001	0.054	0.028	6,482
Par from Sell	-0.008	-0.043	0.000	0.005	0.025	6,482

Table 2. Effects of Flow on Monthly Excess Percentage Returns in Illiquid Periods

This table shows the fund-level impact of flow on monthly excess percentage returns in illiquid periods for loan funds, bond funds and high yield funds from January 2003 to December 2020. The unit of observation is fund-month. The dependent variable is monthly excess fund return in percentage, calculated as the difference between a fund's return and the return of *LLI, BofA,* and *HYBond* indexes for loan funds, bond funds, and high yield funds, respectively, as defined in Table 1. Fund return is the value-weighted monthly return across share classes in a fund. We use three illiquid periods measures based on VIX, HYBB, and TIGHTEN. VIX is the CBOE's VIX index; HYBB is the ICE BofA BB US High Yield Index option-adjusted spread; TIGHTEN is the net percentage of domestic banks tightening standards for commercial and industrial loans to large and middle-market firms. For the first two variables, *I(Illiquid Period)* equals one if the corresponding variable is above the sample average. For TIGHTEN, *I(Illiquid Period)* equals one if the net percentage is positive and zero otherwise. TIGHTEN is of quarterly frequency and we assign the same value for all three months within a quarter. Fund controls include *Alpha, Lagged Flow, Log(TNA), Log(Age), Expense Ratio* and an indicator for whether the fund has a rear load charge, *I(Rear Load)*. Month fixed effects are included in all specifications. T-statistics are reported in parentheses. Standard errors are clustered at the fund level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Monthly Excess Percentage Returns								
	Loan Funds			Bond Funds			High Yield Funds		
	VIX	HYBB	TIGHTEN	VIX	HYBB	TIGHTEN	VIX	HYBB	TIGHTEN
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flow	0.326***	0.451***	0.453***	0.019	0.107	0.505	-0.860	-0.791	-0.586
	(3.32)	(3.38)	(2.88)	(0.05)	(0.31)	(1.42)	(-1.07)	(-0.94)	(-0.77)
Flow × I(Illiquid Period)	0.845**	0.428	0.534	2.085***	1.867***	0.997**	1.854**	1.619**	1.342*
	(2.02)	(1.08)	(1.22)	(5.36)	(4.78)	(2.57)	(2.24)	(2.00)	(1.65)
I(Illiquid Period)	0.184*	0.150	-0.735**	-0.152***	-0.103*	0.571***	-0.153**	-0.120	-0.546*
	(1.72)	(0.99)	(-2.07)	(-3.04)	(-1.79)	(3.02)	(-2.10)	(-1.42)	(-1.83)
Fund Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,768	6,768	6,768	129,872	129,872	129,872	29,388	29,388	29,388
Adj. R-squared	0.133	0.132	0.132	0.270	0.269	0.269	0.128	0.128	0.127

Table 3. Price Impact Analysis

The following table presents estimates of linear regression models where the dependent variable is the percentage change in prices from month *t*-1 to *t* for loans (bonds) held by loan (high yield bond) funds from January 2010 to December 2020. The unit of observation is security-month. We calculate changes in the prices of loans and bonds as follows. For each loan in a month, we calculate the average bid price and ask price from daily quotes by dealers from Markit. We then take the average of the two as the mid-price and calculate its percentage change from the previous month. Similarly, for each bond in a month, we calculate the value-weighted average sell price and buy price from Enhanced TRACE. We then calculate the average of the two as the mid-price. Monthly mutual fund flows and holdings are from the CRSP Mutual Fund database and the security-level flow pressure measures are calculated according to equation (2). We standardize the flow pressure measures to aid interpretation. *I(Loan)* is an indicator equal to one for loans and zero otherwise. T-statistics are in parentheses. Standard errors are clustered at the security level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Percentage Change in Price											
	Full Sample						Sample with Price (*t*) > 80					
	Loans		High Yield Bonds		Loans and HY Bonds		Loans		High Yield Bonds		Loans and HY Bonds	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Flow Pressure Sd	0.157***		0.538***		0.546***		0.156***		0.364***		0.376***	
	(7.38)		(15.29)		(15.45)		(11.03)		(18.51)		(19.01)	
Flow Pressure Sd × I(Loan)					-0.403***						-0.225***	
					(-9.63)						(-9.23)	
Buy Pressure Sd		0.095***		0.393***		0.400***		0.090***		0.195***		0.207***
		(6.27)		(9.88)		(10.14)		(8.37)		(8.83)		(9.33)
Sell Pressure Sd		-0.112***		-0.291***		-0.294***		-0.114***		-0.264***		-0.268***
		(-4.73)		(-8.13)		(-8.19)		(-7.09)		(-14.74)		(-15.02)
Buy Pressure Sd × I(Loan)						-0.308***						-0.120***
						(-7.25)						(-4.85)
Sell Pressure Sd × I(Loan)						0.195***						0.157***
						(4.52)						(6.54)
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,437	28,437	30,911	30,911	59,348	59,348	27,458	27,458	28,999	28,999	56,457	56,457
Adj. R-squared	0.12	0.12	0.17	0.17	0.16	0.16	0.09	0.09	0.22	0.22	0.19	0.19

Table 4. Fire-Sale Spillover for Loan and High Yield Bond Funds

This table presents regression estimates of the relationship between peer flow pressure and monthly fund returns in Panel A and fund flows in Panel B. The unit of observation is fund-month. The sample includes loan and high yield mutual funds from January 2010 to December 2020. The sample is partitioned into loan funds in columns (1) and (2) and high yield funds in columns (3) and (4). We require that security holdings information be available in two consecutive months. Monthly fund returns are taken from the CRSP Mutual Fund database and the peer flow pressure measures are calculated according to equation (3). We standardize the peer flow pressure measures to aid interpretation. *I(Loan Fund)* is an indicator equal to one for loan funds and zero otherwise. T-statistics are in parentheses. Standard errors are clustered at the fund level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Monthly Fund Returns (%)

	Loan Funds		High Yield Funds		Loan and High Yield Funds	
	(1)	(2)	(3)	(4)	(5)	(6)
Peer Flow Pressure Sd	0.42***		0.87***		0.86***	
	(7.25)		(30.46)		(30.72)	
Peer Buy Pressure Sd		0.44***		0.64***		0.63***
		(8.73)		(25.58)		(25.97)
Peer Sell Pressure Sd		-0.24***		-0.58***		-0.57***
		(-5.41)		(-24.76)		(-25.30)
Peer Flow Pressure Sd × I(Loan Fund)					-0.50***	
					(-8.54)	
Peer Buy Pressure Sd × I(Loan Fund)						-0.18***
						(-3.39)
Peer Sell Pressure Sd × I(Loan Fund)						0.39***
						(8.87)
Fund FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,201	3,201	10,000	10,000	13,201	13,201
Adj. R-squared	0.06	0.08	0.23	0.24	0.20	0.20

Panel B. Monthly Fund Flows (%)

	Loan Funds		High Yield Funds		Loan and High Yield Funds	
	(1)	(2)	(3)	(4)	(5)	(6)
Peer Flow Pressure Sd	0.82***		0.95***		1.01***	
	(5.07)		(8.55)		(9.02)	
Peer Buy Pressure Sd		0.66***		0.36***		0.28***
		(4.75)		(4.13)		(3.10)
Peer Sell Pressure Sd		-0.57***		-0.94***		-1.09***
		(-3.45)		(-8.14)		(-9.13)
Peer Flow Pressure Sd × I(Loan Fund)					0.26	
					(1.08)	
Peer Buy Pressure Sd × I(Loan Fund)						0.12
						(0.77)
Peer Sell Pressure Sd × I(Loan Fund)						-0.13
						(-0.52)
Fund FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,201	3,201	10,000	10,000	13,201	13,201
Adj. R-squared	0.25	0.25	0.10	0.11	0.12	0.13

Table 5. Share Creations and Redemptions by Exchange-Traded Funds

This table provides summary statistics and estimates of a multinomial logistic regression of share creations/redemptions for loan exchange-traded funds (ETFs) and high yield bond ETFs from January 2010 to December 2020. The unit of observation is fund-day. Data are from the CRSP Mutual Fund database. Loan and high yield bond ETFs are identified using the ETF/ETN indicator from CRSP. In Panel A, *Premium* equals (Price – NAV)/NAV. *Spread* equals (Ask Price – Bid Price)/Price. *Shares Outstanding* is the number of shares outstanding in thousands. *TNA ($mil)* is monthly total net assets in millions. *Δ(Shares)* equals Shares Outstanding at *t* minus Shares Outstanding at *t*-1. *%Δ(Shares)* equals Δ(Shares)/Shares Outstanding at *t*-1. The creation sample is limited to observations with positive values for Δ(Shares), and the redemption sample to negative values. We report *t*-test results comparing means and median test results comparing medians for premium and spread between the two groups. In Panel B, we report results from a multinomial logistic analysis of the relationship between share creations/redemptions and lagged premiums/discounts. The dependent variable *Creation/No Change/Redemption* equals 1 if Δ(Shares) is positive (creation), -1 if Δ(Shares) is negative (redemption), and 0 if Δ(Shares) is zero (no change). *Premium[t-1]*, *Premium[t-2]*, and *Premium[t-3]* are the premium measures lagged by one, two, and three days, respectively. *Cumulative Premium[t-3:t-1]* is the sum of premiums over the past three days. Control variables (not displayed) include lagged trading volume, average spread over the past five days, and monthly total net assets. We also report the change in marginal probability of creation and redemption induced by a one percentage point change in *Cumulative Premium[t-3:t-1]* from its sample average. In Panel B, *t*-statistics are in parentheses. Standard errors are clustered at the share class level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Summary statistics

	Loan ETFs				High Yield ETFs			
	Mean	Median	Std. Dev.	Obs.	Mean	Median	Std. Dev.	Obs.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Premium (%)	0.03	0.05	0.40	11,614	0.20***	0.15***	1.61	72,160
Spread (%)	0.27	0.08	0.74	11,614	0.24***	0.12***	0.54	72,160
Shares Outstanding (thd)	55,633	14,300	95,981	11,614	27,475	3,700	58,964	72,160
TNA ($mil)	1,497	434	2,242	554	1,366	147	3,518	3,449
Creation Sample								
Δ(Shares) (thd)	1,448	200	4,457	747	1,500	300	4,457	2,358
%Δ(Shares) (in %)	8.53	1.14	126.3	747	11.04	4.35	28.86	2,358
Premium (%)	0.10	0.11	0.20	747	0.36***	0.24***	1.49	2,358
Redemption Sample								
Δ(Shares) (thd)	-2,070	-425	5,300	382	-2,681	-450	8,722	843
%Δ(Shares) (in %)	-3.78	-2.44	4.27	382	-6.91	-3.53	10.36	843
Premium (%)	-0.17	-0.06	0.50	382	-0.26*	-0.11***	0.99	843

Panel B. Multinomial logistic model

	Dependent variable: Creation/No Change/Redemption			
	Loan ETFs		High Yield ETFs	
	(1)	(2)	(3)	(4)
Creation				
Premium[*t*-1]	56.59**		0.198	
	(2.30)		(0.03)	
Premium[*t*-2]	73.81		10.29	
	(1.04)		(1.45)	
Premium[*t*-3]	-51.61		-6.441	
	(-1.53)		(-1.53)	
Cumulative Premium[*t*-3:*t*-1]		26.03		1.314
		(0.78)		(1.25)
Redemption				
Premium[*t*-1]	-84.27**		-40.32***	
	(-2.42)		(-3.86)	
Premium[*t*-2]	-52.83***		-4.794**	
	(-2.72)		(-2.30)	
Premium[*t*-3]	-48.49*		-4.918	
	(-1.81)		(-1.48)	
Cumulative Premium[*t*-3:*t*-1]		-61.80***		-15.22***
		(-2.91)		(-3.57)
ETF Controls	Yes	Yes	Yes	Yes
Observations	11,525	11,525	71,156	71,156
Pseudo R-squared	0.081	0.079	0.017	0.016
Marginal Probability of Creation		0.70%		0.04%
Marginal Probability of Redemption		1.22%		0.16%

Table 6. CLO Par Building and Mutual Fund Flow-Induced Pressure

This table presents estimates of the relationship between CLO par building activity and flow-induced pressure using a sample of loans held by CLOs and mutual funds during the period between January 2010 and December 2020. The unit of observation is loan-month. Par and flow pressure measures for individual loans are calculated according to equations (4) and (2), respectively. We require a loan to be traded by at least three mutual funds to calculate its flow pressure. CLO trades with a transaction price below 80% (i.e., distressed trades) or above 110% (i.e., erroneous observations) of the face value are dropped. In Panel A, we report estimates of a linear regression model where the dependent variable is par and the main independent variable is flow pressure. In Panel B, *I(Negative Outflows from Loan Funds)* equals 1 if the aggregate flow to loan funds in the month is negative and 0 otherwise. T-statistics are in parentheses. Standard errors are clustered at the loan level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. CLO par building and flow-induced pressure

Dependent variable:	Par	Par from Buy		Par from Sell	
	(1)	(2)	(3)	(4)	(5)
Flow Pressure	-0.005***				
	(-4.00)				
Buy Pressure		-0.004***		-0.001	
		(-2.81)		(-0.30)	
Sell Pressure			0.007***		0.001
			(5.11)		(0.39)
Loan FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Observations	6,446	6,446	6,446	6,446	6,446
Adj. R-squared	0.23	0.39	0.40	0.40	0.40

Panel B. Par building and flow pressure during periods of market stress

	Par			
	(1)	(2)	(3)	(4)
Flow Pressure	-0.005***	0.001		
	(-3.77)	(0.02)		
I(Net Outflow from Loan Funds)	0.000	-0.001	0.001	-0.001
	(0.39)	(-0.46)	(0.42)	(-1.15)
Pressure × I(Net Outflow from Loan Funds)		-0.009***		
		(-3.78)		
Buy Pressure			-0.003	-0.002
			(-1.21)	(-0.92)
Sell Pressure			0.007***	-0.002
			(3.66)	(-0.64)
Buy Pressure × I(Net Outflow from Loan Funds)				-0.003
				(-0.78)
Sell Pressure × I(Net Outflow from Loan Funds)				0.011***
				(3.55)
Loan FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	6,446	6,446	6,446	6,446
Adj. R-squared	0.23	0.24	0.23	0.24

Table 7. Price Impact of Flow Pressure by Par Build Eligibility

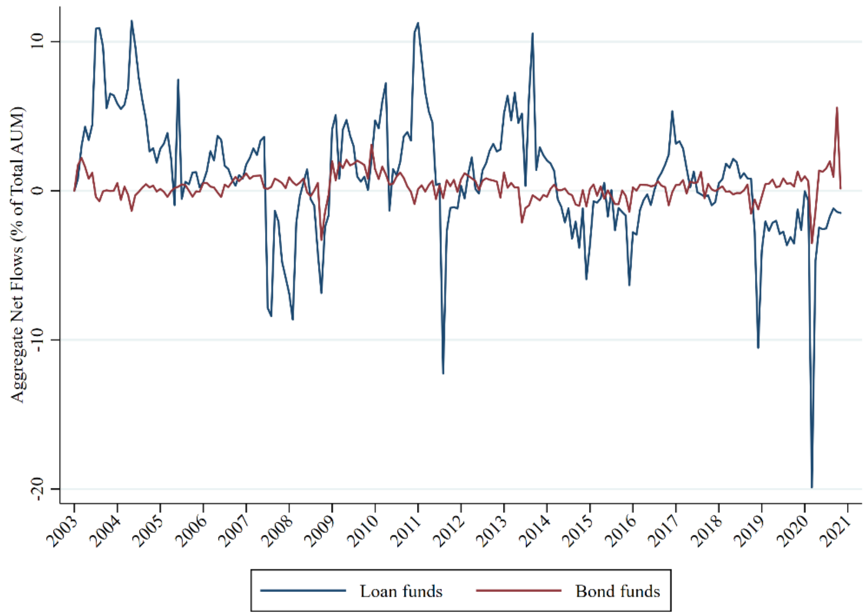
This table presents estimates of the relationship between flow-induced price changes and par build eligibility. The dependent variable is the percentage change in prices from month *t*-1 to *t* for loans (bonds) held by loan (high yield bond) funds. For loans, price refers to the monthly average of daily midpoint of quoted bid and ask prices. For bonds, price refers to the value-weighted average of sell and buy prices in a month. The sample period is from January 2010 to December 2020. Flow pressure measures for loans and high yield bonds are calculated according to equation (2). Par build eligible loans are loans with prices of 90 percent of par or greater. Results reported in columns (1)-(4) are estimated using the full sample and columns (5)-(8) for those priced between 85 and 95. Columns (1), (2), (5), and (6) are for loans, and columns (3), (4), (7), and (8) are for high yield bonds. The unit of observation is security-month. T-statistics are in parentheses. Standard errors are clustered at the security level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Percentage Change in Price							
	Full Sample				Price (*t*) in [85 : 95]			
	Loans		High Yield Bonds		Loans		High Yield Bonds	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Flow Pressure Sd	0.050***		0.338***		0.193*		0.915***	
	(3.97)		(17.44)		(1.66)		(7.88)	
Flow Pressure Sd × I(Price (*t*) < 90)	1.192***		1.855***		1.283***		-0.103	
	(6.99)		(7.11)		(5.86)		(-0.40)	
Buy Pressure Sd		0.109***		0.316***		0.574***		0.504***
		(9.28)		(10.91)		(5.01)		(4.54)
Sell Pressure Sd		0.011		-0.110***		0.087		-0.633***
		(0.73)		(-4.60)		(0.73)		(-5.27)
Buy Pressure Sd × I(Price (*t*) < 90)		-0.275		0.627***		-0.383*		-0.338
		(-1.46)		(2.86)		(-1.87)		(-1.56)
Sell Pressure Sd × I(Price (*t*) < 90)		-1.186***		-1.749***		-1.350***		-0.373**
		(-8.06)		(-7.99)		(-6.85)		(-1.97)
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,437	28,437	30,911	30,911	2,671	2,671	3,322	3,322
Adj. R-squared	0.13	0.13	0.18	0.18	0.45	0.46	0.55	0.55

Figure 1. Monthly Net Flows as a Percentage of Total AUM by Fund Type

This figure plots aggregate monthly fund net flows as a share of total assets under management (AUM) from CRSP. Panel A compares loan funds and bond funds; Panel B compares loan funds and high yield bond funds. The sample is from January 2003 to November 2020.

(a)



(b)

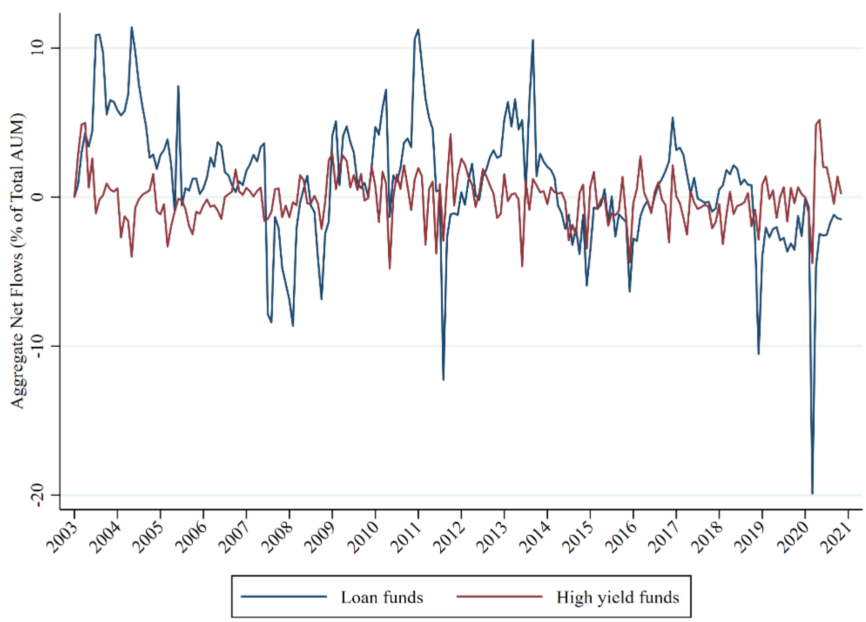
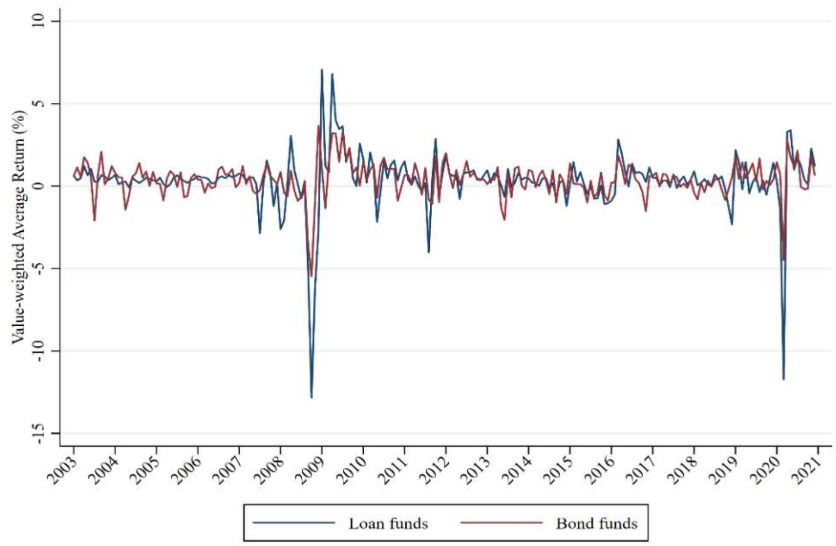


Figure 2. Average Monthly Returns by Fund Type

This figure plots average monthly fund percentage returns weighted by funds' total net assets from CRSP. Panel A compares loan funds and bond funds; Panel B compares loan funds and high yield funds. The sample is from January 2003 to November 2020.

(a)



(b)

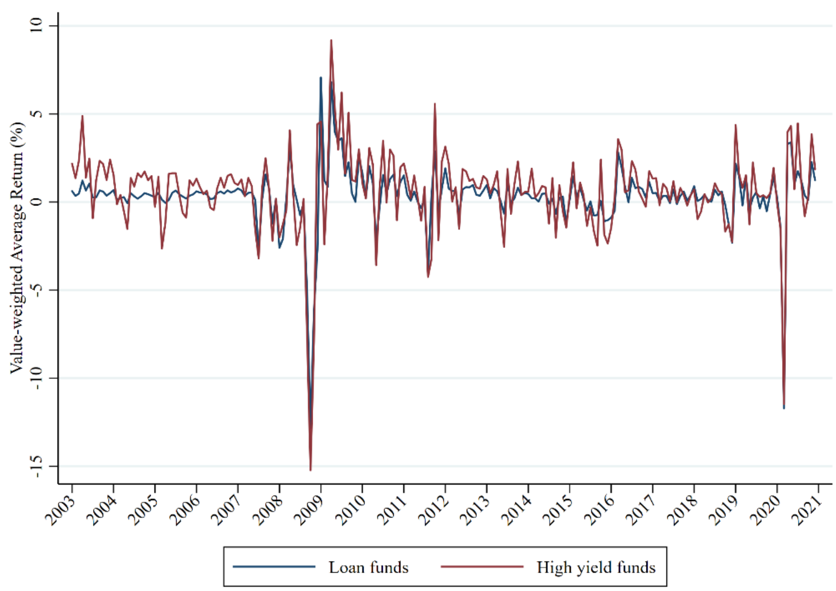


Figure 3. Effects of Selling Pressure on Loan and Bond Prices by Par Build Eligibility

This figure plots the impact of flow-induced selling pressure on loan and high yield bond returns based on regression results reported in Table 7 (columns (6) and (8)). Loans (high yield bonds) are designated as eligible for par building if they are priced between 90 and 95 percent of face value, and ineligible if between 85 and 90.

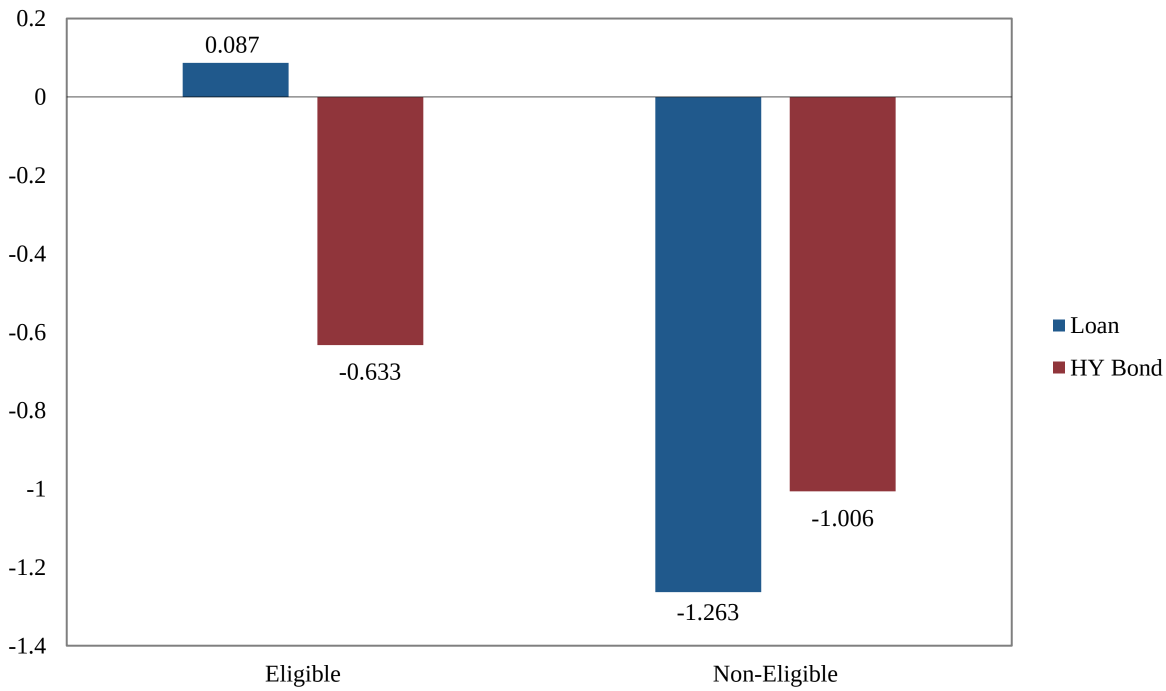


Figure 4. Par Building Activity by Loan Price

This figure plots the average of net CLO trade amount by loan price. We construct a sample of loan-month observations that are in the intersection of loan fund holdings and CLO holdings datasets. We restrict the sample to trades that were executed between January 2010 and December 2020. For each loan-month, we aggregate the net trade amount by CLOs at face value. The net trade amount is calculated as total buy trades at face value minus total sell trades at face value for each loan-month. The Y-axis represents the average of net trade amount among the loan-month observations. Loans are grouped into bins based on monthly average of daily quoted prices. The first (last) bin indicates all trades executed by CLOs in loans that are priced below 70 (above 110). Other bins are created by an increment of 2.5 of par value. For example, the 80 bin includes CLO trades involving loans that are priced between 80 (inclusive) and 82.5 (exclusive).

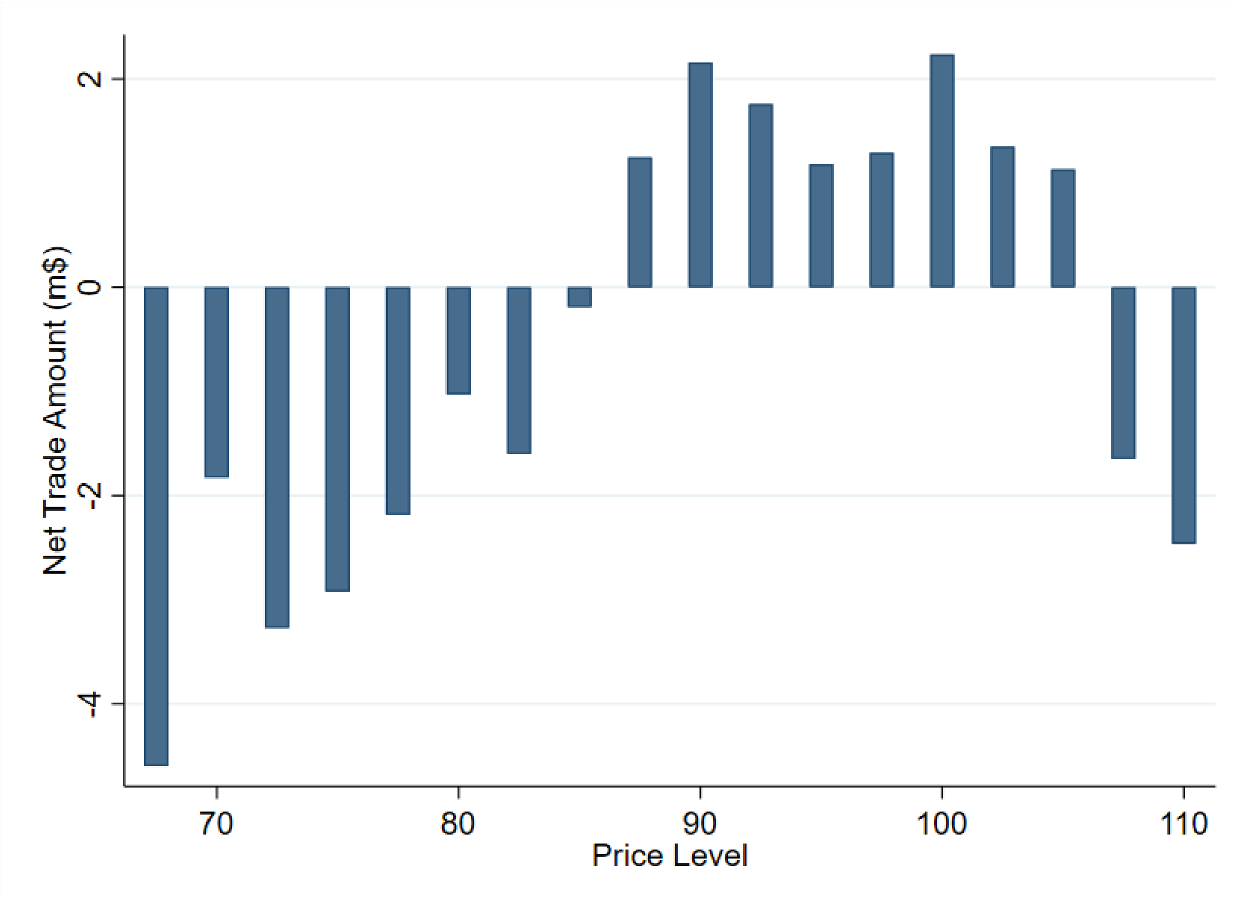
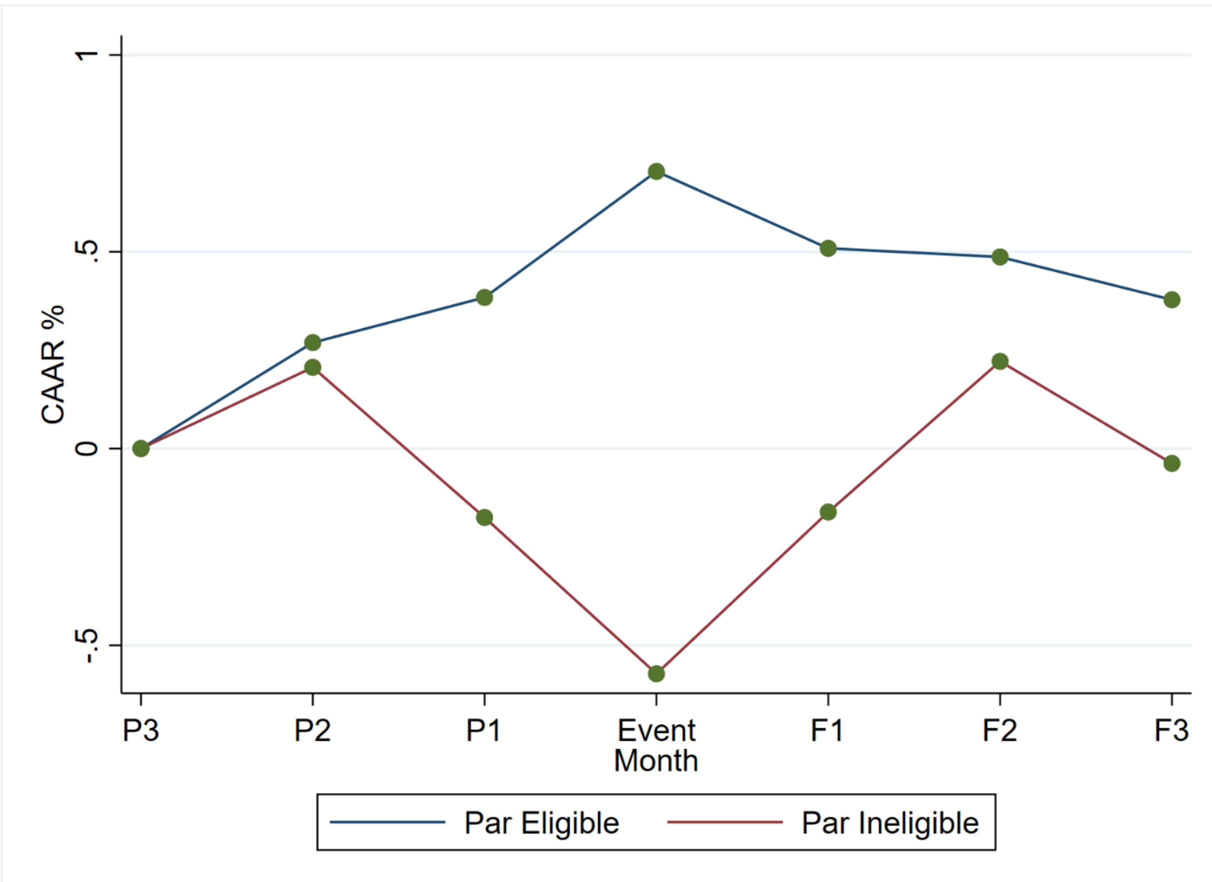


Figure 5. Cumulative Abnormal Returns Around Loan Fund Fire Sales by Par Build Eligibility

This figure plots cumulative average abnormal returns (CAARs) for loans that are subject to mutual fund sell pressure. CAARs are measured as monthly returns in excess of the equally weighted average return of all loans held by loan mutual funds at the start of the month. Transactions in the event month are identified as "forced" if its flow pressure measure is in the bottom quartile. The blue line represents loans that are par build eligible, which are priced at or above 90 percent of face value in the event month. The red line represents loans that are par build ineligible, which are priced below 90 percent of face value. The sample is restricted to loans priced between 87.5 and 92.5 percent of par.



Appendix A.

Table A1. Flow-performance relationship in loan, bond, and high yield funds.

This table provides estimates of the flow-performance relationship for loan funds, general corporate bond funds, and high yield bond funds. The sample is from January 2003 to December 2020. The unit of observation is share class-month. The dependent variable, $Flow_t$, is the net flow as a percentage of the prior month's total net assets (TNA). For the lagged performance measure, in columns (1)-(3) we use raw returns and in columns (4)-(6) we use alpha. *Return* is the annualized net return in percent. *Alpha [t-12:t-1]* is estimated using a 2-factor model on a 12-month rolling sample up to last month, requiring 9 minimum observations. The factors used in estimating alpha for loan funds are excess returns of the ICE BofA US Corporate Index (*BofA*) and the S&P/LSTA LL Index (*LLI*). For bond funds and high yield funds, the two factors are excess returns of the *BofA* index and the S&P Merrill Lynch US High Yield Corporate Bond Index (*HYBond*). Flow, Return and Alpha are winsorized at 1% and 99% levels. *I(Performance < 0)* is a dummy variable equal to one if the corresponding performance measure is negative. Controls include lagged flow, the natural logarithm of total net assets in millions (*Log(TNA)*), the natural logarithm of share class age (*Log(Age)*), the net expense ratio in percent (*Expense Ratio*), and an indicator variable for whether the share class charges rear loads (*I(Rear Load)*). All regressions include share-class and month fixed effects. Standard errors are clustered at the share-class level and *t*-statistics are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% statistical significance, respectively.

	Performance: Return			Performance: Alpha		
	(1)	(2)	(3)	(4)	(5)	(6)
	Loan Funds	Bond Funds	High Yield Funds	Loan Funds	Bond Funds	High Yield Funds
Performance_{t-1}	0.071***	0.001	0.025***	13.768***	1.601***	2.959***
	(2.70)	(0.22)	(3.52)	(4.36)	(6.27)	(5.12)
$\text{I}(\text{Performance}_{t-1} < 0)$	-0.512	-0.172***	0.025	0.010	-0.222***	-0.199*
	(-1.49)	(-3.01)	(0.13)	(0.04)	(-4.31)	(-1.88)
$\text{Performance}_{t-1} \times \text{I}(\text{Performance}_{t-1} < 0)$	0.018	0.025***	0.035**	-7.791**	0.596*	-0.226
	(0.32)	(4.41)	(2.28)	(-2.41)	(1.83)	(-0.31)
Lagged Flow	0.214***	0.144***	0.085***	0.153***	0.102***	0.036***
	(10.84)	(23.30)	(6.36)	(6.21)	(15.67)	(2.67)
Log(TNA)	-0.158	0.289***	0.383***	0.256*	0.368***	0.528***
	(-0.96)	(8.37)	(4.39)	(1.76)	(10.24)	(5.72)
Log(Age)	-5.929***	-3.954***	-4.999***	-5.398***	-3.383***	-4.544***
	(-11.16)	(-34.20)	(-18.21)	(-9.57)	(-26.82)	(-15.34)
Expense Ratio	-3.681	-0.638**	-0.120	0.666	-0.790***	-0.344
	(-1.45)	(-2.39)	(-0.23)	(0.31)	(-3.16)	(-0.74)
I(Rear Load)	0.817	0.104	0.191	1.300**	-0.046	-0.012
	(1.28)	(0.73)	(0.82)	(2.02)	(-0.36)	(-0.06)
Share Class FEs	Yes	Yes	Yes	Yes	Yes	Yes
Month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30,231	422,327	106,388	27,512	398,931	100,785
Adj. R-squared	0.216	0.069	0.079	0.173	0.041	0.061

Table A2. Effects of Flow on Monthly Excess Percentage Returns in Illiquid Periods

This table repeats Table 2, except that the sample period is from January 2003 to December 2019. The unit of observation is fund-month. Standard errors are clustered at the fund level and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Loan Funds			Bond Funds			High Yield Funds		
	VIX	HYBB	TIGHTEN	VIX	HYBB	TIGHTEN	VIX	HYBB	TIGHTEN
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flow	0.292***	0.427***	0.324**	-0.030	0.068	0.379	-0.906	-0.844	-0.662
	(2.99)	(2.96)	(2.44)	(-0.08)	(0.19)	(1.05)	(-1.10)	(-0.97)	(-0.84)
Flow × I(Illiquid Period)	0.668*	0.192	0.614	2.289***	1.964***	1.320***	1.959**	1.696**	1.508*
	(1.76)	(0.54)	(1.56)	(5.70)	(4.91)	(3.30)	(2.31)	(2.03)	(1.79)
I(Illiquid Period)	-0.328**	-0.307*	-0.454***	-0.174***	-0.169***	-0.204***	0.121	0.129	-0.250***
	(-2.28)	(-1.92)	(-3.33)	(-3.50)	(-3.42)	(-5.00)	(1.47)	(1.57)	(-3.81)
Alpha [t-12 : t-1]	-3.509	-3.396	-4.257	-18.303***	-18.103***	-18.006***	18.740**	18.843**	18.564**
	(-0.51)	(-0.50)	(-0.64)	(-4.16)	(-4.09)	(-4.10)	(2.11)	(2.10)	(2.11)
Lagged Flow	0.003	0.006	0.004	0.112	0.118	0.113	-0.113	-0.134	-0.148
	(0.02)	(0.03)	(0.02)	(1.25)	(1.30)	(1.27)	(-0.72)	(-0.87)	(-0.96)
Log(TNA)	-0.006	-0.007	-0.006	0.017***	0.016***	0.016***	0.007	0.007	0.008
	(-0.48)	(-0.51)	(-0.49)	(4.99)	(4.93)	(4.93)	(1.12)	(1.09)	(1.13)
Log(Age)	0.009	0.011	0.010	-0.023***	-0.023***	-0.022**	-0.006	-0.006	-0.006
	(0.31)	(0.36)	(0.33)	(-2.69)	(-2.61)	(-2.54)	(-0.31)	(-0.31)	(-0.31)
Expense Ratio	5.562	5.321	5.328	7.315***	7.287***	7.414***	-5.087**	-5.238**	-5.303**
	(1.12)	(1.09)	(1.08)	(4.14)	(4.13)	(4.19)	(-2.09)	(-2.19)	(-2.22)
I(Rear Load)	0.008	0.007	0.007	0.029**	0.030**	0.029**	0.018	0.018	0.018
	(0.32)	(0.28)	(0.27)	(2.20)	(2.23)	(2.21)	(0.93)	(0.92)	(0.92)
Month FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,220	6,220	6,220	123,182	123,182	123,182	28,166	28,166	28,166
Adj. R-squared	0.152	0.151	0.152	0.278	0.277	0.277	0.133	0.133	0.132

Table A3. Price Impact of Flow Pressure by Par Build Eligibility

This table repeats Table 7, except that par build eligible loans are loans with prices of 87.5 percent of par or greater. Results reported in columns (1)-(4) are estimated using the full sample, while those reported in columns (5)-(8) are estimated using loans and bonds with prices in the interval from 85 to 95 percent of par. Columns (1), (2), (5), and (6) are for loans, and columns (3), (4), (7), and (8) are for high yield bonds. The unit of observation is security-month. Standard errors are clustered at the security level and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Percentage Change in Price							
	Full Sample				Price (*t*) in [85 : 95]			
	Loans		High Yield Bonds		Loans		High Yield Bonds	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Flow Pressure Sd	0.083***		0.340***		0.550***		0.804***	
	(6.02)		(17.24)		(4.94)		(7.62)	
Flow Pressure Sd × I(Price (*t*) < 87.5)	1.073***		2.217***		0.754**		0.510	
	(5.20)		(7.30)		(2.52)		(1.28)	
Buy Pressure Sd		0.112***		0.314***		0.527***		0.373***
		(9.35)		(10.67)		(4.83)		(3.57)
Sell Pressure Sd		-0.024		-0.113***		-0.314***		-0.680***
		(-1.48)		(-4.68)		(-2.81)		(-5.94)
Buy Pressure Sd × I(Price (*t*) < 87.5)		-0.424*		0.833***		-0.367		0.162
		(-1.74)		(3.10)		(-1.32)		(0.42)
Sell Pressure Sd × I(Price (*t*) < 87.5)		-1.102***		-1.956***		-0.835***		-0.484**
		(-6.30)		(-8.01)		(-3.13)		(-2.09)
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,437	28,437	30,911	30,911	2,671	2,671	3,322	3,322
Adj. R-squared	0.13	0.13	0.18	0.18	0.44	0.45	0.55	0.55