CFR WORKING PAPER NO. 15-09

Interfund Lending in Mutual Fund Families: Role in Liquidity Management

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November 2018

Abstract

Although the 1940 Act restricts interfund lending within a mutual fund family, families can apply for regulatory exemptions to participate in interfund lending. We find that the monitoring mechanisms and investment restrictions influence the family's decision to apply for interfund lending. We document several benefits of interfund lending for the equity funds. First, participating funds reduce cash holdings and increase investments in illiquid assets. Second, investors in participating funds exhibit less run-like behavior. Third, it helps mitigate asset fire sales for participating funds subsequent to extreme investor redemptions. Offsetting these benefits, money market funds in participating families experience investor outflows.

JEL Classification: G23, G28, G32

Keywords: interfund lending, financial fragility, fire sales, liquidity management

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Interfund lending in mutual fund families: Role in liquidity management

Introduction

Under the Investment Company Act of 1940 (henceforth 1940 Act), open-end mutual funds in the U.S. have to provide daily liquidity to their investors. If these funds invest in illiquid securities, such liquidity provision can impose several types of costs on funds. First, the managers have to sell assets in a relatively short period of time, which can lead to costly fire sales (Coval and Stafford, 2007). Second, illiquid funds are more susceptible to investor runs and financial fragility (Chen, Goldstein, and Jiang, 2010; Goldstein, Jiang, and Ng, 2017). With more illiquid investments, fund investors can anticipate the fire sale externalities from other investors' redemptions, thereby redeem strategically especially after poor fund performance. Third, liquidity buffers such as cash holdings are associated with lower returns compared to those from illiquid investments. While funds can hold more cash to deter fund runs, it reduces investment efficiency (Liu and Mello, 2011).

We provide the first study on the interfund lending program (henceforth ILP), a liquidity management tool that facilitates liquidity sharing within the fund family. Borrowing and lending within the family as an internal capital market have not been examined previously in the literature, perhaps because the 1940 Act prohibits borrowing and lending between affiliated funds (i.e., funds belonging to the same family) to prevent potential cross-fund subsidization. However, Section 6(c), Section 12(d)(1)(J), and Section 17(b) of the 1940 Act state that an exemption can be granted by the Securities and Exchange Commission (SEC) if it is "appropriate in the public interest and consistent with the protection of investors." The ILP is an exemption from the 1940 Act that has become increasingly popular as shown in Table 1. Under the ILP, the affiliated funds can borrow from each other to meet their liquidity needs associated with investor redemptions (institutional details follow in Section 1). We address the following questions in this study. First, what is the motivation for fund families to apply for the ILP? Second, what are the implications of the ILP for the funds and fund investors?

Finally, when and to what extent do funds exercise the option to use the ILP, and can the ILP help reduce flow-induced fire sales of stocks held by funds?

There are reasons to believe that the ILP can benefit both funds and investors. First, due to access to liquidity provision from affiliated funds within the family, managers can have more flexibility to invest in illiquid securities and hold less cash. Second, with access to the ILP, funds can borrow from affiliated funds to satisfy investor redemptions. This, in turn, provides funds more time to liquidate their investments and lower the price impact of their flow-induced trades, especially when funds face extreme investor outflows that are typically associated with costly fire sales. Third, the ILP can mitigate the fund runs due to strategic investor redemptions. Redemptions from the funds that have access to the ILP are less likely to induce fire sale externalities, so investors that choose to remain in the funds should be less concerned about the adverse effects of the redemptions from other investors.

Offsetting these benefits, there can be several costs associated with interfund lending. First, certain investors of money market funds (MMFs), which are likely to be on the lending side of the interfund transactions, may not like the fact that their funds can now lend to the riskier funds within the family. The ILP can expose the investors of MMFs to the risk of the illiquid funds, which can result in outflows from MMFs if such exposures deviate from the investment objective of the MMF investors. Second, funds have to follow stringent regulatory conditions in the interfund lending agreements.[1] Funds need to bear substantial compliance costs to establish the internal control procedures necessary to satisfy these conditions. In absence of a proper monitoring mechanism and failure of controls, funds can face significant litigation costs, loss of reputational capital, and investor redemptions.[2]

[1] For example, the interfund loan rate is typically the average of the external lending and borrowing rates to minimize the possibility of cross-fund subsidization. Funds need to meet conditions related to the duration of the loans, the upper limit for borrowing, and the seniority of the loan. The basic structure of the interfund lending arrangement is largely similar across fund families. For an example of interfund lending arrangement within the T. Rowe Price family, see Online Appendix I.

[2] The SEC in 2015 investigated the inadequate conflicts of interest disclosure of interfund loans by a private fund, Stilwell Value LLC. Although the total loan of $20 million was fully repaid, Stilwell incurred a penalty of $589,000 to settle the case, and was banned from associating with a broker/dealer or registered investment advisor for a year.

We first examine the determinants of a fund family's decision to apply for the ILP. We find that families are more likely to apply when they face better monitoring, such as greater director ownership, more board independence, and larger family size. Under Section 13(a) of the 1940 Act, funds have to seek shareholder approval to participate in interfund lending. Therefore, these findings are consistent with an equilibrium where fund shareholders only allow better-monitored fund managers to have the privilege of using interfund lending, reminiscent of the contracting equilibrium in Almazan et al. (2004) where shareholders constrain poorly monitored fund managers. In addition, we find that the families' decision to apply for the ILP depends on the investment restrictions affecting their funds. In particular, we find a greater propensity for a family to apply when their funds are restricted from external borrowing, or unrestricted from investing in illiquid securities, i.e., when they are more likely to face liquidity problems and are constrained from borrowing externally.

We then examine the implications of interfund lending. First, consistent with the ILP relieving funds' need to maintain liquidity in their portfolios, we find that funds reduce their cash holdings and invest more in illiquid assets. Second, we find that investor flows are less sensitive to poor performance of funds that participate in the ILP. This suggests that the ILP helps mitigate investor runs due to strategic complementarities among the investors of poorly performing funds. Moreover, we show that the effects of the ILP in reducing the flow-performance sensitivity and investor runs are more pronounced among both equity and bond funds that invest in more illiquid assets.

Since the decision to use the ILP is endogenous, we conduct additional tests to corroborate the implications of the ILP on funds' liquidity choice and investors' behavior. First, we use the two-stage least squares (2SLS) methodology and the number of MMFs as a proportion of the total number of funds in a family as an instrumental variable (IV) for a family's decision to participate in the ILP. Families with more MMFs should have a greater source of liquidity and therefore are more likely to participate. Moreover, the presence of MMFs should not directly affect the portfolio liquidity and flows of affiliated funds except through the ILP, since Section 17 of the 1940 Act restricts transactions among affiliated funds (unless they obtain exemption for interfund lending). Second, we implement a matched sample approach where we match the treated funds (those with access to the ILP) with control funds (those without access to the ILP) on observable fund and family characteristics. Finally, we use the September 11 terrorist attacks as an exogenous shock to investor flows. Our results are robust to the use of these identification approaches.

After documenting the benefits of the ILP, we switch to examining its costs. Consistent with the notion that MMF investors may not like the fact that access to the ILP allows their funds to lend to more risky and poorly performing equity funds, we find that MMFs experience significant reduction in net flows after participation in the ILP. We further show that these findings are not driven by the industrial trends and changes in macroeconomic conditions that potentially affect MMF flows.

Finally, we manually collect the SEC filings data on funds' utilization of interfund lending to study the determinants and implications of ex-post borrowing through the ILP. Specifically, we first examine when and to what extent funds exercise the option to use interfund lending. We find that the average borrowing amount through the ILP is economically significant (about 3% of borrowing fund's assets). In addition, funds are more likely to use the ILP when they experience outflows, perform poorly, or lack enough cash to satisfy investor redemptions. These results suggest that the funds in general use interfund lending for the intended purpose, i.e., to address funding liquidity problems. Second, we examine whether the ILP can mitigate asset fire sales resulting from investor outflows. We find that the adverse effect of flow-induced pressure on stock performance is significantly weakened if the stock is owned more by funds with ILP. This result suggests that the ex-post interfund borrowing activities play an important role in liquidity management since without such activities, the price pressures should be similar regardless of the ownership of the ILP funds.

Our paper contributes to several strands of literature. First, our paper extends the emerging literature on the liquidity management issues in open-end mutual funds.[3] Recently, there has been growing concerns about the liquidity management practices in open-end funds that have drawn significant attention of the regulators.[4] While traditional liquidity management tools such as cash holdings and credit lines have been studied in the literature, little is known about the nature of costs and benefits of the ILP. We are the first to examine the determinants and implications of the ILP, and our study provides a first step towards understanding the economics of the ILP. Second, our paper contributes to the recent literature on fund runs and financial fragility in open-end funds. Recent studies show that "shadow banks" can also suffer from investor runs due to strategic complementarities, especially when they invest in illiquid asset classes.[5] We find that liquidity sharing through the ILP can help alleviate investor runs and financial fragility, as investor flows are less responsive to poor past performance for funds with the ILP.

1. Institutional background

The 1940 Act places several restrictions on interfund lending transactions. First, Section 17(a) of the Act prohibits lending or borrowing activities between affiliated funds. Second, interfund lending creates a debt-like security for the borrowers, while Section 18(f) prohibits registered open-end investment companies from issuing senior securities except for bank loans. Finally, Section 21(b) of the Act generally prohibits any registered investment company from lending to any person who is under common control with such a company. The purpose of these regulatory restrictions is to mitigate the conflicts of interest between funds and investors. Without these restrictions, the affiliated funds can

[3] See Bhattacharya, Lee, and Pool (2013); Goncalves-Pinto and Schmidt (2013); Casavecchia and Tiwari (2016); Chernenko and Sunderam (2016); Eisele et al. (2017); Agarwal, Aragon, and Shi (2018); and Goncalves-Pinto, Sotes-Paladino, and Xu (2018).

[4] See SEC Release No. 33-10233, 2016. We provide more detailed discussion on policy implications in Section 7.

[5] The growing literature on capital fragility of non-bank financial intermediaries include studies on equity funds (Chen, Goldstein, and Jiang, 2010), bond funds (Goldstein, Jiang, and Ng, 2017), money market funds (Schmidt, Timmermann, and Wermers, 2016), and hedge funds (Aragon, Nanda, and Zhao, 2018).

transfer money using a higher or lower rate than that in an arm's length transaction, which can lead to cross-fund subsidization at the expense of fund investors.

In contrast, the prohibition of interfund transactions also rules out the potential efficiency gains from the internal transactions within the fund family. Section 6(c), Section 12(d)(1)(J), and Section 17(b) of the 1940 Act recognize this possibility and state that an exemptive order can be granted if it protects shareholder interests. The ILP is based on the premise of such exemptions. The ILP application is made by the fund families, and subsequent to the SEC approval, each fund within the family is eligible to participate in interfund lending. In general, fund families establish a central credit facility that allows their funds to lend to and borrow money from each other to meet investor redemptions.

Although the direct costs to apply for the ILP may not appear substantial, regulators have imposed a number of restrictions associated with the implementation of these programs to protect the fund investors. For example, Section 13(a) of the 1940 Act mandates that funds have to obtain shareholder approval to engage in interfund lending. The interfund loan rate is typically set to be the average of the external lending and borrowing rates to prevent cross-fund subsidization.[6] Interfund lending arrangements limit borrowings to 10 percent of a fund's total assets on an unsecured basis for a short duration. Any amount borrowed in excess of 10% has to be on a secured basis and total borrowings are capped at 33 1/3 percent of total assets in accordance with the 1940 Act leverage restrictions. If a fund has any outstanding secured loan from an outside lender, the interfund loan has to be secured with at least an equal priority. In addition, funds can only borrow for a short period of time (duration of loan not exceeding seven days and lender fund can demand repayment at any time)

[6] The optimality of the loan rate is not obvious. On one hand, internal lenders may face greater risk when lending to affiliated funds that may be performing poorly or are liquidity constrained. On the other hand, the internal lenders may face lower risk due to less information asymmetry about the affiliated borrowing funds. Unfortunately, it is not feasible to conduct large-scale empirical analysis on the loan rate due to lack of sufficient data on it, since the funds are not required to systematically report such information during our sample period.

to meet investor redemptions. The borrowers can only use excess cash that the lenders would otherwise invest in short-term instruments.

2. Related literature and development of hypotheses

Our first hypothesis is regarding the determinants of the interfund lending applications. We posit funds' monitoring mechanisms and investment restrictions are likely to influence a family's decision to apply for the ILP. Families with stronger monitoring mechanisms should be in a better position to comply with the stringent regulatory requirements, and are less likely to violate the terms and conditions of the ILP. This, in turn, will reduce their risk of facing substantial litigation and reputational costs and investor withdrawals. Therefore, funds with better monitoring mechanisms should be more likely to apply for the ILP.

We test this prediction using different proxies for monitoring mechanisms that include internal monitoring by fund boards and external monitoring by fund investors. As required in the ILP agreements, fund boards are responsible for the proper implementation of the ILP and compliance with the regulatory guidelines. Therefore, our first set of monitoring proxies relates to internal mechanisms such as board characteristics and family size. Directors with more ownership in their funds should have greater incentives to monitor (Chen, Goldstein, and Jiang, 2008; Cremers et al., 2009). Independent board members are likely to provide better monitoring quality due to less conflicts of interest (Yermack, 2004; Khorana, Tufano, and Wedge, 2007), and smaller boards are likely to have less coordination problem (Yermack, 1996; Eisenberg, Sundgren, and Wells, 1998).[7] Larger families with more funds are likely to have better monitoring from peers (Almazan et al., 2004). Our second set of monitoring proxies relates to external mechanisms. Institutional investors can be more active in monitoring fund performance and operations than retail investors (Evans and Fahlenbrach, 2012). Load fees discourage

[7] Recent literature finds that small boards may not be optimal for decision making in complex firms that have a greater demand for board advising (Coles, Daniel, and Naveen, 2008).

investor redemptions (Chordia, 1996) and therefore funds without load fees should face more external monitoring from the investors.

Funds' investment restrictions should also affect the decision of their families to apply for the ILP. Funds face different investment restrictions such as borrowing (including margin purchases and short sales) and investing in illiquid securities (see Almazan et al., 2004 for details). If a fund has external borrowing restrictions, it is likely to benefit more from the ILP as it effectively relaxes those restrictions. In addition, funds may be prohibited from investing in illiquid or restricted securities. Such funds are less subject to fire-sale costs due to flow-induced selling, and therefore should have a lesser need to rely on interfund lending as they face lower costs from funding liquidity shocks.

Taken together, the above economic arguments lead to our first hypothesis:

H1: *Funds with better monitoring mechanisms, more restriction from external borrowing, and less restriction from investing in illiquid securities are more likely to participate in the ILP*.

Our next set of hypotheses are related to the potential benefits and costs of the ILP. We examine the benefits of the ILP for (i) funds' liquidity choice, (ii) investors' redemption behavior, and (iii) flow-induced selling pressure on funds' holdings. First, the ILP should influence the funds' liquidity choice since fund managers can increase the illiquid investments if funds have access to additional liquidity provision from other funds in the family. Specifically, we predict a reduction in funds' cash holdings and a greater investment in illiquid assets.

Second, due to fire sale costs, investors who redeem their capital early create negative externality for others who redeem late. Such strategic complementarities among investors can lead to fund runs captured through the stronger flow-performance sensitivity after poor fund performance (Chen, Goldstein, and Jiang, 2010). If funds have access to liquidity from affiliated funds, investors are less likely to engage in strategic redemptions as the ILP can mitigate the expected fire sale costs. Therefore, we predict that the ILP should weaken the flow-performance sensitivity, especially after poor fund performance.

Finally, large investor outflows can lead to forced selling by fund managers, creating significant price pressure on funds' underlying holdings (Coval and Stafford, 2007). When managers have access to the ILP, they can obtain more liquidity provision from affiliated funds at a lower cost than external borrowing. In addition, interfund borrowing extends the time for the funds to sell the securities, allowing them to patiently trade in smaller amounts and providing more flexibility to manage liquidity shocks. We therefore expect the ILP to mitigate the price impact on the underlying holdings of funds facing large investor redemptions.

Above economic arguments lead to the following hypotheses:

H2a: *Funds choose more illiquid portfolios and hold less cash subsequent to their access to the ILP*.

H2b: *Funds have weaker flow-performance sensitivity subsequent to their access to the ILP, especially after poor performance*.

H2c: *ILP reduces the flow-induced price pressure on the funds' underlying stock holdings when funds experience extreme investor outflows*.

Offsetting the aforementioned benefits, there can be potential costs associated with the ILP. Specifically, there can be outflows from MMFs within the families participating in the ILP. Since MMFs typically hold very liquid assets and are likely to be on the lending side in the interfund transactions, their investors may not like the fact that MMFs are exposed to the higher risk of equity funds, especially if the equity funds tend to borrow after suffering from poor performance. This can prompt the MMF investors to withdraw their capital after the fund families obtain access to the ILP.

H3: *Money market funds experience less net flows subsequent to their participation in the ILP*.

3. Data and variable construction

3.1 Interfund lending data

We build a comprehensive data on the ILP from multiple sources since the data on SEC exemptive orders are not available from standard mutual fund datasets. Fund families who seek to obtain exemptive orders from the SEC have to file Form 40-APP, the *Application for Exemption and Other Relief* under the 1940 Act. After the SEC reviews the applications and considers issuing the exemption, it will issue a Notice (Form APP NTC) that the applications have been received. In accordance with Section 40(a) of the 1940 Act, the Notice has to be posted on Federal Register website for public comments, and the SEC will issue an ORDER (APP ORDR) with its ruling decisions within one month if there is no public hearing on the applications. We construct our sample of the ILP applications by searching the Federal Register website using keywords “interfund”, “Notice of Application”, and “Exemptive Order”.[8] In each Notice, the SEC discusses the application and mentions the names of the funds and their filing dates. We include all the ILP applications filed before December 2013 in our sample.

Funds may change their names, merge with other funds, or be liquidated and disappear. If a fund family only changes the name without significant change in its operations, then it may still be able to use the previously granted exemptive orders.[9] However, if there are material changes to the operations such as a change of an advisor and fee structure, then the family may not be able to use the previously granted exemptive orders. For example, the Marshall Funds changed the name to BMO after acquisition by the Bank of Montreal in 2011. Although Marshall Funds obtained an exemptive order on October 5, 2005, the BMO Funds filed and obtained another exemptive order to engage in interfund lending due to a change in investment advisor. We manually check the history of each family in our sample to ensure proper accounting of such events.

[8] The natural source of interfund lending data comes from the SEC EDGAR website. However, the Form 40-APP data on EDGAR is not available for the entire sample period. Therefore, we use the filing dates from the Federal Register, which provides complete historical information on the filing of interfund lending applications.

[9] For example, AMR Investment obtained an exemptive order for the ILP on May 4, 2004. On February 21, 2005, the company announces that it will change the name to American Beacon Advisors, effective March 1, 2005 although the products and services remain the same. In this case, we find that the funds can still rely on the previous exemptive order since we observe various interfund lending activities in the company’s N-CSR filings.

Table 1 shows the total number of ILP applications by fund families and the number of those applications approved by the SEC. We observe that both the number of applications and SEC approvals increase over time. Note that the numbers of applications and approvals do not always match in every year due to the time taken by the SEC to review the applications and make approval decisions (we do not observe denial or revoking of applications during our sample period). Table 1 also reports both the number and value of equity holdings of funds that have access to the ILP, as well as fraction of these two variables as a percentage of the total number and value of equity holdings of all equity funds in the CRSP mutual fund data. We observe that in general, the percentage of funds and value of equity holdings that are associated with the ILP grow over time, reaching close to 20% and 48%, respectively, at the end of our sample period in 2013. Overall, these statistics suggest that interfund lending is an economically significant phenomenon gaining more importance over time.

3.2 Mutual fund data

We use the Center for Research in Security Prices (CRSP) equity mutual fund data from January 1994 to December 2013 and merge the monthly return and assets under management data with fund characteristics such as expense ratio, load fee, and cash holding. We add the funds' portfolio holdings data from the Thomson Reuters S12 database using the MFLINKS table from the Wharton Research Data Services (WRDS). We focus on domestic equity funds with CRSP style code='E' and 'D'. Following Almazan et al. (2004) and Khorana, Tufano, and Wedge (2007), we manually collect the information on funds' board of directors from fund prospectuses (Forms 485APOS and 485BPOS) such as director ownership, board independence, and board size. We also manually collect the information on credit lines from the N-CSR filings and fund prospectuses.

3.3 Construction of variables

3.3.1 Measures of portfolio illiquidity

We estimate a fund's stock portfolio illiquidity using the Amihud (2002) measure and relative bid-ask spread. The Amihud (2002) measure for a stock *k* in quarter *t* is defined as:

$$Amihud_{k,t} = \frac{1}{N} \sum_{s=1}^{N} \frac{\left| R_{k,s} \right|}{P_{k,s} \times Vol_{k,s}} \quad (1)$$

where *s* is the index for days during quarter *t*, *N* is the number of trading days in the quarter, $R_{k,s}$ is the daily return of stock *k*, $P_{k,s}$ is the stock's closing price, and $Vol_{k,s}$ is the trading volume. We take the weighted average of the Amihud measure of all stocks in a given fund's portfolio, weighted by the dollar amount of holdings in these stocks to compute the first portfolio illiquidity measure (*amihud*). Similarly, we take a weighted average of the relative spread for all stocks held by the fund:

$$spread_{k,t} = \frac{1}{N} \sum_{s=1}^{N} \frac{Ask_{k,s} - Bid_{k,s}}{0.5\left(Ask_{k,s} + Bid_{k,s} \right)} \quad (2)$$

and construct the second portfolio illiquidity measure (*spread*).

3.3.2 Measures of investment restrictions

We follow Almazan et al. (2004) and construct the measures of borrowing and illiquidity restrictions using funds' N-SAR filings. Specifically, to measure a fund's external borrowing restrictions, we take the average of two indicator variables, margin and short selling, which take a value of one if a fund is restricted from margin purchasing and short selling, respectively, and zero otherwise (questions #70.Q and #70.R in N-SAR). Similarly, to measure a fund's illiquidity restriction, we use an indicator variable that takes a value of one if the fund is restricted from investing in illiquid securities, and zero otherwise (question #70.J in N-SAR).

3.3.3 Measures of monitoring mechanisms

We use six variables as proxies for fund's internal and external monitoring mechanisms. Our internal monitoring proxies are director ownership, board size, board independence, and family size. Specifically, the board of directors' ownership (*bodown*) is the average ownership of all board members. For each director, the ownership level is usually reported as a range (e.g., between $10,000 and $50,000), so we take the midpoint of the range (e.g., $30,000). Board size (*numbod*) is the number of board of directors. Following Khorana, Tufano, and Wedge (2007), board independence (*allindep*) is an indicator variable that is equal to one if all directors are independent, and zero otherwise. Funds in the same family usually have the same board (unitary board). Therefore, we construct our board variables at the family level. In the unconventional cases where the family has a separate board for each individual fund, we aggregate the fund-level board characteristics to the family level. Our last measure for internal monitoring is *familysize*, the logarithm of a fund family's total assets under management. To proxy for external monitoring, we use *inst*, i.e., the proportion of institutional shares as a percentage of the fund's assets; and *loadfee*, an indicator variable that is equal to one if a fund charges back-end load fees, and zero otherwise. Finally, we construct a comprehensive monitoring variable, *mon*, by taking the principal component of the six proxies: *bodown*, *numbod*, *allindep*, *familysize*, *loadfee*, and *inst*.

3.3.4 Measures of fund flows and performance

We estimate the net quarterly flows for each fund using its quarterly return and assets under management (AUM) as follows:

$$Flow_{i,t} = \frac{AUM_{i,t} - AUM_{i,t-1}\left(1 + Ret_{i,t}\right)}{AUM_{i,t-1}} \tag{3}$$

where t denotes the quarter and i denotes the fund. To measure fund performance, we estimate factor loadings from the three-factor model in Fama and French (1993) and the four-factor model as in Carhart (1997) using monthly net-of-fee returns over 24-month rolling windows. Alphas are estimated out of sample each quarter using the factor loadings from the prior 24 months.

3.3.5 Measures of alternative liquidity management tools

We measure a fund's use of bank loans through an indicator variable *bankloan*, which equals one if the fund borrows in excess of 1% of their assets either through a bank loan or through an overdraft during the period, and zero otherwise (questions #55.A and #55.B in N-SAR). We measure the fund's cash position (*cash*) as a percentage of the fund's total assets. Finally, the credit line (*cline*) is the dollar amount of credit available as a proportion of a fund family's total assets.

Table 2 reports the descriptive statistics of the variables discussed above.

4. Determinants of interfund lending applications

4.1 Factors influencing the application for the ILP

We first investigate the determinants of interfund lending applications by estimating the Cox (1972) proportional hazard model, i.e., the likelihood that there is an ILP application at *t*+1 given that the family has not applied until time *t*:

$$\lambda_t^{t+1}(x_{i,t}) = \lambda_0(t)\exp\left(x_{i,t}^{'}\delta\right) \quad (4)$$

where $x_{i,t}$ is a vector of fund and family characteristics, δ is a vector of coefficients on these characteristics, and $\lambda_0(t)$ is the baseline hazard function.

Table 3 reports the estimation results of equation (4). We observe from Model (1) that a stronger monitoring mechanism is associated with a greater propensity of ILP filing. Specifically, both better internal monitoring (greater board ownership, independent board, and larger family size) and external monitoring (no back-end load fees) increase the likelihood of ILP filing.[10] In Model (2), instead of using the six monitoring proxies individually, we use their first principal component as a single monitoring measure (*mon*). The coefficient on *mon* is positive and significant, again suggesting that families with better monitoring are more likely to apply for interfund lending. For brevity, we use *mon* as our composite monitoring measure for all subsequent analyses. Moreover, we find that a fund's borrowing and illiquidity restrictions (*borrestrict* and *illiqrestrict*) show a positive and a negative

[10] Coles, Daniel, and Naveen (2008) suggests that both large and small corporate boards can be optimal for different types of firms, and mid-sized boards are suboptimal due to transaction costs. In untabulated results, we find that moderate board size (e.g., board size falling within the middle 50% among all funds) is negatively related to the probability of filing for the ILP. However, examining whether the arguments in Coles, Daniel, and Naveen (2008) about corporate boards apply to our setting requires a comprehensive analysis of the optimal mutual fund board size, which is outside the scope of our paper.

relation, respectively, with the probability of ILP filing. This finding indicates that families with more restriction from external borrowing, and less restriction from investing in illiquid securities are more likely to apply for the ILP. Model (3) controls for any nonlinear effects of family size by including dummy variables for family size quintiles (*i.FSquintiles*) in addition to the linear effect of family size, and yields similar results.

We use fund-quarter observations in our analysis so far to control for various fund-level heterogeneities since the majority of our variables are measured at the fund level. However, since the ILP application is filed at the family level, we next address potential concerns about our prior results. First, the error terms can be correlated for funds within a family. Second, families may overweight the characteristics of its larger funds when making the application decisions. Third, fund-level regression assigns a higher weight to families with more funds due to more observations in the panel data. We address these issues as follows. First, we cluster the standard errors at the family level in all specifications to control for the correlated error terms within the family. Second, in Model (4), we weight the fund-level observations by the fund size (to control for the possibility of overweighting of larger funds) scaled by the number of funds within a family (to control for more funds in larger families). Lastly, we use family-quarter observations and repeat our analysis in Model (5) where we aggregate all the variables at the family level using fund size as weights. Collectively, the findings from these additional specifications are qualitatively similar (albeit somewhat weaker for *borrestrict* in the family-level analysis in the last model, perhaps due to a significant loss of observations).

4.2 Alternative liquidity management tools

Funds can adopt other liquidity management tools to manage investor redemption shocks, such as cash holdings, bank loans, and credit lines. It is not obvious if the different liquidity management tools are substitutes or complements of the ILP. On one hand, funds with alternative tools are likely to have more demand for liquidity, which would predict that these funds are more likely to participate in the ILP, i.e., a complementary relation between the different tools. On the other hand, funds that rely on alternative tools may do so because they have limited benefit from internal borrowing through the ILP, i.e., a substitution relation between the various tools. In Table 3, we find that the two effects seem to offset each other as neither cash nor credit line is significantly related with the ILP application. Moreover, we find evidence of bank loan being negatively related to the ILP.[11] Finally, in Table OA.1 of the Online Appendix, we observe reduction in both credit line and bank loan usage after funds participate in the ILP. These results indicate a weak substitution effect between the ILP and alternative liquidity management tools.

5. Implications of interfund lending

We next explore the implications of the ILP by examining the liquidity choice and investor capital allocation in equity funds that are likely to be on the borrowing side, and net flows into MMFs that are likely to be on the lending side in interfund transactions.

5.1 Changes in funds' liquidity choice

We hypothesize that funds will increase their portfolio illiquidity subsequent to their families filing for the ILP as they need to be less concerned about meeting investor redemptions. We study several proxies of portfolio liquidity: illiquidity of the stock holdings measured by price impact (*amihud*) and relative spread (*spread*), and cash holdings (*cash*). We estimate the following difference-in-differences regressions (DID) to examine the change in liquidity:

$$fundliquidity_{i,j,t+1} = \alpha + \varsigma ILP_{i,t} + \eta \phi_{i,t} + \omega_j + \kappa_t + \varepsilon_{i,j,t} \quad (5)$$

where $fundliquidity_{i,j,t+1}$ denotes the different proxies of liquidity of fund *i* belonging to family *j* during quarter $t+1$; $ILP_{i,t}$ is an indicator variable that is equal to one if fund *i* has access to the ILP in quarter *t*, and zero otherwise; $\phi_{i,t}$ is a vector of fund characteristics at the end of quarter *t*; and κ_t is

[11] One potential explanation for this finding is that when a fund has outstanding secured loan from an outside lender, interfund loan has to be secured with at least an equal priority as we discussed in the institutional background (see Section 1). Therefore, it can be more difficult for a fund to obtain bank loans if it has existing interfund loans, and vice versa.

quarter fixed effects. We control for family fixed effects ω_j and cluster the standard errors at the family level to control for correlated standard errors among funds within the same family.

Our main variable of interest, *ILP*, is an indicator variable that is equal to one for treated funds after they gain access to the ILP, and zero for (a) treated funds before gaining access to the ILP; and (b) control funds that never have access to the ILP. Therefore, equation (5) estimates the change in liquidity choice for the treated funds before and after the ILP, relative to the change in control group of funds that do not have access to the ILP. The control funds help absorb any economic shocks that affect the change in funds' liquidity choices at the same time. The ILP adoptions are staggered across families, as they apply for the ILP at different points of time. Therefore, the specification in equation (5) resembles those in the prior literature that use staggered DID methodology with binary treatment effects.[12] In our sample, the treated funds (from 45 families as shown in Table 1) have 25,106 fund-quarter observations, out of a total of 109,157 fund-quarter observations we use in equation (5). Therefore, there is an economically large variation in our main variable of interest, *ILP*, to allow us to examine how funds are affected by the ILP.

From results reported in the first three models in Panel A of Table 4, we observe a statistically significant increase in the portfolio illiquidity and decrease in the funds' cash holdings after participation in the ILP. These changes are also economically significant. For example, the average decrease in funds' cash (expressed as a fraction of fund's assets) after the ILP filing is 0.304%, or 8.0% of the average cash holdings amount as reported in Table 2. Note that the DID methodology in the first three models in Panel A estimate the differences in fund characteristics before and after the adoption of the ILP, compared to the control group. Therefore, the differences already measure the changes (instead of the level) in the variables. To lend further support to the finding that the funds change their

[12] See Bertrand and Mullainathan (2003), Giroud and Mueller (2010), Amore, Schneider, and Žaldokas (2013), and Acharya, Baghai, and Subramanian (2014). The binary treatment effect variable is equal to one for firms (analogous to funds in our setting) located in a treated state (i.e., family in our case) after state law change (i.e., ILP in our setting).

liquidity choice after the ILP, we include the lagged dependent variables as controls and estimate a dynamic panel with the Arellano and Bond (1991) correction. The last three models in Panel A of Table 4 suggest that our results on fund liquidity choices are robust to using this alternative specification.

We acknowledge that a family's decision to file for the ILP is endogenous. Therefore, we use the two-stage least squares (2SLS) approach to further investigate the implications of the ILP. Specifically, we use the number of MMFs as a proportion of the total number of funds in a family as an instrumental variable (IV). Our IV should satisfy both the validity and the exclusion criteria. Families with more MMFs should have a greater source of liquidity and therefore are more likely to opt for the ILP. This argument forms the basis for the validity of the IV.[13] Our IV should also satisfy the exclusion criterion since it should not directly affect the funds' liquidity choice in the second stage, except through the interfund lending arrangement. The rationale for this argument is that the funds within the same family are legally independent entities. Section 17 of the 1940 Act restricts borrowing, lending, and investing between affiliated funds, unless the family obtains approval for interfund lending. Therefore, the MMFs should not have direct impact on the liquidity choice of the equity funds in the family except through interfund lending.

We report the results of the 2SLS estimation in Panel B of Table 4. First, the proportion of MMFs in the family is strongly related to the ILP access, indicating that we do not have a weak instrument problem. The Kleibergen-Paap *F*-statistic (24.8) exceeds the conventional critical value of 10 for weak instruments (Stock, Wright, and Yogo, 2002) and the critical values compiled by Stock and Yogo (2005). Second, we examine the effect of the ILP on a fund's portfolio liquidity in the second stage where *pILP* is the predicted value of *ILP* from the first stage. We again observe an increase in

[13] Later when we analyze the costs of the ILP, we find that MMFs experience less flows after their family applies for the ILP, suggesting a negative relation between MMFs and ILP applications. Our finding of a positive relation in the first stage implies that the benefits of having a greater source of liquidity outweighs the costs of MMF outflows for the families that choose to apply for the ILP.

funds' portfolio illiquidity and reduction in cash holdings after the ILP. In untabulated results, we also control for nonlinear effects of family size and find similar results.[14]

One potential concern about our finding can be the fact that the *ILP* variable remains unchanged for a long period, during which there can be other confounding effects on funds' liquidity choices. We address this concern as follows. First, we zoom in on changes around the ILP application by restricting the pre- and post-ILP periods to two years for both the ILP funds and non-ILP funds. Our main results continue to hold as shown in Panel C of Table 4. Second, we conduct an event-time analysis in Table OA.2 and observe the effects of the ILP in the two years immediately after a fund has access to the ILP. This indicates that our results are unlikely to be driven by any confounding shocks that occur long after funds obtain access to the ILP. The same table also shows that there are no observable differences in the outcome variables for the ILP and non-ILP funds before the ILP.[15]

Our results so far support the hypothesis that funds choose more illiquid portfolios after gaining access to the ILP. However, there can be a potential concern of reverse causality in the form of a feedback effect where mutual fund investments affect stock liquidity. Such a feedback effect is likely to bias against our findings. For example, Brunnermeier and Pedersen (2009) show that a reduction in traders' funding liquidity negatively affects the market liquidity of their asset holdings. In our setting, since the ILP alleviates the funding liquidity constraints, we should have found an improvement in the asset liquidity due to feedback effect. In contrast, we find that ILP is negatively associated with the liquidity of funds' assets, suggesting that feedback effect is not significant enough to alter our findings. Another channel of feedback effect is that institutional ownership can affect firms' real investment

[14] Like in Table 3, we do not include family fixed effects since the variables to proxy for board monitoring and investment restrictions usually do not change over time for a given family. In addition, adding family fixed effects would force us to drop the families that never apply for the ILP during our sample period. We do, however, include family fixed effects in the DID analysis to ensure that the results on fund liquidity and flow-performance sensitivity are not driven by unobservable time-invariant family attributes.

[15] This test is essentially a test of dynamic effects in prior studies that use staggered DID methodology (Bertrand and Mullainathan, 2003; Amore, Schneider, and Žaldokas, 2013; Acharya, Baghai, and Subramanian, 2014).

when corporate managers learn from asset prices (e.g. Edmans, Goldstein, and Jiang, 2015). This channel should also bias against our finding since lower funding constraints for institutional investors due to the ILP should make the prices more informative, which should help the corporate managers to better learn from stock prices, resulting in greater price efficiency and liquidity.

We conduct several additional robustness checks for the findings on funds' liquidity choices after access to the ILP. First, we use a matched sample approach and match the treated and control funds based on observable fund and family characteristics. Second, we conduct a Granger causality test by including the changes in fund liquidity in the determinants regression of the ILP applications.[16] Third, since the choice of the ILP application is made at the family level, we repeat the analysis by aggregating fund-level characteristics to the family level using funds' assets as weights. Lastly, we use fund fixed effects instead of family fixed effects to control for any time-invariant fund-level omitted variables that affect funds' liquidity choices. Our results are robust to these alternative specifications and tests reported in Tables OA.2 through OA.5 in the Online Appendix.

Despite conducting these battery of tests, we acknowledge that it is challenging to unambiguously identify a causal relation between the ILP and the changes in fund's portfolio liquidity. However, we believe it is still interesting to document that a fund family simultaneously files for interfund lending when it shifts towards more illiquid portfolio after controlling for observables and instrumenting the decision to apply for the ILP. Overall, the results in this section support our second hypothesis that the funds choose to increase their portfolio illiquidity when faced with lower cost of providing liquidity to their investors due to the access to interfund lending.

[16] A predictive regression such as the one in equation (5) may suffer from the Stambaugh (1999) bias, since such a bias can also arise in regressions using panel data with fixed effects (Pástor, Stambaugh, and Taylor, 2015). However, Granger causality test in Table OA.3 shows that an increase in fund illiquidity does not precede the ILP application. Therefore, the innovation in our regression disturbance does not drive the change in the independent variable. In addition, if funds that experience liquidity problems in the past are more likely to apply for the ILP, this would lead to a downward bias in the estimate of the *ILP* variable, i.e., the mean reversion of fund liquidity choice can only bias us against our findings.

5.2 Changes in investors' capital allocation

In this section, we first provide the baseline analysis on the implications of interfund lending for the flow-performance relation. We then investigate whether these implications are more pronounced among funds holding more illiquid assets. Lastly, we use a shock to investor redemptions to study the effect of the ILP on mitigating investors' run-like behavior.

5.2.1 Baseline results

Before we study fund investors' capital allocation decisions, we note that investors should be aware of their funds' access to the ILP since they need to vote for it and can also observe its existence through media coverage and various disclosure documents of the funds including their financial statements, prospectuses, and statements of additional information (SAI). We provide examples for each of these channels in the Online Appendix II. For additional evidence, we also include a case study where we examine the page view records of Blackrock's ILP application disclosed in the SEC EDGAR's web server log files. We observe that the number of page views on that specific ILP filing document is economically significant and much greater than the page views on the company's N-CSR filing during a similar period as shown in Online Appendix II.

We next test our hypothesis on the flow-performance sensitivity by estimating the following DID regression:

$$Flow_{i,j,t+1} = \alpha + \beta Perf_{i,t} + \gamma ILP_{i,t} + \delta ILP \times Perf_{i,t} + \eta \phi_{i,t} + \kappa_t + \omega_j + \varepsilon_{i,j,t} \quad (6)$$

where $Flow_{i,j,t+1}$ denotes the investor flows of fund *i* in family *j* during quarter *t*+1, and $ILP \times Perf_{i,t}$ is the interaction term between $ILP_{i,t}$ and fund's performance during quarter *t*. Other variables are as defined previously.

We include several control variables that can affect the flow-performance relation. First, we add fund's illiquidity and an interaction of fund illiquidity and performance to control for the change in fund's illiquidity after its participation in the ILP, and the effect of illiquidity on the flow-performance relation (e.g., Chen, Goldstein, and Jiang, 2010). Second, we control for the interactions between performance and variables related to the likelihood of applying for the ILP, such as family size and the composite monitoring variable (see Table 3). Third, we control for the interaction between performance and risk taking since funds can take more risks after the ILP (as we observe later in Section 5.3). Finally, we include the interaction of the ILP indicator variable with all fund and family characteristics, although we suppress reporting the estimated coefficients for brevity.

Panel A of Table 5 reports the results of the regression in equation (6). We use three measures of past performance: raw return in Model (1), three-factor alpha in Model (2), and four-factor alpha in Model (3). We allow for nonlinearity in the flow-performance relation as investors can have asymmetric responses to good and bad fund performance. This asymmetry is important in the context of fund runs as strategic redemptions by investors should especially apply to poor performance. We report the flow-performance sensitivities for good (i.e., positive) performance, *perfpos*, and bad (i.e., negative) performance, *perfneg*, separately. The interaction terms between *ILP* and *perfneg* are significantly negative, while the interactions between *ILP* and *perfpos* are insignificant. Moreover, these results are economically meaningful. For example, in the specification with three-factor alpha as performance measure, the coefficient on the interaction of *ILP* and *perfneg* is –0.199, while the coefficient on *perfneg* is 0.399. In addition, the sum of the two coefficients is equal to 0.20, with a *p*-value equal to 1.78%. This evidence suggests that the sensitivity of flows to poor performance is reduced, but not completely eliminated, after funds have access to the ILP. These results support our hypothesis that a fund's participation in the ILP helps weaken the flow-performance sensitivity when past performance is poor.

As mentioned earlier, we expect fund investors to be aware of the fund's access to the ILP through various sources. However, it is possible that institutional investors are more sophisticated (e.g., Evans and Fahlenbrach, 2012) and therefore are more likely to be aware of the ILP compared to the retail investors. In Panel B, we estimate the flow-performance sensitivity separately for the institutional and retail flows. For each fund, we compute the institutional and retail flows by aggregating the flows from all institutional and retail share classes in a fund, respectively. Despite a significant reduction in sample size due to missing information on fund share class classifications in the CRSP mutual fund data (around 40%), we continue to observe a weaker flow-performance relation after funds' access to the ILP, and this effect to be more pronounced for institutional clients.

Our results complement the findings from the prior studies (e.g., Chen, Goldstein, and Jiang, 2010; Goldstein, Jiang, and Ng, 2017). Both these studies find that funds with institutional clients are also subject to runs as these clients have "more resources to monitor the performance of their investments, and are more tuned in to news about past performance" (see pp. 610 of Goldstein, Jiang, and Ng, 2017). Taken together, our findings complement those from these prior studies that show funds with institutional investors are also subject to runs. Specifically, we show that run-like behavior from institutional clients is mitigated once their funds have access to the ILP.

We next repeat our analysis of the implications of the ILP for flow-performance sensitivity after considering the fund family's endogenous choice of the ILP. Panel C of Table 5 reports the results of the 2SLS where we replace *ILP* with the predicted value of *ILP* from first stage (*pILP*), and interact the predicted value with fund performance in the second stage. Overall, we find the attenuating influence of the ILP on the flow-performance sensitivity to be robust after controlling for funds' endogenous choice to participate in the ILP.

5.2.2 Additional evidence from funds with more illiquid assets

Chen, Goldsten, and Jiang (2010) and Goldstein, Jiang, and Ng (2017) show that financial fragility is a greater concern for more illiquid equity funds and bond funds, respectively. We investigate whether the ILP can help alleviate the fragility issues among funds investing in illiquid asset classes in two ways. First, in Panel D of Table 5, we re-estimate equation (6) using a subsample of most illiquid equity funds, defined as the top quartile of all funds ranked by the fund illiquidity measure, *amihud*.

We find that the coefficient on the interaction of ILP and poor performance continues to be negative, and the economic magnitude is larger than that for the overall sample reported in Panel A of Table 5.

Second, we follow Goldstein, Jiang, and Ng (2017) (hereafter GJN) and construct a sample of bond mutual funds to further shed light on the role of illiquidity when examining the relation between the ILP and investor runs. We first verify that our results match those in GJN. Specifically, we construct an indicator variable, *low*, that is equal to one if the performance measure (two-factor alpha as in GJN) is negative, and zero otherwise. Model (1) of Table 6 shows that the coefficient on the interaction term between performance and *low* is positive, suggesting a stronger flow-performance sensitivity when bond funds have poor performance in the past.[17]

Next, in Model (2) we examine whether the ILP attenuates the sensitivity of flows to poor performance in case of bond funds too. To maintain consistency with our prior results using equity funds, we include *perfpos*, *perfneg* and the interactions between *ILP* and these two variables (instead of using the *low* dummy as in GJN). We again find that the coefficient on *ILP×perfneg* is negative and significant, while the coefficient on *ILP×perfpos* is insignificant.

Finally, in Models (3) and (4) we extend the flow-performance analysis and further examine the role of fund liquidity. As in GJN, we use the excess fund cash holdings as a measure of bond fund liquidity. Specifically, *illiqfund* is an indicator variable that is equal to one if a fund holds less cash than other funds within the same investment style during the same period, and zero otherwise. Funds following the same investment style arguably hold assets with similar illiquidity levels, therefore a greater level of cash holdings than the peers can be viewed as a proxy for a more liquid fund. In Model (3), we repeat the analysis in GJN by conditioning the sample on poor fund performance measured by negative alpha. We observe that the coefficient on the interaction term between *illiqfund* and performance is positive, suggesting that illiquid bond funds are relatively more subject to investor runs.

[17] We use monthly observations in Table 6 to provide better comparison with GJN, although our results are similar using quarterly observations.

In Model (4), we include the triple interaction between *ILP*, *illiqfund*, and fund performance (and all possible double interactions). The coefficient on the triple interaction term is negative and significant, suggesting that the ILP can help alleviate the investor runs among more illiquid funds.

5.2.3 Evidence from the 9/11 attacks

We use an exogenous shock related to September 11 attacks in 2001 to further address any endogeneity concerns regarding the effect of the ILP on the flow-performance sensitivity. There is no reason to believe that fund managers knew about this event in advance, and filed for the ILP in anticipation. When the attacks occurred, we expect that investors of treated funds (those that had participated in the ILP before the event) will exhibit less run-like behavior and redeem less capital.

Since daily fund assets are not available in the CRSP mutual fund database, we use the daily fund flow data from TrimTabs. The daily flows from Trimtabs are the actual fund flows, and therefore are not subject to measurement error as in the case of flows imputed from funds' assets and returns. We use two windows: [–2,+2] and [–5,+5] around the September 11 attacks. *post* is an indicator variable that is equal to zero in the two- or five-trading-day window before the attacks, and equal to one during the two- or five-trading-day window after the attacks. We exclude the event day because of the unavailability of the fund's NAV at the end of the trading on 9/11 since the markets closed early.[18] We interact *post* with *ILP* as defined earlier and denote the interaction term as *ILP×post*. We conduct a standard DID analysis where our main variable of interest is the interaction term, *ILP×post*, which measures the marginal effect of the ILP on fund flows after the 9/11 attacks.

We report the results from the DID analysis in Table 7. Models (1)-(3) report the results for the [–2,+2] window and Models (4)-(6) present the findings for the [–5,+5] window. First, we observe that the coefficients on the indicator variable *post* is significantly negative in Models (1) and (4). The average daily outflow is 0.067% as indicated by *post* in Model (1), and is economically significant

[18] Rule 22(e) of the 1940 Act allows funds to suspend the withdrawal requests if the market is closed as was the case after 9/11. Therefore, while constructing the indicator variable *post*, we exclude the days when the market was closed.

compared with a mean and standard deviation of daily flows of –0.01% and 0.11% as reported in Greene and Hodges (2002) which also use Trimtabs data. The heavy investor redemption after 9/11 is perhaps not surprising given the severity and unexpected nature of the attacks. Second, the coefficient on the interaction term, *ILP×post*, is significantly positive in Models (2) and (5) where *post* is included but absorbed by the day fixed effects. This indicates that after the attacks, investors withdrew *less* from the funds that participated in the ILP prior to the attacks. In addition, funds may differ in other dimensions such as their exposure to the terrorist attacks, their liquidity reserves, and reputation, all of which can potentially affect investor flows in response to the attacks. In Models (3) and (6), we interact *post* with fund return as a proxy for the fund's exposure to the attacks, fund's cash holdings as a measure of its liquidity reserves, and fund and family sizes as measures of reputation. The coefficients on *ILP×post* remain significant after controlling for these factors, suggesting that our findings are not driven by differences across such dimensions.

5.3 Changes in funds' risk-taking behavior

If the ILP mitigates investor runs and raises the convexity of the flow-performance relation, funds with access to the ILP can have incentives to take on more risks to capture more investor flows and fees, a form of agency cost documented in prior studies (Brown, Harlow, and Starks, 1996; Chevalier and Ellison, 1997). We examine this issue in Table OA.6 in the Online Appendix and find an increase in the style-adjusted volatility of equity funds after obtaining access to the ILP. However, the implications of increased risk for fund investors are not clear since managers may do so to exploit investment opportunities and benefit their shareholders if the ILP relaxes the investment constraints of the funds. Moreover, the implications of fund risk taking on fund performance are challenging to examine since any relation between performance and risk-taking is convoluted by the other consequences of the ILP documented in this study. Therefore, although we observe evidence of more risk-taking behavior after funds have access to the ILP, we do not draw definitive conclusions about whether changes in risk subsequent to the ILP are excessive.

5.4 Changes in flows into money market funds

In this section, we study the change in investor flows into money market funds (MMFs) after the family obtains access to the ILP to shed light on the costs of the ILP. Certain investors of MMFs within the family may not like the fact that their funds can now potentially lend to the illiquid and risky funds in the family since it exposes MMFs to the risk of these funds.[19] In addition, we show later in Section 6.1 that equity funds are more likely to borrow through the ILP when they perform poorly, creating incentive for the MMF investors to withdraw from their funds. Consistent with this prediction, in Table 8 we find that MMFs lose significant investor flows after their families participate in the ILP. For example, we observe a decline of 1.6% in quarterly flows as shown in Model (1), which is economically significant considering that the mean and standard deviation of quarterly flows are 2.4% and 19%, respectively.

Several macroeconomic events occurred during our sample period that affected the MMF industry. First, MMFs experienced a boom and bust followed by extraordinary monetary policy during the recent financial crisis (Kacperczyk and Schnabl, 2013). Starting from August 2007, there was a crisis in the asset-backed commercial paper market, and MMFs had incentives to reach for higher yields as their underlying investments were perceived to have become riskier. The higher yields, in turn, attracted more inflows to MMFs. Second, immediately after Lehman Brothers filed for bankruptcy, the Reserve Primary Fund broke the buck on September 16, 2008, followed by significant outflows from MMFs in the next few days. Third, the Department of Treasury announced a guarantee program on September 19, 2008 that insured all the MMF investments for one year till September 18, 2009, followed by programs announced by the Federal Reserve on October 7 and 21, 2009. These programs stopped the runs on MMFs as the outflows from prime MMFs largely ended by early October 2008 (Schmidt, Timmermann, and Wermers, 2016). Therefore, one potential concern about our result

[19] See, for example, https://www.barrons.com/articles/when-funds-lend-to-one-another-1510369094.

on MMF flows is that it could reflect the intertemporal trend in the MMF industry and fund families' different exposures to this industry.

We address this concern in several ways. First, in Table 8 we control for the trend in aggregate MMF flows by including time fixed effects, which should absorb any industry-level trend in the MMF flows driven by the macroeconomic conditions. In addition, our DID methodology controls for the common economic shocks that affect the *changes* in fund flows for the treatment group and the control group at the same time. Second, the MMFs' exposures to the macroeconomic conditions should be reflected in their realized returns. Since we include MMF returns in all specifications, it should further help control for the MMFs' exposures to macroeconomic shocks. Third, MMFs may experience abnormal investor flows during the three periods of boom, bust, and Treasury's special guarantee program (08/2007-09/2008, 09/2008-10/2008, and 10/2008-09/2009). If MMFs are affected differently due to these events, then time fixed effects are not going to be sufficient to control for the funds' differential exposures to these events. We conduct additional tests and find that our results on MMF flows are robust after excluding each of the three periods individually, or all three periods.[20] We report these results in Models (2) through (5) in Table 8.

Gaspar, Massa, and Matos (2006) argue that fund families can adopt three strategies for their underlying funds: non-cooperative, risk sharing, and cross-fund subsidization.[21] To the extent that the equity funds have access to more liquidity provision after the ILP, and MMFs can earn a higher return than lending externally, interfund lending belongs to the risk sharing strategy, which benefits both parties involved in an internal capital market transactions. However, our finding of a significant decline

[20] Since we use quarterly data in the analysis, the second period we exclude is from 09/2008 to 12/2008 and the third period is from 01/2009 to 09/2009.

[21] Under the first strategy, funds within the family operate as independent legal entities, as they should by law. Under the second strategy, funds in the same family benefit each other through the sharing of information or risks. Under the third strategy, certain funds in the same family systematically take advantage of other funds.

in net flows into MMFs after the ILP suggests that cross-fund subsidization is also relevant in our context.

6. Ex-post analysis of interfund lending

Our analysis so far is based on the funds' ex-ante access to the ILP, rather than the actual (ex-post) utilization of the program. It is important to understand whether the funds with access to the ILP actually use it for the intended purpose, and whether utilization of the ILP has the intended consequence, e.g., to help mitigate the asset fire sales.

6.1 Analysis of the borrowing behavior

In general, the borrowing activities through the ILP are disclosed in forms N-30D, N-Q, N-CSR, N-CSRS, and N-SAR. We download these forms that are electronically available starting from January 1994 till the end of our sample period in December 2013 from the SEC EDGAR database. Within each filing, we search for the keywords "interfund", "SEC Exempt", and "Exemptive Order" to identify the use of interfund lending facility, and manually go through the filing and collect information on interfund lending. We construct an indicator variable, *borrow*, that is equal to one if a fund engages in any borrowing through the ILP during the period, and zero otherwise.

After merging with the CRSP mutual fund database, we find that, on average, the ILP is used in 7.1% of all fund-quarter observations. Panel A of Table 9 reports that the ILP usage as a percentage of borrowing funds' assets is economically relevant. For example, these figures are similar in magnitude to another liquidity management tool – cash holdings (see summary statistics reported in Table 2). Since funds are not required to disclose the details of borrowing through the ILP during our sample period, we are likely to underestimate the extent and magnitude of funds' ex-post borrowing activity.[22]

[22] In the future, this information may become more widely available. The SEC recently proposed that mutual funds have to disclose the details on interfund loans in Item 44 on Form N-CEN (SEC Release No. 33-9922).

Panel B of Table 9 reports the results on the funds' utilization of the ILP. We find that funds with access to the ILP are more likely to borrow when they experience investor outflows. This suggests that the funds, in general, use the ILP for its intended purpose as a tool for liquidity management when faced with investor outflows. In addition to the outflows, we find that bad performance (using both raw return and risk-adjusted performance measures) is positively associated with ex-post borrowing, suggesting that the utilization of the ILP takes place when funds perform poorly. This finding is also consistent with the idea that poorly performing funds may face higher external borrowing costs and have greater benefits from using the ILP. Moreover, the interaction term between cash and flow is positive, indicating that cash holdings reduce the fund's need to borrow through the ILP after outflows.

Bhattacharya, Lee, and Pool (2013) (henceforth BLP) show that affiliated funds of mutual funds (AFoMFs) can also provide liquidity to distressed equity funds that experience extreme investor outflows. Therefore, it is important to distinguish our results from BLP. First, the channel in BLP differs from the one in our setting as BLP require the affiliated funds of mutual funds (AFoMFs) as a conduit. This is in contrast to the liquidity management under the ILP where all funds within the family can participate in liquidity provision. Second, BLP highlight that AFoMFs provide liquidity to distressed equity funds *only* when the equity funds suffer from extreme investor outflows, i.e., when fund flows fall into the lowest decile. To allow for this possibility, in Models (3) and (4) of Panel B of Table 9, we use an indicator variable for investor flows in the lowest decile (*extremeflow*). We find that although funds tend to utilize the ILP more when they suffer extreme outflows, they are also more likely to use the ILP when they experience less than extreme outflows. For robustness, in Models (5) and (6) we exclude the observations where *extremeflow*=1 and find that investor flows are negatively related to the probability of using the ILP. These results are in sharp contrast with those in BLP since the liquidity provision to distressed funds by AFoMFs is illegal (see p.174 of BLP). Fund families are more likely to violate their fiduciary duty when the benefit of providing liquidity significantly outweighs the cost.[23] In our setting, funds are not restricted to borrow through the ILP only when they suffer from extreme outflows, since the ILP is a legal liquidity provision facility within the fund family.

6.2 Price pressure from extreme investor outflows

Coval and Stafford (2007) show that investor outflows from equity mutual funds can lead to fire sale of the stocks. If funds can borrow through the ILP to meet temporary liquidity needs, we should expect that the ILP can alleviate the flow-induced price pressure on the mutual funds' underlying stock holdings. Although Coval and Stafford (2007) condition their tests on stock sale due to large investor outflows, there is a concern that fund managers can still sell for informational reasons (Edmans, Goldstein, and Jiang, 2012; Huang, Ringgenberg, and Zhang, 2016; Agarwal and Zhao, 2017). Therefore, we follow Edmans, Goldstein, and Jiang (2012) to compute the flow-induced pressure at the stock level conditional on outflows being equal to or more than 5% of a fund's assets, by assuming a fund sells shares in proportion to its holdings:

$$press_{k,t} = \sum_{j=1}^{N} \frac{F_{j,t} \times Shares_{k,j,t-1} \times PRC_{k,t-1}}{TA_{j,t-1} \times Vol_{k,t}} \quad (7)$$

where $press_{k,t}$ is the pressure measure on stock *k* in quarter *t*, $F_{j,t}$ is the absolute value of dollar outflow for fund *j*, $s_{k,j,t-1} = \frac{Shares_{k,j,t-1} \times PRC_{k,t-1}}{TA_{j,t-1}}$ is the fund's ownership of the stock as a percentage of fund's total assets, and $Vol_{k,t}$ is the dollar trading volume of the stock during a quarter. The interpretation is that for each fund with outflow $F_{j,t}$, we expect the fund to sell $F_{j,t}s_{k,j,t-1}$ of stock *k*. So $\frac{F_{j,t}s_{k,j,t-1}}{Vol_{k,t}}$ measures the expected flow-induced trade of stock *k* by fund *j* as a percentage of a

[23] This argument is in line with Becker (1968)'s theory of crime: people commit crime when the expected benefit exceeds the expected cost of being caught and punished.

stock's total trading volume. The benefit of estimating funds' hypothetical sale is that it is induced by investor flows rather than funds' discretionary trades (Edmans, Goldstein, and Jiang, 2012).

To examine whether the pressure generated by the ILP funds and non-ILP funds have different effects on stock prices, we next construct a variable *ilpown* to measure the ownership by the ILP funds as a proportion of the total mutual fund ownership. We then estimate the following regression:

$$CAR_{k,t} = \alpha + \beta press \times ilpown_{k,t} + \gamma press_{k,t} + \delta ilpown_{k,t} + \eta \phi_{k,t} + \kappa_t + \varepsilon_{k,t} \quad (8)$$

where $CAR_{k,t}$ is the quarterly cumulative abnormal return of stock *k* in quarter *t*, $\phi_{k,t}$ denotes stock characteristics such as size and book-to-market ratio, and κ_t denotes time fixed effects.

Table 10 reports our findings. The coefficients on *press* is negative, indicating that more selling pressure on the stocks due to fund outflows leads to worse stock performance. More importantly, the coefficient on *press*×*ilpown* is positive and significant. This result suggests that the effect of flow-induced pressure on stock performance is significantly weakened if the stock is owned more by funds with access to interfund lending. The sum of the coefficient on *press*×*ilpown* and *press* is negative (e.g., –0.451=0.371–0.822 in Model (1)). This implies that the ILP can help mitigate, but not eliminate, the price pressure on the stocks due to outflows. Note that these findings should be due to the ex-post borrowing activity because we condition our analysis on outflows. Given the same outflows, the price pressure generated by the ILP and non-ILP funds should be similar if funds do not use the ILP. [24]

Goncalves-Pinto and Schmidt (2013), henceforth GS, show that cross-trading between funds in the same family can also help mitigate the costs of asset fire sales. However, funds typically have to belong to the same investment style or hold similar assets to engage in cross-trading. In contrast, borrowing funds and lending funds do not have to belong to the same investment style or hold similar

[24] We note that the probability of borrowing of 7% reported earlier is a lower bound of the ex-post borrowing activity since funds are not required to report borrowing through the ILP during our sample period. Therefore, part of the difference of price pressure from the ILP and non-ILP funds can be due to the unreported borrowing activity.

assets to engage in interfund lending. In fact, since the liquidity shocks are likely to be correlated for funds investing in the same asset class, the ILP can help the fund families diversify the liquidity shocks by allowing funds in different asset classes to be involved in interfund transactions. In addition, GS find that there seems to be a reciprocal arrangement and a greater likelihood for the same manager to be involved in such transactions. In contrast, interfund lending provides more flexibility to the fund families as it is not necessary for the same manager to be involved in interfund transactions.

To further distinguish our results on price pressure from GS, we construct their measure of co-insurance (*coinsure*). Specifically, *coinsure* is the relative selling pressure exerted by coinsurance-family funds as a proportion of the total selling pressure:

$$coinsure_{k,t} = \frac{\sum_{f \in CF} \%Sell_{f,k,t}}{\sum_{f} \%Sell_{f,k,t}} \tag{9}$$

where $\%Sell_{f,k,t}$ is the proportion of stock k sold by family f during quarter t. In the denominator, the summation is over all funds owning the stock, while in the numerator the summation is over all funds that belong to the coinsurance families. Following GS, we define the coinsurance family as a family ranked in the top 5% in terms of its number of funds for a given quarter since families with more funds exhibit more cross-trading activities. We then interact *coinsure* with the pressure-sale variable *press* in Models (4) to (6) of Table 10. We find that the interaction term *press*×*coinsure* is positive and significant in all specifications, i.e., co-insurance can help reduce the price impact of flow-induced trading by mutual funds on the stocks, thus supporting the finding in GS. More importantly, the interaction between *press* and the proportional ownership by the ILP funds (*ilpown*) remains positive even after controlling for the effect of co-insurance. This result further confirms that the channel of liquidity provision through the ILP is distinct from that in GS.

Overall, the results in this section underscore the importance of the ex-post effects of the ILP for funds' liquidity management, both in terms of its intended use and a reduction of price pressure when funds face redemption shocks.

7. Policy implications and discussion

7.1 Policy implications

Our study has important policy implications. Recently, there has been growing concerns about the liquidity management issues in open-end mutual funds that have drawn significant attention of the regulators.[25] First, the market of open-end funds has grown more complex, with more funds pursuing strategies involving illiquid asset classes such as fixed income (Goldstein, Jiang, and Ng, 2017) and private securities (Agarwal et al., 2018; Kwon, Lowry, and Qian, 2017). Second, with the increased competition and change in industry standards, more funds settle investor redemptions in windows shorter than the seven-day window stipulated in the 1940 Act. Third, recent events have demonstrated the significant adverse consequences of financial fragility when funds fail to properly manage liquidity. For example, following a period of heavy redemption requests, the Third Avenue Focused Credit Fund suffered from forced liquidation and suspended shareholder redemptions. The SEC noted that these factors "*have made the role of fund liquidity and liquidity management more important than ever*", and passed new rules on mandatory liquidity management programs and disclosures including Form N-LIQUID for funds' portfolio liquidity, Form N-1A for their redemption procedures, and Form N-CEN for interfund lending programs and lines of credit (SEC Release No. 33-10233).

Although the Release explicitly cites the ILP as one of the major tools for liquidity management, it does not discuss its costs and benefits. While the traditional liquidity management tools such as cash holdings and credit lines have been previously studied in the literature, little is known about the nature of costs and benefits of the ILP. The lack of academic study on the ILP is surprising, since the mutual

[25] See Investment Company Liquidity Risk Management Programs, SEC Release No. 33-10233, 2016.

fund industry has been using the ILP for more than 20 years, and around 20% of the equity mutual funds have access to the ILP towards the end of our sample period, representing 48% of the total equity holdings of all CRSP mutual funds (see Table 1).

Our study fills the gap in the literature and provides a first step towards understanding the economics of the ILP. We find that ILP can benefit illiquid funds in reducing asset fire sales and investors' run-like behavior, while exposing the investors of MMFs to the risk of the illiquid funds. The regulators should weigh these cost and benefits of interfund lending for making policies related to the liquidity management programs for the open-end mutual funds.

7.2 Comparisons of different liquidity management tools

Funds can adopt other liquidity management tools in addition to the ILP to manage investor redemption shocks. First, funds can use cash holdings as a liquidity buffer to hedge redemption risks. Second, funds can have access to credit lines and bank loans. Third, cross-trading between funds in the same family can help mitigate the price impact associated with flow-induced trading.

There are both pros and cons of the ILP over these alternative liquidity management tools including cash, bank loans, and cross-trading. First, when funds hold more cash for their liquidity needs, they have to forgo profitable investment opportunities. In contrast, by using a common source of liquidity within the family, the illiquid funds do not have to each hold cash, and incur duplicative costs associated with cash holdings. Second, families need to pay commission fees to maintain the lines of credit for the option to borrow externally. In contrast, the ILP provides access to liquidity internally within the family, which can be associated with substantial savings compared with the lines of credit. Moreover, since the interfund loan rate is set to be the average of external borrowing and lending rates, the borrowing funds are likely to benefit from the ILP since they may pay a lower rate of interest compared with bank loans. Third, funds typically have to belong to the same investment style or hold similar assets to engage in cross-trading. Moreover, there seems to be a reciprocal arrangement and a greater likelihood of the same manager involved in cross-trading. In contrast, interfund lending provides more flexibility as it does not have such requirements.

Offsetting the aforementioned relative benefits of the ILP compared to other tools, certain investors of MMFs within the family may withdraw their capital since their funds can now lend to the illiquid and more risky equity funds, especially when the equity funds perform poorly, and expose them to the associated risks. Such issues are unlikely to be associated with the other tools to manage liquidity.

8. Conclusion

We evaluate the determinants and implications of the interfund lending programs in the mutual fund industry. Our results show that fund families that stand to benefit the most tend to apply for the program, i.e., when their funds have better monitoring mechanisms, more restriction from external borrowing, and less restriction from investing in illiquid securities. We document several benefits for funds that have access to interfund lending. First, we observe that the funds shift to more illiquid portfolios and hold less cash. Second, funds with access to interfund lending are less exposed to investor runs. Third, we find that the flow-induced price pressure on stocks conditional on extreme outflows is lower when funds have access to interfund lending. Offsetting these benefits, we find loss of capital for money market funds within the families after gaining access to interfund lending. Finally, we find that funds use interfund lending after outflows and poor performance, situations in which they are likely to face greater liquidity needs. Collectively, these findings should help inform the regulators, investors, and fund managers about the efficacy of interfund lending as a tool for liquidity management.

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Table 1: Interfund lending applications and grants

This table reports statistics on the trend in the interfund lending program (ILP). *Filings* is the number of fund families that file with the SEC for the exemptive order for interfund lending; *Approvals* is the number of fund families that are approved by the SEC for the ILP; *holding_ILP* is the total value of equity holdings (in billions of dollars) of the ILP funds; *holding_pct* is *holding_ILP* divided by the total equity holdings of all CRSP equity funds; *numfund_ILP* is the number of equity funds that have access to the ILP; *numfund_pct* is *numfund_ILP* divided by the total number of CRSP equity funds.

Year	*Filings*	*Approvals*	*holding_ILP*	*holding_pct*	*numfund_ILP*	*numfund_pct*
1994	0	0	13.46	9.51%	12	3.64%
1995	2	0	32.24	18.29%	19	5.25%
1996	1	2	42.15	14.91%	25	4.73%
1997	1	1	58.69	13.69%	32	4.16%
1998	2	1	125.45	19.70%	60	5.71%
1999	8	7	178.98	24.10%	92	8.08%
2000	3	1	262.49	27.77%	128	9.54%
2001	5	1	270.19	28.85%	143	9.19%
2002	7	7	373.47	38.46%	229	12.02%
2003	3	4	1108.5	49.57%	622	16.14%
2004	1	2	1277.6	47.73%	662	17.01%
2005	1	3	1318.2	44.93%	699	17.88%
2006	0	5	1433.6	43.47%	719	18.16%
2007	1	0	1604.7	43.51%	758	17.60%
2008	5	2	1552.4	50.19%	829	17.29%
2009	1	2	1371.8	50.36%	831	17.77%
2010	0	1	1492.9	46.57%	794	18.24%
2011	1	3	1590.3	45.72%	793	18.85%
2012	0	0	1614.9	44.30%	762	19.13%
2013	3	0	1982.6	48.18%	751	20.04%

Table 2: Summary statistics

This table reports summary statistics of the data using fund-quarter observations between January 1994 and December 2013. *amihud* and *spread* are the illiquidity of the fund's stock holdings as measured by Amihud and relative spread (scaled after multiplying by 10^8 and 10^4 respectively for expositional convenience); *ret* is the fund return net of fees in percentage; *alpha3* and *alpha4* are the three-factor and four-factor alphas in percentage, respectively; *numbod* and *bodown* are the number of board directors and director ownership (in thousand dollars), respectively; *allindep* is an indicator variable that is equal to one if all board directors of a fund are independent, and zero otherwise; *loadfee* is an indicator variable that is equal to one if a fund charges back-end load fees, and zero otherwise; *inst* is the proportion of assets from institutional share classes in a fund over the fund's total assets; *mon* is a fund's composite monitoring measure; *borrestrict* is the average of two indicator variables, margin and short selling, which take a value of one if the fund is restricted from margin purchasing and short selling, respectively, and zero otherwise; *illiqrestrict* is an indicator variable that is equal to one if a fund is restricted from investing in illiquid securities, and zero otherwise; *cash* is the cash holdings of a fund as a percentage of the fund's assets; *cline* is the family-level credit line amount as a percentage of family assets; *bankloan* is an indicator variable that is equal to one if a fund borrows in excess of 1% of its assets either through a bank loan or through an overdraft, and zero otherwise; *size* is the logarithm of a fund's assets; *retvol* is the style-adjusted return volatility using the past 12 months of returns (i.e., volatility of fund returns in excess of the average return volatility of all funds in the same style); *exp_ratio* is a fund's expense ratio expressed in percentage; *turn_ratio* is the turnover ratio of a fund; and *flow* is a fund's quarterly flows in percentage.

	N	Mean	SD	25%	Median	75%
amihud	177404	0.31	0.93	0.01	0.02	0.13
spread	177059	2.50	4.60	0.42	0.85	2.01
ret	179932	0.55	3.03	–0.02	0.02	0.87
alpha3	172998	–0.20	4.01	–2.05	–0.19	1.59
alpha4	172998	–0.13	4.24	–2.00	–0.13	1.75
numbod	137910	7.29	5.34	4.00	6.00	9.00
bodown	137910	51.44	33.27	30.00	45.00	75.00
allindep	137910	0.19	0.41	0.00	0.00	0.00
loadfee	121371	0.64	0.47	0.00	1.00	1.00
inst	164210	0.05	0.29	0.00	0.01	0.36
mon	137910	0.00	0.73	–0.43	–0.41	0.32
borrestrict	188019	0.63	0.28	0.50	0.50	0.88
illiqrestrict	188019	0.09	0.21	0.00	0.00	0.00
cash	216618	3.78	5.45	0.55	2.20	4.72
cline	164218	0.70	5.58	0.00	0.00	0.00
bankloan	188019	0.36	0.38	0.00	0.33	0.60
size	217459	18.64	2.12	17.27	18.76	20.15
retvol	184662	0.00	0.47	–0.35	–0.11	0.24
exp_ratio	196072	1.34	1.00	1.00	1.35	1.65
turn_ratio	196072	0.90	0.95	0.36	0.67	1.11
flow	209028	3.39	17.50	–4.20	1.46	9.45

Table 3: Determinants of interfund lending applications

This table reports the estimates from the Cox proportional hazard model, which models the likelihood that there is an ILP application at *t*+1 given that the family has not applied until time *t*. The additional control variables include *size*, *exp_ratio*, *turn_ratio*, and *flow* (untabulated for brevity). Models (1)-(4) use fund-quarter observations and Model (5) uses family-quarter observations. i.*FSquintiles* are dummy variables for family size quintiles. Observations in the weighted Cox model (Model (4)) are weighted by the fund size scaled by the number of funds within a family. Other variables are defined in Table 2. The standard errors are clustered at the family level in all models.

	Pred. Sign	(1)	(2)	(3)	(4)	(5)
Monitoring						
mon	+		0.518***	0.527***	1.446***	1.694***
			(2.86)	(2.84)	(7.42)	(2.75)
bodown	+	0.009***				
		(6.35)				
numbod	–	–0.010				
		(–0.80)				
allindep	+	0.423***				
		(2.90)				
familysize	+	8.377***	7.278***	0.176***	0.188***	0.295***
		(8.25)	(7.70)	(5.43)	(7.45)	(6.21)
inst	+	–0.013				
		(–1.31)				
loadfee	–	–0.459***				
		(–3.50)				
Restrictions						
borrestrict	+	0.711***	0.655***	0.589***	1.221***	0.615
		(3.41)	(3.14)	(2.74)	(3.23)	(1.03)
illiqrestrict	–	–0.903***	–0.893***	–0.782**	–1.958***	–1.101**
		(–2.79)	(–2.78)	(–2.44)	(–3.85)	(–2.03)
Controls						
Alternative tools						
cash		–0.009	–0.010	–0.007	–0.059**	–0.033
		(–0.72)	(–0.78)	(–0.61)	(–2.13)	(–0.91)
cline		–1.435	–2.071	–2.610	0.766	–2.204*
		(–0.77)	(–1.03)	(–1.09)	(0.48)	(–1.87)
bankloan		–0.712***	–0.701***	–0.644***	–1.052**	–0.223
		(–3.30)	(–3.29)	(–3.02)	(–2.27)	(–0.48)
Add'l controls		Yes	Yes	Yes	Yes	Yes
Quarter FE		Yes	Yes	Yes	Yes	Yes
i.*FSquintiles*		No	No	Yes	No	No
Weighted Cox		No	No	No	Yes	No
Observations		58,579	58,579	58,579	58,579	14,222

Table 4: Implications of interfund lending for the liquidity choice of funds

This table reports the post-ILP changes in funds' liquidity choices. *ILP* is an indicator variable that is equal to one for treated funds after they gain access to the ILP, and zero for (a) treated funds before gaining access to the ILP; and (b) control funds that never have access to the ILP. Panel A shows the results using difference-in-differences specifications in Models (1) to (3), and dynamic panel with the Arellano and Bond (1991) correction in Models (4) to (6). Panel B shows the two-stage least squares (2SLS) estimation results. Model (1) shows the first-stage results using the number of money market funds as a proportion of all funds in the family (*mmf*) as an instrument. Models (2) to (4) show the second-stage results where *pILP* is the predicted value of the *ILP* from the first stage. Panel C uses the difference-in-differences specifications and restricts the pre and post sample periods to two years for both treatment and control groups. The control variables in all specifications are the same as those in Model (2) in Table 3 (untabulated for brevity). The regressions control for family and quarter fixed effects and the standard errors are clustered at the family level.

Panel A

	(1) *amihud*	(2) *spread*	(3) *cash*	(4) *amihud*	(5) *spread*	(6) *cash*
ILP	0.056**	0.169**	–0.304**	0.015*	0.096***	–0.164**
	(1.98)	(2.48)	(–1.98)	(1.75)	(2.64)	(–2.03)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	109,157	109,157	109,157	109,157	109,157	109,157
Adj. R^2	0.132	0.507	0.527	0.132	0.507	0.527

Panel B

	First Stage	*Second Stage*		
	(1) *ILP*	(2) *amihud*	(3) *spread*	(4) *cash*
mmf	0.006***			
	(6.43)			
pILP		0.069**	0.199**	–0.266*
		(2.48)	(2.55)	(–1.80)
Controls and Quarter FE	Yes	Yes	Yes	Yes
Observations	109,157	109,157	109,157	109,157
Adj. R^2	0.060	0.039	0.049	0.025

Panel C

	(1) *amihud*	(2) *spread*	(3) *cash*
ILP	0.058**	0.171**	–0.302*
	(2.13)	(2.25)	(–1.86)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes
Observations	94,021	94,021	94,021
Adj. R^2	0.144	0.513	0.558

Table 5: Flow-performance sensitivity after the ILP filing

This table reports the results of the flow-performance regressions using quarterly investor flows (*flow*) as the dependent variable. The main independent variables include three performance measures, all measured at the end of the previous quarter: (i) raw returns in Model (1), (ii) three-factor alpha as in Fama and French (1993) in Model (2), and (iii) four-factor alpha as in Carhart (1997) in Model (3). *perfpos* (*perfneg*) are equal to the positive (negative) values of raw return, three-factor alpha, and four-factor alpha when the corresponding performance measure is positive (negative), and zero otherwise. *pILP* denotes the predicted value of *ILP*. "×" denotes the interaction between the corresponding variables. Panel A reports the baseline results for the overall sample. The control variables include *size*, *exp_ratio*, *turn_ratio*, *lagflow*, *borrestrict*, *illiqrestrict*, *bankloan*, *mon*, *familysize*, *retvol*, and *amihud*. The table also includes the interaction terms between *ILP* and control variables as well as the interactions of fund performance with *size*, *familysize*, *mon*, and *retvol* (untabulated for brevity). Panels B reports the results for institutional and retail flows. For each fund, institutional and retail flows are estimated by aggregating the flows from all institutional and retail share classes in a fund, respectively. Panel C reports the results from the two-stage least squares (2SLS) approach. Panel D reports the results using the subsample of most illiquid funds (those in the top quartile of illiquidity). Control variables in Panels B through D are the same as Panel A, and are not reported for brevity. The regressions control for family and quarter fixed effects and the standard errors are clustered at the family level.

Panel A: Overall sample

	(1)	(2)	(3)
perfpos	0.477***	0.317***	0.249***
	(11.22)	(4.96)	(4.36)
ILP×perfpos	–0.018	0.027	0.044
	(–0.19)	(0.41)	(0.68)
perfneg	0.380***	0.399***	0.336***
	(6.88)	(6.30)	(5.39)
ILP×perfneg	–0.194***	–0.199**	–0.230***
	(–2.74)	(–2.46)	(–2.94)
ILP	0.034**	0.033*	0.058***
	(2.14)	(1.92)	(2.98)
amihud×perf	0.005	0.058***	0.245***
	(0.41)	(3.84)	(16.97)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes
Observations	109,157	109,157	109,157
Adj. R^2	0.281	0.162	0.168

Panel B: Institutional and retail flows

Institutional			
ILP×perfneg	–0.490**	–0.407***	–0.402***
	(–2.41)	(–2.90)	(–2.88)
Retail			
ILP×perfneg	0.040	–0.086	–0.074
	(0.37)	(–0.92)	(–0.80)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes

Panel C: Overall sample (2SLS)

pILP×perfpos	0.002	–0.038	–0.004
	(0.33)	(–0.35)	(–0.04)
pILP×perfneg	–0.161*	–0.270**	–0.273**
	(–1.85)	(–2.27)	(–2.20)
Controls	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes

Panel D: Subsample of illiquid funds

ILP×perfpos	–0.139	–0.077	–0.023
	(–0.88)	(–0.60)	(–0.20)
ILP×perfneg	–0.319***	–0.220*	–0.287**
	(–4.30)	(–1.75)	(–2.02)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes

Table 6: Flow-performance sensitivity for bond funds

This table reports the results of the flow-performance analyses for a sample of bond mutual funds, following the methodology in Goldstein, Jiang, and Ng (2017). Bond funds are selected from the CRSP mutual fund database between January 1994 and December 2013 using Lipper objective codes: A, BBB, HY, SII, SID, or IID; Strategic Insight objective codes: CGN, CHQ, CHY, CIM, CMQ, CPR, or CSM; Wiesenberger objective codes: CBD or CHY; or the first two characters of the CRSP objective code equal to IC. Out-of-sample alphas are the estimated intercepts from fund-by-fund 12-month rolling-window regressions of excess corporate bond fund returns (in excess of the risk-free rate) on excess returns of both the aggregate bond market and stock market. The aggregate bond market return is measured by Vanguard Total Bond Market Index Fund return and the aggregate stock market return is the return on the CRSP value-weighted index. A fund is classified as an illiquid fund (*illiqfund*) when its cash holdings fall below the median value of all the funds within the same investment style during the same period. *low* is an indicator variable that is equal to one if a fund's alpha is negative, and zero otherwise. "×" denotes the interaction between the corresponding variables. The other variables are defined in Table 2. The dependent variable is monthly flow (*flow*) and the control variables include *size*, *exp_ratio*, *turn_ratio*, *lagflow*, *retvol*, *illiqfund*. The table also includes the interaction terms between *ILP* and control variables as well as the interactions of fund performance with *size*, *familysize*, *mon*, and *retvol* (untabulated for brevity). Models (1) and (2) use the full sample of bond funds, and Models (3) and (4) use the subsample of bond funds when fund performance is negative. The regressions use share class-month observations and control for family and month fixed effects. The standard errors are clustered at the family level.

	Full Sample		Alpha<0	
	(1)	(2)	(3)	(4)
perf	0.103*		1.134***	2.026***
	(1.71)		(13.09)	(11.45)
perf×low	0.424***			
	(4.01)			
low	–0.006***			
	(–9.66)			
perfpos		0.760***		
		(4.39)		
perfneg		1.853***		
		(9.74)		
ILP×perfpos		–0.019		
		(–0.15)		
ILP×perfneg		–0.302**		
		(–2.09)		
illiqfund×perf			0.267**	0.477***
			(2.37)	(3.32)
ILP×perf×illiqfund				–0.414**
				(–1.96)
illiqfund			–0.003***	–0.003***
			(–4.51)	(–3.40)
participate		0.006**		–0.004
		(2.08)		(–0.86)
Add'l controls	Yes	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes	Yes
Observations	328,679	328,679	125,156	125,156
Adj. R^2	0.075	0.086	0.097	0.098

Table 7: Investor flows before and after September 11 attacks

This table reports the results of the difference-in-differences analysis of the investor flows before and after the September 11 attacks for the funds with and without access to the ILP prior to the attacks. The dependent variable is the percentage daily investor flows from investors (*dflow*), computed from the daily dollar flows and funds' assets reported in Trimtabs database. We use two windows: [–2,+2] and [–5,+5] around the September 11 attacks. *post* is an indicator variable that is equal to zero in the two- or five-trading-day window before the attacks, and equal to one during the two- or five-trading-day window after the attacks. Models (1)-(3) report the results for the [–2,+2] window and Models (4)-(6) report the results for the [–5,+5] window. "×" denotes the interaction between the corresponding variables. *lagdflow* and *lagdret* are the lagged daily flow and the lagged daily return, respectively. Additional control variables include *ILP*, *cash*, *size*, *familysize*, and *retvol* (untabulated for brevity). The standard errors are clustered at the family level.

	[–2,+2] Window			[–5,+5] Window		
	(1)	(2)	(3)	(4)	(5)	(6)
	dflow	*dflow*	*dflow*	*dflow*	*dflow*	*dflow*
post	–0.067***			–0.053***		
	(–3.01)			(–3.16)		
ILP×post		0.068**	0.079**		0.051**	0.046**
		(2.29)	(2.09)		(2.39)	(2.13)
lagdret	0.013*	0.013*	–0.052	0.020***	0.020***	–0.053
	(1.98)	(1.99)	(–0.95)	(4.09)	(4.07)	(–1.11)
lagdflow	–0.334***	–0.335***	–0.345***	–0.229***	–0.229***	–0.232***
	(–4.38)	(–4.37)	(–4.73)	(–3.84)	(–3.84)	(–3.89)
lagdret×post			0.067			0.074
			(1.22)			(1.57)
familysize×post			–0.002			–0.006
			(–0.08)			(–0.31)
cash×post			0.008			0.004
			(1.33)			(0.79)
size×post			–0.006			0.010
			(–0.40)			(0.84)
retvol×post			–3.411			3.765
			(–0.45)			(0.58)
Add'l controls	Yes	Yes	Yes	Yes	Yes	Yes
Day FE	No	Yes	Yes	No	Yes	Yes
Family FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	745	745	745	1,360	1,360	1,360
Adj. R^2	0.427	0.428	0.438	0.300	0.300	0.304

Table 8: Flows into the money market funds after access to the ILP

This table reports the post-ILP changes in money market funds' (MMFs) investor flows using a panel of fund-quarter observations of MMFs from Morningstar. The dependent variable is the quarterly investor flows (*flow*), and the independent variables are lagged fund characteristics, all measured at the end of the previous quarter. Model (1) uses the full sample of MMFs, Model (2) excludes the period of runs on asset-backed commercial paper (08/2007-08/2008), Model (3) excludes the quarter of runs on MMFs (09/2008-12/2008), Model (4) excludes the period of the Department of Treasury's guarantee program for MMF investments (12/2008-09/2009), and Model (5) excludes all three periods (08/2007-09/2009). The regressions control for the family and quarter fixed effects and standard errors are clustered at the family level.

	(1) *flow*	(2) *flow*	(3) *flow*	(4) *flow*	(5) *flow*
ILP	–0.016**	–0.016**	–0.015**	–0.017**	–0.017**
	(–2.27)	(–2.44)	(–2.18)	(–2.39)	(–2.46)
size	–0.012***	–0.012***	–0.012***	–0.012***	–0.012***
	(–6.81)	(–6.55)	(–6.67)	(–6.64)	(–6.23)
ret	0.141***	0.169***	0.137***	0.136***	0.159***
	(3.45)	(3.16)	(3.27)	(3.45)	(2.90)
loadfee	–0.007***	–0.007***	–0.008***	–0.007***	–0.008***
	(–2.89)	(–2.75)	(–3.22)	(–2.88)	(–3.10)
exp_ratio	–0.037***	–0.039***	–0.036***	–0.034***	–0.036***
	(–4.33)	(–4.52)	(–4.06)	(–4.10)	(–3.98)
familysize	–0.003	–0.002	–0.003	–0.003	–0.003
	(–0.50)	(–0.40)	(–0.51)	(–0.54)	(–0.47)
lagflow	0.010	0.009	0.009	0.007	0.004
	(0.61)	(0.51)	(0.56)	(0.40)	(0.23)
Family and Quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	58,207	55,648	56,705	56,616	52,555
Adj. R^2	0.108	0.105	0.108	0.106	0.103

Table 9: Utilization of the ILP

Panel A reports the summary of the amount of interfund borrowing as a percentage of borrowing funds' assets. Panel B reports the determinants for funds to borrow through the ILP. *borrow* is an indicator variable that is equal to one if a fund engages in interfund borrowing during the period, and zero otherwise. *extremeflow* is an indicator variable that is equal to one if *flow* ranks in the lowest decile among all funds during a quarter, and zero otherwise. Other variables are defined in Table 2 in the paper. Models (1)-(4) use all observations, and Models (5) and (6) exclude the observations where *extremeflow*=1. The control variables include *mon*, *borrestrict*, *illiqrestrict*, *size*, *loadfee*, and *turn_ratio*, and are suppressed for brevity. The regressions control for fund and quarter fixed effects and the standard errors are clustered at the fund level.

Panel A

	25%	50%	75%	Mean	SD
ILP Usage (% of AUM)	0.38	0.90	2.33	3.11	6.11

Panel B

	(1) *borrow*	(2) *borrow*	(3) *borrow*	(4) *borrow*	(5) *borrow*	(6) *borrow*
flow	–0.072***	–0.072***	–0.051***	–0.051***	–0.039***	–0.040***
	(–6.57)	(–6.60)	(–4.36)	(–4.38)	(–3.21)	(–3.24)
cash	–0.002***	–0.002***	–0.002***	–0.002***	–0.002***	–0.002***
	(–5.24)	(–5.23)	(–5.20)	(–5.20)	(–4.63)	(–4.61)
cash×flow	0.010***	0.010***	0.010***	0.010***	0.008***	0.008***
	(4.62)	(4.62)	(4.40)	(4.39)	(3.36)	(3.35)
ret	–0.049*		–0.047*		–0.067**	
	(–1.87)		(–1.80)		(–2.42)	
alpha4		–0.052*		–0.051*		–0.058**
		(–1.90)		(–1.85)		(–2.01)
extremeflow			0.020***	0.020***		
			(4.85)	(4.85)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fund and Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,441	24,441	24,441	24,441	21,813	21,813
Adj. R^2	0.602	0.602	0.603	0.603	0.596	0.596

Table 10: Access to interfund lending and the flow-induced fire sale of assets

This table reports the effect of the ILP on the flow-induced fire sale of assets. The dependent variables are cumulative abnormal returns *car90_1f*, *car90_3f* and *car90_4f* estimated using the CAPM, three-factor model, and four-factor model, respectively for each stock during each quarter. *press* is the stock-level flow-induced pressure defined in equation (7). *ilpown* is the aggregate ownership of the ILP funds as a proportion of total mutual fund ownership in the stock. *coinsure* is the relative selling pressure exerted by coinsurance-family funds as a proportion of the total selling pressure as defined in Goncalves-Pinto and Schmidt (2013). *btm*, *size*, and *ownership* are the book-to-market ratio, logarithm of firm size, and the total mutual fund ownership, respectively. "×" denotes the interaction between the corresponding variables. The regressions control for quarter fixed effects and the standard errors are clustered at the stock level.

	(1) *car90_1f*	(2) *car90_3f*	(3) *car90_4f*	(4) *car90_1f*	(5) *car90_3f*	(6) *car90_4f*
press×ilpown	0.371**	0.530***	0.460***	0.292*	0.456***	0.352**
	(2.28)	(3.45)	(2.97)	(1.73)	(2.86)	(2.18)
press	–0.822***	–0.845***	–0.804***	–0.877***	–0.896***	–0.878***
	(–14.82)	(–16.30)	(–15.26)	(–13.99)	(–15.20)	(–14.73)
ilpown	–0.004	0.009***	0.010***	–0.001	0.012***	0.013***
	(–1.57)	(3.91)	(4.29)	(–0.46)	(4.90)	(5.22)
press×coinsure				0.209**	0.188**	0.259***
				(2.30)	(2.17)	(2.93)
coinsure				–0.018***	–0.014***	–0.013***
				(–10.40)	(–9.15)	(–8.62)
btm	0.003**	–0.002	–0.001	0.003**	–0.001	–0.001
	(2.05)	(–1.61)	(–1.04)	(2.46)	(–1.19)	(–0.65)
size	0.001*	–0.005***	–0.005***	0.002***	–0.004***	–0.004***
	(1.71)	(–17.59)	(–17.43)	(5.10)	(–13.56)	(–13.67)
ownership	0.033***	–0.012**	–0.015**	0.047***	–0.001	0.033***
	(5.04)	(–2.15)	(–2.57)	(7.15)	(–0.20)	(5.04)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	245,672	245,672	245,672	245,672	245,672	245,672
Adj. R^2	0.067	0.036	0.032	0.067	0.037	0.033

Online Appendix I: Interfund lending application by T. Rowe Price

T. Rowe Price fund family applied for the interfund lending program in September 1998. In its application, T. Rowe Price argued that unexpected investor redemptions can create short-term funding liquidity issues. The funds may not have sufficient cash on hand to satisfy withdrawals, and security sales can take several days especially with sale fails while redemption requests are effective immediately. When funds seek external liquidity provision from banks, the borrowing funds pay significantly higher rates to banks than the rate earned by lending funds by investing in short-term instruments of the same maturity. Credit lines from banks require substantial fees in addition to the interests paid. T. Rowe Price argued that liquidity provision from funds within the family through interfund lending programs could help reduce such costs by settling the lending and borrowing needs internally. Their ILP application was approved by the SEC in December 1998.

The 1940 Act initially prohibits transitions between funds belonging to the same family. The main concern with borrowing and lending between funds within a family is cross-fund subsidization at the expense of investors. The interfund transaction would benefit borrowing funds if the internal rate is lower than external lending rate, in which case the lender subsidizes the borrower. Likewise, the borrower can subsidize the lender if the interfund rate is higher than external borrowing rate. To address this problem, for any interfund transactions, the rate is set to the average of external borrowing and lending rates. In addition, the program imposes several other restrictions to ensure the exemptive order is consistent with the protection of investors: (1) the family will ensure the interfund loan rate is calculated using the daily best available external rates for both the borrower and the lender; (2) the board will monitor the terms and conditions of the loans, and make sure that they comply with individual fund's investment policies and limitations; (3) all funds should participate in the program on an equitable basis, and make quarterly reports to the Trustees regarding the ILP; (4) there would be no duplicative costs or fees to the shareholders, and that family would receive no additional compensation for its services in administering the ILP; and (5) interfund loans would not involve a greater risk than other similar investments.

The application imposed strong restrictions to reduce the risk of interfund loans. Below we provide a summary of these restrictions:

- The maturity should be no longer than any outstanding bank loan and less than seven days;
- If default occurs on an outstanding bank loan, the interfund loan will be called by the lender who will exercise all rights regarding any collateral;

- A fund may make an unsecured borrowing through the ILP if its outstanding borrowing from all sources immediately after the interfund loan is less than 10% of its total assets;
- If the fund has a secured loan outstanding from any other lender, its interfund borrowing will be secured on at least an equal priority basis with at least an equivalent percentage of collateral to loan value;
- If a fund's total outstanding borrowings immediately after the interfund loan would be greater than 10% of its total assets, the fund may only borrow on a secured basis;
- Fund may not borrow through the ILP if its total outstanding borrowings immediately after the borrowing would be more than 33 1⁄3% of its total assets;
- If the outstanding borrowings from all sources exceed 10% of its total assets, the fund must first secure each outstanding interfund loan by the pledge of segregated collateral with a market value at least equal to 102% of the outstanding principal value of the loan. If the total outstanding borrowings exceeds 10% of its total assets due to a decline in net asset value or shareholder redemptions, the fund will within one business day repay all outstanding interfund loans, reduce its outstanding debt to 10% or less of its total assets, or secure each interfund loan by collateral with a market value at least equal to 102% of the outstanding principal value of the loan;
- No equity, taxable bond or money market fund may lend to another fund if the loan would cause its aggregate outstanding loans through the ILP to exceed 5%, 7.5%, or 10% of net assets;
- A fund's borrowings through the ILP will not exceed the greater of 125% of the total net cash redemptions and 102% of sales fails for the preceding seven calendar days.
- Interfund loan may be called on one business day's notice by the lender.

After the exemptive order was granted, T. Rowe Price disclosed the interfund lending program for each fund in their SAI (Statement of Additional Information) and financial statements. The other fund families include similar terms and conditions in their ILP applications to the SEC. The ILP also applies to sub-advised funds; for example, see page 64293 of T. Rowe Price's application: (https://www.gpo.gov/fdsys/pkg/FR-1998-11-19/html/98-30893.htm).

Online Appendix II: Investor awareness of the interfund lending programs

To demonstrate investor awareness of the ILP, we first use Blackrock's ILP application as a case study and examine the page view records of it application disclosed in SEC EDGAR's web server log files. Second, we show that investors can learn about the presence of ILP from a number of other sources.

Blackrock's ILP Application

We examine the page view records of Blackrock's ILP application disclosed in SEC EDGAR's web server log files to identify the specific filing document that is related to Blackrock's ILP application (accession=0000905148-15-000620).[1] It is important to note that the ILP application is a separate filing that discloses information only about the ILP. This is unlike other filings such as NA-1 (registration filing), N-CSR, SAI, or fund prospectus etc. that tend to disclose information on multiple items. This makes our identification better since the investor attention is on the event of the ILP filing itself, instead of any other event. Next, we download all the page view records subsequent to Blackrock's filing date on June 26, 2015 up to June 30, 2017 (end date of the log files currently available on EDGAR). The total number of page views since its filing date is 32,594, generated from 1,886 unique IP addresses. The ILP filing document generated 2,865 page views on the ILP filing date, and 7,008 views on the day after the filing date, all classified as non-crawlers by the SEC log files. These page view records are economically significant. As a comparison, the total page views on Blackrock's 2015 shareholder statement (N-CSR filing) is only 7,891 from 951 unique IP addresses over roughly the same period from December 02, 2015 to June 30, 2017.

Unfortunately, the SEC log file is incomplete since the SEC does not appear to track the entire history of network traffic. This is shown in the log file description from the SEC website: "Due to certain limitations, including the existence of lost or damaged files, the information assembled by

[1] The log file is publically available at https://www.sec.gov/dera/data/edgar-log-file-data-set.html.

DERA may not capture all SEC.gov website traffic" (see https://www.sec.gov/dera/data/edgar-log-file-data-set.html). In addition, the server log files are only available starting from January 1, 2003 with the exception of September 24, 2005 to May 11, 2006 when the SEC did not retain the log data (Bauguess, Cooney, and Hanley, 2013). Despite these data limitations, we believe that the Blackrock example should help demonstrate that there is significant attention from market participants on the ILP.

Other Sources of Investor Awareness

SEC EDGAR is only one of the many ways that investors can learn about the ILP. First, there is coverage by major media outlets after the applications.[2] Second, ILPs are disclosed in funds' financial statements.[3] Third, ILPs are disclosed in funds' prospectuses.[4] Fourth, investors can learn about the existence of the ILP from proxy documents mailed to fund investors since they need to vote on the ILP. Fifth, ILPs are disclosed in funds' Statement of Additional Information (SAI) and registration statement (N-1A).[5] Finally, ILP applications have to be posted on the Federal Register website for public comments before final approval.[6]

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[2] For example, Bloomberg covered Blackrock's ILP application in one of its news articles on June 26, 2015: https://www.bloomberg.com/news/articles/2015-06-27/blackrock-seeks-sec-clearance-for-internal-fund-lending.

[3] As an example, Fidelity disclosed its ILP and the interfund lending transactions in its 2017 annual report: https://www.sec.gov/Archives/edgar/data/744822/000137949117008627/filing918.htm.

[4] For instance in Victory Capital's 2017 prospectus, the interfund lending program is disclosed under "Additional Information about Redemptions" together with the discussions on alternative liquidity management tools such as cash and credit lines. In addition, there are detailed discussions about the ILP on page 27 of the document: https://www.sec.gov/Archives/edgar/data/1547580/000110465917064243/a17-22921_1485bpos.htm.

[5] For example, see John Hancock Funds' SAI for 2012:
https://www.sec.gov/Archives/edgar/data/1331971/000095012312011686/b90904a1e497.htm
and its 2012 registration statement:
https://www.sec.gov/Archives/edgar/data/1331971/000095012312013260/b91114a1e485bpos.htm.

[6] See, for example, the application by Invesco in 1999: https://www.gpo.gov/fdsys/pkg/FR-1999-12-01/pdf/FR-1999-12-01.pdf.

Online Appendix III: Additional robustness tests

This online appendix includes six sets of results. Section 1 examines the change in bank loan usage and credit line choices after mutual funds have access to the ILP. Section 2 includes the matched sample analysis using entropy-balanced approach. Section 3 is the Granger causality test of funds' cash holdings, liquidity choice, and ILP filing decisions. Section 4 uses the family-level analysis of funds' liquidity choice. Section 5 reports the results on fund liquidity choice using fund fixed effects. Section 6 analyzes the changes in fund risk-taking behavior after gaining access to the ILP. The results for all the sections are reported in Tables OA.1 to OA.6.

1. Change in bank loan and credit line after funds' access to the ILP

This section reports the post-ILP changes in funds' credit line and bank loan usage in Table OA.1. The dependent variables are credit line (*cline*) and bank loan usage (*bankloan*) in Models (1) and (2), respectively. We observe that both the credit line and the bank loan usage decrease after the funds have access to the ILP. In conjunction with the findings reported in Table 4 of the paper where we observe a decline in cash holdings after funds have access to the ILP, these additional results indicate that there is a substitution effect between the ILP and alternative liquidity management tools.

2. Matched sample analysis

In this section, we adopt a matched sample approach to provide additional evidence on the implications of the ILP on funds' liquidity choice and investor capital allocation. We rely on recent advances in matching technique and use an entropy balanced sample of treatment and control firms. Entropy balancing is a generalization of the traditional propensity score matching and has several advantages (Hainmueller, 2012; Agarwal, Vashishtha, and Venkatachalam, 2018). First, it can achieve significantly improved matching between the treatment and control groups. Unlike the propensity score matching where a control fund is assigned a weight equal to either one or zero (i.e., either retained or dropped), the entropy balancing approach assigns a continuous set of weights to control funds. The control counterfactuals can therefore match much more closely to the treatment funds. Second, the entropy balancing approach can better utilize the information in the control funds since most control funds are assigned nonzero weights instead of being dropped from the analysis.

We report the results of the DID analysis using entropy balanced samples in Table OA.2. Panel A reports the differences in observable fund and family characteristics for both the treated and control funds. We observe that the two groups of funds have almost the same fund and family characteristics both statistically and economically, suggesting that our approach yields good matches. Panel B reports the implications of the ILP for funds' liquidity choices. We continue to observe that funds increase portfolio illiquidity and reduce cash holdings after participation in the ILP. To test the parallel trend assumption for the DID approach, we also include an indicator variable *preILP* that is equal to one for treated funds before the ILP filing, and zero otherwise. The coefficients on *preILP* are insignificant, suggesting that our results are not driven by any differences in funds' liquidity choices before the ILP filing. Finally, the estimation of dynamic effects in Panel C shows that the effects of the ILP take place in the two years after a fund has access to the ILP, and do not reverse in the subsequent years. In addition, we do not observe differences in fund liquidity choice between treated and control funds before the ILP. In untabulated results, we also verify that the results on flow-performance sensitivity are also robust using the matched-sample approach.

3. Granger causality test of cash holdings, liquidity choice, and the ILP

In this section, we include the changes in fund liquidity in the determinants regression (see Table 3 in the paper for the results) to examine if they influence a family's decision to apply for interfund lending. Specifically, we include *chgcash* which is the change in fund's cash holdings from the previous quarter, and *chgamihud* which is the change in fund's portfolio illiquidity under the Amihud measure from the previous quarter. The coefficients on these two proxies of fund liquidity are insignificant as we observe in Table OA.3. This evidence suggests that the access to the ILP leads to the changes in fund liquidity (see Table 4 in the paper), rather than the other way around. These results are also consistent with our finding in Panel C of Table OA.2, where we show that the differences in fund liquidity choices between the treated and the control funds do not exist before the funds actually have access to the ILP, but only afterwards.

4. Family-level analysis of funds' liquidity choice

Since the choice of the ILP application is made at the family level, in our previous analyses we cluster the standard errors at the family level to control for the possibility that the error terms are correlated within a family. In this section, we repeat our analyses on fund liquidity choice using family-level observations. Specifically, for each family in each quarter, we aggregate fund-level characteristics to the family level using assets under management of each fund in the family as weights. We report the results for the implications of the ILP for funds' portfolio choice in Table OA.4. We continue to find an increase in portfolio illiquidity and a reduction in cash holdings when we conduct our analysis at the family level.

Note that we do not conduct our flow-performance analysis at the family level. This is because the match between the dependent and independent variables are problematic with family-level observations since they only capture the average effects of all funds within a family and do not properly account for fund-level heterogeneities. For example, suppose there are two funds within a family. Consider the following two scenarios:

Scenario 1		
	Flow	Performance
Fund 1	3%	4%
Fund 2	–4%	–5%

Scenario 2		
	Flow	Performance
Fund 1	–4%	4%
Fund 2	3%	–5%

With fund-level analysis, Scenario 1 corresponds to "smart money" while Scenario 2 should be consistent with "dumb money". However, by aggregating all variables at the family level, both scenarios would yield the same family level flow (3%–4%) and performance (4%–5%), i.e., we cannot properly distinguish between the two different scenarios.

5. Fund fixed effects

We control for family fixed effects and cluster the standard errors at the family level in our main analysis. As pointed out by Bertrand, Duflo, and Mullainathan (2004), it is important to cluster the errors at the level where the policy is administrated (i.e., state level in their paper, which is analogous to family in our setting). Our findings for fund liquidity choice and flow-performance relation are robust after inclusion of fund fixed effects, and we report these results in Table OA.5.

6. Changes in risk-taking behavior of funds after access to the ILP

In this section, we examine the changes in fund risk taking after having access to the ILP. We first compute a fund's return volatility using the past 12 months of fund returns. We then calculate a measure of abnormal risk taking by subtracting the average return volatility for all funds in the same style during the same quarter from the fund's return volatility. We report the results in Table OA.6. We find a significant increase in the style-adjusted volatility of equity funds after access to the ILP, as indicated by the positive and significant coefficient on *ILP*. The estimated coefficient of 0.032 in the DID specification in Model (1) represents 6.8% of the standard deviation of style-adjusted volatility as shown in Table 2 in the paper. Both Model (2) using the 2SLS specification and Model (3) using the entropy balanced matched samples also show positive and significant coefficients on *ILP*.

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Table OA.1 Change in bank loan and credit line after ILP

This table reports the post-ILP changes in funds' credit line and bank loan usage. The dependent variables are credit line (*cline*) and bank loan usage (*bankloan*) in Model (1) and (2), respectively. All the variable definitions are provided in Table 2 of the paper and the control variables are the same as those in Table 4. The regressions use fund-quarter observations and the standard errors are clustered at the family level.

	(1) *cline*	(2) *bankloan*
ILP	–0.006*	–0.082*
	(–1.68)	(–1.74)
Controls	Yes	Yes
Family and Quarter FE	Yes	Yes
Observations	109,157	109,157
Adj. R^2	0.545	0.460

Table OA.2: Matched sample analysis of funds' liquidity choices

This table reports the post-ILP changes in funds' liquidity choices using entropy balanced sample of treatment funds (those with access to the ILP) and control funds (those without access to the ILP). Panel A shows the differences of fund and family characteristics between treatment and control funds. Panel B reports the results using difference-in-differences specification and the control variables are the same as those in Table 4. *preILP* is an indicator variable that is equal to one for treated funds in the 5 years before ILP filing, and zero otherwise. In Panel C, *pre5_3* is an indicator variable that is equal to one if it is 3 to 5 years before the filing date for treated funds, and zero otherwise. *pre2_1* is an indicator variable that is equal to one if it is 2 or 1 year before the filing date for treated funds, and zero otherwise. *post1_2* is an indicator variable that is equal to one if it is 1 or 2 years after the filing date for treated funds, and zero otherwise. *post3+* is an indicator variable that is equal to one if it is more than 2 years after the filing date for treated funds, and zero otherwise. The other variables are as defined in Table 2. The regressions use fund-quarter observations and the standard errors are clustered at the family level.

Panel A

	Treatment	Control
familysize	24.6	24.6
mon	–0.0156	–0.0156
borrestrict	0.589	0.588
illiqrestrict	0.0380	0.0384
bankloan	0.205	0.204
cline	0.500	0.500
turn_ratio	0.537	0.538
exp_ratio	1.10	1.10
size	20.0	20.0
flow	0.0283	0.0283

Panel B

	(1) *amihud*	(2) *spread*	(3) *cash*
ILP	0.280**	0.703**	–1.100**
	(2.48)	(2.01)	(–1.99)
preILP	–0.022	–0.211	–0.262
	(–0.31)	(–0.90)	(–1.08)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes

Panel C

	(1) *amihud*	(2) *spread*	(3) *cash*
pre5_3	–0.021	–0.170	0.043
	(–0.28)	(–0.61)	(0.13)
pre2_1	0.090	–0.057	0.169
	(0.98)	(–0.23)	(0.38)
post1_2	0.432***	0.717*	–1.124*
	(3.10)	(1.71)	(–1.79)
post3+	0.487***	0.842*	–1.309**
	(3.37)	(1.91)	(–2.09)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes
Observations	109,157	109,157	109,157
Adj. R^2	0.160	0.525	0.258

Table OA.3: Granger causality test of funds' cash holdings, liquidity choice, and the ILP

This table reports the determinants of the ILP applications using a Cox proportional hazard model. *chgcash* is the change in fund's cash holdings, and *chgamihud* is the change in fund's portfolio illiquidity under the Amihud measure. The other independent variables including the controls are the same as in Table 3 of the paper. Models (1)-(4) use fund-quarter observations and Model (5) uses family-quarter observations. i.*FSquintiles* are dummy variables for family size quintiles. Observations in the weighted Cox model (Model (4)) are weighted by the fund size scaled by the number of funds within a family. The standard errors are clustered at the family level.

	(1)	(2)	(3)	(4)	(5)
chgcash	0.000	–0.001	–0.001	0.015	–0.005
	(0.02)	(–0.04)	(–0.08)	(0.74)	(–0.15)
chgamihud	–0.031	–0.038	–0.042	0.037	–0.250
	(–0.39)	(–0.47)	(–0.50)	(0.37)	(–1.14)
Controls	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
i.*FSquintiles*	No	No	Yes	No	No
Weighted Cox	No	No	No	Yes	No
Family level	No	No	No	No	Yes
Observations	58,579	58,579	58,579	58,579	14,222

Table OA.4: Interfund lending and liquidity choice: family level analysis

This table reports the family level analysis of post-ILP changes in funds' liquidity choices. The dependent variable and the control variables are aggregated from the fund level to the family level using the assets under management for funds within a family as weights. The regressions use family-quarter observations and the standard errors are clustered at the family level.

	(1) *amihud*	(2) *spread*	(3) *cash*
ILP	0.156*	0.906**	–0.285***
	(1.65)	(2.55)	(–3.41)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes
Observations	24,610	24,610	24,610
Adj. R^2	0.470	0.685	0.456

Table OA.5 Fund fixed effects

This table reports the change in fund liquidity choices and flow-performance sensitivity after controlling for fund fixed effects. Panel A reports the post-ILP changes in funds' liquidity choices. The control variables are the same as those in Table 4 and the standard errors are clustered at the fund level. Panel B reports the results on flow-performance sensitivity. The control variables are the same as in Panel A of Table 5 and the standard errors are clustered at the fund level.

Panel A

	(1) *amihud*	(2) *spread*	(3) *cash*
ILP	0.033**	0.174***	–0.312***
	(2.20)	(2.98)	(–3.86)
Controls	Yes	Yes	Yes
Fund and Quarter FE	Yes	Yes	Yes
Observations	109,157	109,157	109,157
Adj. R^2	0.443	0.624	0.546

Panel B

	(1) *flow*	(2) *flow*	(3) *flow*
ILP×perfpos	–0.060	–0.013	–0.003
	(–0.94)	(–0.18)	(–0.05)
pILP×perfneg	–0.168**	–0.165**	–0.176**
	(–2.28)	(–1.99)	(–2.13)
Controls	Yes	Yes	Yes
Fund and Quarter FE	Yes	Yes	Yes
Observations	109,157	109,157	109,157
Adj. R^2	0.320	0.206	0.213

Table OA.6: Funds' risk-taking behavior after access to the ILP

This table reports the post-ILP changes in funds' risk-taking, measured by funds' return volatility in excess of the average return volatility of all funds following the same investment style. The control variables are the same as those in Table 4. Models (1), (2), and (3) report the results from the difference-in-differences (DID), two-stage least squares (2SLS), and entropy balanced matched sample approach (MS), respectively. The regressions use fund-quarter observations and the standard errors are clustered at the family level.

	DID (1)	2SLS (2)	MS (3)
ILP	0.032**	0.150***	0.028*
	(2.02)	(3.31)	(1.67)
Controls	Yes	Yes	Yes
Family and Quarter FE	Yes	Yes	Yes
Observations	109,157	109,157	109,157
Adj. R^2	0.501	0.380	0.505

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