Mutual Fund Partial Liquidation and Future Performance

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Abstract

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JEL Classification: G11, G23

Keywords: decreasing returns to scale, mutual fund, partial liquidation, size, performance, flow

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Abstract

We examine the determinants of mutual fund partial liquidation and its impact on future performance. We find that the likelihood of partial liquidation positively relates to fees, age, and the number of share classes, inversely relates to turnover and family size, and doesn't correlate with past performance. As size decreases after partial liquidation, future fund performance increases. This effect is stronger for funds with a larger shock in size and funds with a smaller pre-event size. These findings are consistent with mutual funds having decreasing returns to scale. We also document funds attract more flow as their performance increases post-event.

1. Introduction

Partial liquidation among mutual funds is not a new phenomenon, yet our understanding of its determinants and impact is limited. Our study aims to fill this void in the literature. This paper contributes to the growing literature on mutual fund organization and governance with an empirical examination of the determinants of mutual fund partial liquidation and its subsequent impact on future performance. Our analysis offers novel contributions to the literature along three important dimensions. First, it contributes to the existing body of knowledge on corporate restructurings. Second, it assists regulatory agencies, such as the Securities and Exchange Commission (SEC), in understanding the drivers and consequences of the practice of partial liquidation in the fund industry. Lastly, it provides valuable information for investors when they are confronted with a decrease in the available selection of fund share classes.

Fund liquidation takes two forms—full liquidation and partial liquidation. Full liquidation means the whole fund is liquidated; whereas partial liquidation refers to one or multiple share classes of a fund being liquidated, yet the fund continues to exist with the remaining share classes. In general, different share classes represent ownership in the same fund but with different underlying fee structures, and they are created to attract investors with similar investment objectives but different investment time horizons or tax situations. So, liquidating one or multiple share classes would narrow the fund's appeal to diverse investors, break the relationship with shareholders, and lose the associated management fees. Partial liquidation thus seems to induce a high cost to the fund and family without mitigating benefits. Yet, it could be a strategic restructuring of the fund family. Partial liquidation could be a venue to eliminate the share classes that are incapable of attracting or maintaining assets. Partial liquidation could also be an attempt to take advantage of mutual funds decreasing returns to scale and thus to strengthen fund performance. If this is the case, we would expect that fund performance increases after partial liquidation.

Our test sample includes 398 actively managed U.S domestic fund partial liquidations during the period from 2000 to 2019. We use multinomial logistic regression models to study the determinants of mutual fund partial liquidation and find that funds that are older, from smaller families, charge a higher fee, have a lower return volatility, and have more share classes are more likely to be involved in partial liquidation. In contrast, our results indicate that prior fund performance level and flow are not significant determinants of partial liquidation. These findings indicate that investment advisers do not partially liquidate funds either to preserve their record of superior performance or to cover their poor performing record. Next, we investigate which share class(es) in the fund are more likely to be partially liquidated, given the fund being a partial liquidation fund. For this test, we run multinomial logistic regressions using a share-class-level dataset. The explanatory variables are share class characteristics. We find that share classes that suffer outflows, have a lower flow volatility, and charge a lower fee are more likely to be liquidated. We also find that retail share classes are more likely to be liquidated than institution share classes. These findings suggest that fund partial liquidation could be partly motivated by a desire to eliminate the share classes that have not attracted and maintained assets at a sufficient level for them to be viable.

Our analysis shows that the remaining shareholders of the partial liquidation funds appear to be the major beneficiaries of fund restructuring, as their fund's performance improves in the two years after the partial liquidation. We also find that funds that experience a larger negative shock in size perform better post event. These findings provide evidence that mutual funds have decreasing returns to scale and thus provide supportive empirical evidence for the theoretical model of Berk and Green (2004). While previous studies examine whether fund performance declines when size grows, our paper is the first study that investigates the size-performance relation by examining the opposite direction of size change. Specifically, we use fund partial liquidation as a negative shock to fund size and investigate whether funds perform better after size shrinks.

Next, we investigate whether liquidity is the underlying factor for the negative size-performance relation documented in this paper. We find that funds with a larger pre-event size experience a smaller increase in performance after size decreases resulting from partial liquidation. This finding is consistent with the literature that liquidity is the driving mechanism for the decreasing-returns-to-scale feature of mutual funds (Chen, Hong, Huang, and Kubik, 2004; Yan, 2008, McLemore, 2019).

We show that fund performance increases after partial liquidation due to decreasing returns to scale. A natural question to ask is whether there are other channels that lead to a higher fund performance after the event. For example, the improvement in fund performance could be driven by decreases in either expense ratio or turnover. We use panel regression models to examine the changes in expense ratio and changes in turnover around the event. We find that fund expense ratio does not change significantly, and fund turnover increases marginally after the event. These findings show that neither changes in expense ratio nor turnover could explain the increases in performance after partial liquidation. These findings thus buttress our argument that partial liquidation affects the change in performance only through its effect on the change in size.

Ex ante, it is not clear how fund flows would change after partial liquidation. A fund could receive more flow post-event because its performance increases, and flow chases performance (Chevalier and Ellison, 1997; Sirri and Tufano, 1998; and Sapp and Tiwari, 2004). It is also possible that flow might decrease after a fund experiences a partial liquidation as investors may be wary of the increasing uncertainties (Falkenstein 1996; Kumar, 2009). Additionally, investors of the existing share classes could also leave the fund for safer options, leading to net outflows. However, we find that fund flow increases after a partial liquidation event. This finding is logically consistent with performance increasing after funds experience a negative shock in size, and as performance increases, more money flows in the fund, resulting in faster growth after the event.

Lastly, we use fund holdings data to examine whether and how managers reposition their portfolios after partial liquidations. We find that managers sell lower performance stocks and buy higher performance stocks after the events. These findings are consistent with the literature that shows managers have stock picking skills (e.g. Chen, Jegadeesh, and Wermers, 2000; Baker, Litov, Wachter, and Wurgler, 2010), and these skills could be better exercised when liquidation restriction is lower.

This paper contributes to two strands of literature. A first set studies the strategic behavior of mutual fund families. Mutual fund families originate new funds (Khorana and Servaes, 1999) and introduce multiple share classes (Nanda, Wang, and Zheng, 2009) to attract flows and expand their customer base. Massa (2003) finds that fund families actively exploit heterogeneity among funds to compete for customers. Families could pursue start-creating strategies induced by the spillover effect (Nanda, Wang, and Zheng, 2004) or could strategically subsidize and favor the funds that are more likely to increase overall family profits (Gaspar, Massa, and Matos, 2006). Fund families also use incubation (Evans, 2010), the reputation stretching strategy (Chen and Lai, 2010), and target date funds (Chan, Chen, Chiang, and Lai, 2017) to attract inflows. Bhattacharya, Lee, and Pool (2013) discover that fund families use the affiliated funds of mutual funds to provide insurance against temporary liquidity shocks to other funds in the family.

Zhao (2005) compares the family decision on merger versus full liquidation. He finds that funds that are older, from larger families, and with more share classes are more likely to be merged, whereas the smallest and youngest funds that have fewer share classes are more likely to be liquidated. A few studies also examine family decision on fund exit mode (e.g. within-family merger, across-family merger, and full liquidation) (e.g. Jayaraman, Khorana, and Nelling, 2002; Ding, 2006; Khorana, Wedge, and Tufano, 2007; English, Demiralp, and Dukes, 2011; Namvar and Phillips, 2013). Even though partial liquidations have been occurring in the mutual fund industry since 1995, our understanding of this practice is still limited. Funds exit after full liquidation, yet funds still exist after partial liquidations. In this sense, partial liquidation is not a fund exit decision, but rather a strategic decision relating to funds' size and customer base. Fund families can also close funds to new investors to restrict them from growing. This strategy does not seem to be successful in protecting performance of the closed funds, yet it does attract flows into the rest of the family and increase management fees (Manakyan and Liano, 1997; Zhao, 2004; Bris, Gulen, Kadiyala, and Rau, 2007; Chen, Gao, and Hu, 2012). Our paper is the first study that focuses on partial liquidation and investigates its determinants and effects.

A second strand of literature that our paper contributes to analyzes whether mutual funds have decreasing returns to scale. Early empirical studies find a negative relation between size and performance (Chen, Hong, Huang, and Kubik, 2004; Edelen, Evans, and Kadlec, 2007; Yan, 2008; Pollet and Wilson, 2008), which is consistent with the theoretical model of Berk and Green (2004). Liquidity constraint is identified as an underlying mechanism that drives decreasing returns to scale (Chen, Hong, Huang, and Kubik, 2004; Yan, 2008; Pollet and Wilson, 2008; Ferreira, Keswani, Miguel, and Ramos, 2013). However, recent studies raise the endogeneity concern of size and challenge the findings of the earlier literature (Reuter and Zitzewitz, 2021; Pastor, Stambaugh, and Taylor, 2015; Phillips, Pukthuanthong, and Rau, 2018). Addressing the endogeneity concern, McLemore (2019) uses fund merger as a shock to size and document robust evidence that mutual funds have decreasing returns to scale. Song (2020) find that funds would have negative expected future performance if their size grows beyond what managers can manage. Different from previous studies, we examine the size-performance relation using fund partial liquidation as a negative shock to fund size.[1] Particularly, we investigate whether fund performance increases after its size decreases resulting from partial liquidation.

[1] We do not claim that partial liquidations generate exogenous shocks to fund size as liquidations are endogenous. Yet, we carefully document that pre-liquidation fund performance does not predict future partial liquidation.

2. Data and Sample Description

2.1. Data

We collect monthly fund returns and characteristics from the CRSP survivor-bias-free mutual fund database and mutual fund holdings from the Thomson/Refinitiv mutual fund holdings database. We use WRDS MFLINKS to merge the CRSP fund data and the Thomson/Refinitiv holdings data. The SEC adopted *Rule 18f-3* that allows mutual funds to offer multiple share classes in 1995. Due to the limited number of partial liquidations that occurred before 2000, we restrict our sample period to 2000-2019. Following previous work, we conduct standard data cleaning procedures that include restricting the sample to the actively-managed U.S. equity mutual funds, removing the first year returns to eliminate the incubation bias (Evans, 2010), and excluding funds with total net assets (TNA) less than $1 million to eliminate the upward bias in their reported returns.

We identify a partial liquidated fund as having a delist code of "L" for some (but not all) of its share classes. Partial liquidation funds continue to exist in the database after the event. Next, we identify a group of funds without a delist code of "L" but of which the number of share classes decreases. Within this group, we exclude within-fund mergers since these funds do not necessarily lose assets under management due to restructuring. A within-fund merger is defined as having a share class that receives abnormal inflow when one or multiple share classes of the same fund is liquidated. Abnormal inflow is defined as flow being two standard deviations higher than the previous year average monthly flow.

Figure 1 plots the number of fund partial liquidation cases by year (solid line). Previous studies focus on full liquidations while partial liquidations are left uninvestigated (Zhao, 2005). For comparison purposes, we also plot the number of full liquidations (dotted line). We observe significant variation in the time-series plot of the number of liquidation events with a maximum of 48 partial liquidations in 2008 and a maximum of 55 full liquidations in 2004. Overall, there are more full liquidations than partial liquidations in our sample period (576 vs 398). Figure 2 plots the total dollar amount that is partially liquidated (solid line) in each year and the average ratio of the partial liquidation amount over the fund total net assets one quarter before the partial liquidation events (dotted line). Over $131 billion of assets under management is liquidated in partial liquidation events during the sample period, which accounts for more than 32% of partial liquidating funds' corresponding TNA. About 43% of the total partial liquidation value occurred in 2008.

2.2. Sample Description

We aggregate share classes by calculating their value-weighted characteristics and obtain fund-level variables following Wermers (2000). *Size* is fund total net assets (TNA) in $ millions. *Family TNA* is the total net assets in $ millions of all funds in a family excluding the fund of interest. *Expense Ratio* is fund's annual expense ratio in percent. *Age* is fund age in months. *Turnover* measures the percentage of a fund's holdings that have changed over the previous 12 months. *Cash Holding* is the proportion of fund assets in cash. *Net Return* is monthly fund net (expense) return reported by CRSP. *Return Volatility* is the standard deviation of monthly net returns over the previous 12 months. *Gross Return* equals monthly net returns plus 1/12 of the annual expense ratio reported by CRSP. *Style-Adjusted Return (%)* is monthly net return minus average monthly net return across all the funds with the same investment style.[2] *Factor Alpha* is fitted CAPM alpha. We run the CAPM model using the previous 36 monthly net returns (with a requirement of a minimum of 12 months of data) to collect the factor loading associated with the monthly excess returns of the market portfolio for each fund i in month t. We use the factor loading to calculate the model-fitted return for each fund i in month $t+1$. The

[2] Investment style is defined by the CRSP variable *crsp_obj_cd*.

difference between the monthly realized return and monthly fitted return is the monthly fitted factor alpha. *Flow* is calculated as:

$$Flow_{i,t} = \frac{TNA_{i,t} - \left(1 + R_{i,t}\right) \times TNA_{i,t-1}}{TNA_{i,t-1}} \ , \tag{1}$$

where $TNA_{i,t}$ and $R_{i,t}$ are total net assets and monthly net return of fund *i* in month *t*. *Flow Volatility* is the standard deviation of monthly flows over the previous 12 months. *Market Beta* is the factor loading on market excess return based on a Carhart (1997) four-factor regression over the previous 12 months. *Front Load* and *Rear Load* are the front-end and back-end load fees divided by seven (Sirri and Tufano, 1998; Huang, Wei, and Yan, 2007). *Number of Share Classes* is the number of unique share classes in a fund. *Number of Stocks* is the number of stocks held by a fund. *% Inst. Share C.* is the number of institution share classes divided by the total number of share classes in a fund. This variable captures the percentage of the fund being held by institutional investors.[3]

Table 1 reports the summary statistics of characteristics for partial liquidation funds and other funds that are not involved in liquidations. Specifically, for each partial liquidation fund, we calculate the average fund characteristics over the six months before the event and report the time-series average of the cross-sectional mean characteristics in column (1). For other funds, we report the time-series average of the cross-sectional mean characteristics in column (2). Columns (3) and (4) compare characteristics between partial liquidation funds and other funds. We find that partial liquidation funds are smaller, from a smaller family, experience lower turnover, hold less cash, charge higher front and rear load fees, have more share classes and number of stocks, and have higher institutional investor representation. While the net returns and gross returns of partial liquidation funds are not significantly

[3] We also calculate the dollar value (TNA) of institution share classes divided by the TNA of the fund to capture the percentage of the fund being held by institution investors. This alternative measure yields the same results for all empirical tests. The results of using this alternative measure are not reported for brevity and available upon request.

different from other funds, the style-adjusted return and the factor alpha of partial liquidation funds are significantly lower.

3. Size-Performance Relation

3.1. Determinants of Being a Partial Liquidation Fund

We start our empirical analysis by investigating the determinants of fund partial liquidations using the following logistic regression model following Jayaraman, Khorana, and Nelling (2002) and McLemore (2019):

$$\begin{aligned} Probability\_Liquidation_{i,t} = {} & \beta_0 + \beta_1 \times Size_{i,t-1} + \beta_2 \times Family\ Size_{i,t-1} + \beta_3 \times Expense\ Ratio_{i,t-12} \\ & + \beta_4 \times log\ (Age)_{i,t-1} + \beta_5 \times Turnover_{i,t-12} + \beta_6 \times Cash_{i,t-1} \\ & + \beta_7 \times Performance_{i,t-1} + \beta_8 \times Return\ Volatility_{i,t-1} \\ & + \beta_9 \times Flow_{i,t-1} + \beta_{10} \times Flow\ Volatility_{i,t-1} \\ & + \beta_{11} \times Market\ Beta_{i,t-1} + \beta_{12} \times Front\ Load_{i,t-1} \\ & + \beta_{13} \times Rear\ Load_{i,t-1} + \beta_{14} \times No\ of\ Shares\ Classes_{i,t-1} \\ & + \beta_{15} \times No.of\ Stocks_{i,t-1} + \beta_{16} \times \%\ Inst.Share\ C._{i,t-1} \\ & + \mathcal{E}_{i,t}, \end{aligned} \quad (2)$$

where *i* indicates fund *i* and *t* refers to time *t*. We construct both dependent and independent variables every year in June and December. This test is thus performed semiannually.

The dependent variable equals one if a fund experiences a partial liquidation in the subsequent six months and zero otherwise. *Expense Ratio* and *Turnover* are lagged 12 months. Other independent variables are average fund characteristics over the previous six months except for *Performance*, *Return Volatility* and *Flow Volatility*. *Performance* is fund cumulative return over the previous six months. *Return Volatility* is the standard deviation of monthly net returns over the previous 12 months. *Flow Volatility* is the standard deviation of monthly fund flows over the previous 12 months. *Size* is the logarithm of TNA in $ millions. *Family Size* is the logarithm of total net assets in $ millions of all funds in a family excluding the fund of interest. *Expense Ratio* is the annual ratio of total investment that shareholders pay for the fund's operating expenses. Log(*Age*) is the logarithm of one plus fund age in months.

Turnover is the minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month total net assets of a fund. *Cash Holding* is the proportion of fund's asset allocation in cash. We run the Carhart (1997) four-factor model using monthly returns in the previous year to obtain *Market Beta*, which is the factor loading on the excess market returns. *Market Beta* captures the sensitivity of fund returns to the overall market performance and controls for the fund's exposure to the systematic risk. *Front Load* and *Rear Load* are the front-end and back-end load fees divided by seven (Sirri and Tufano, 1998; Huang, Wei, and Yan, 2007). Missing loads are filled with zeros. *Flow* is calculated using Equation (1). *No. of Shares Class* is the number of unique share classes in a fund. *No. of Stocks* is the number of stocks held by a fund and controls for fund's diversification effect (Pollet and Wilson, 2008). *% Inst. Share C.* is the number of institution share classes divided by the number of total share classes in a fund.

Table 2 column (1) reports the regression coefficients, and column (2) reports the marginal effect for partial liquidations.[4] We include style×year fixed effects to control for unobserved heterogeneity (Gormley and Matsa, 2014; McLemore, 2019). We find that funds that are older, more expensive, from a smaller family, with lower turnover and return volatility, and have a larger number of share classes and stocks are more likely to be involved in partial liquidations. While prior studies focus on the comparison between the determinants of full liquidation and fund mergers (Jayaraman, Khorana, and Nelling, 2002; Zhao, 2005), we are the first paper investigating factors that explain fund partial liquidation.

One key finding from Table 3 columns (1) and (2) is that past fund performance is not significantly related to the probability of partial liquidations. This result holds when using alternative measures for performance, such as the cumulated six-month style-adjusted returns and factor alphas. The finding

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[4] The marginal effect of independent variable X for observation i is $ME(X)_i = P_i \times (1 - P_i) \times \widehat{\beta_x}$, where P is the predicted probability of being a partial liquidation fund, and $\widehat{\beta_x}$ is the parameter estimate for regressor X. The mean predicted probability is 0.009 of being a partial liquidation fund.

that past performance is not a determinant for partial liquidation suggests that partial liquidation could be driven by a fund family's desire to strategically realign its product offerings. This finding also implies that while fully liquidated funds could be failure funds that are eliminated by a fund family (Zhao, 2005), partial liquidation funds are not necessarily failure funds. Nonetheless, this finding enables us to test fund decreasing returns to scale using partial liquidation as a negative shock in size.

3.2. Determinants of Being a Liquidated Share Class

A natural question is which share classes are liquidated and which share classes are retained in the partial liquidation funds. We hypothesize that share classes that do not attract inflows and charge lower fees (thus less profitable to the fund) are more likely to be liquidated. These share classes are undesirable to both investors, the fund, and fund families. To investigate the determinants of being a liquidated share class of a partial liquidation fund, we use the logistic model of Equation (2) with a few changes. Now the regression is run at the share class level. The dependent variable equals one if a share class of a partial liquidation fund is liquidated in the subsequent six months and zero otherwise. Independent variables are share class characteristics. *Institution Dummy* is a dummy variable that equals one for institutional share class and zero otherwise.

Table 2 columns (3) and (4) report the results. We find that the parameter estimate for *Expense Ratio* is negative and significant at the 5% level. This result shows that share classes charging lower fees (and thus less profitable to the fund) are more likely to be liquidated. We also find that the coefficients of both *Flow* and *Flow Volatility* are negative and statistically significant. This finding indicates that share classes that have volatile money flows and experience investor redemptions are more likely to be liquidated. The mean predicted probability of being a liquidated share class is 0.267. Overall, consistent with our hypothesis, the unpopular share classes that lose investor base are more likely to be eliminated from the fund via partial liquidation.

3.3. Fund Performance after Partial Liquidation

3.3.1. Characteristics Comparison before and after Partial Liquidation

In this subsection, we compare fund characteristics before and after partial liquidation. For the pre-event characteristics, we calculate the average fund characteristic over the six months before a partial liquidation and report the time-series average of the cross-sectional mean characteristics in Table 3 column (1). The post-event characteristics are calculated using fund characteristics over the six months after the event and reported in column (2). Columns (3) and (4) report the difference in mean characteristics. The main finding of this table is that fund performance increases after size decreases resulting from partial liquidation. The mean monthly net (gross) returns increase by 0.57% (0.58%) after the event, and the change is significant at the 5% level. Monthly style-adjusted returns and factor alpha (the CAPM alpha) both significantly increase by 0.16% and 0.1% respectively after the event. These findings provide initial evidence of the inverse relationship between fund size and performance. The comparison also shows that flow and flow volatility increase after partial liquidation,[5] but other fund characteristics do not change significantly.

3.3.2. Change in Performance after Partial Liquidation

As shown in section 3.1, partial liquidation funds are not necessarily failure funds and fund pre-event performance does not correlate with becoming a partial liquidation fund. We argue that this finding enables us to test whether funds exhibit decreasing returns to scale using partial liquidation as a negative shock in size. In this subsection, we examine the size-performance relation. Decreasing returns to scale predicts that fund performance would increase as fund size decreases. We use the following multivariate regression model to test this conjecture:

$$Performance_{i,t} = \beta_0 + \beta_1 \times Event\ Year_{i,t} + \beta_2 \times Size_{i,t-1} + \beta_3 \times Family\ Size_{i,t-1}$$

[5] We investigate the change in fund flows after partial liquidation in Section 6.1.

$$
\begin{aligned}
&+ \beta_4\times \text{Expense Ratio}_{i,t-12} + \beta_5\times \text{Log}(\text{Age})_{i,t-1} + \beta_6\times \text{Turnover}_{i,t-12} \\
&+ \beta_7\times \text{Net Return}_{i,t-1} + \beta_8\times \text{Return Volatility}_{i,t-1} + \beta_9\times \text{Flow}_{i,t-1} \\
&+ \beta_{10}\times \text{Flow Volatility}_{i,t-1} + \beta_{11}\times \text{Market Beta}_{i,t-1} \\
&+ \beta_{12}\times \text{Front Load}_{i,t-1} + \beta_{13}\times \text{Rear Load}_{i,t-1} \\
&+ \beta_{14}\times \text{No. of Stocks}_{i,t-3} + \beta_{15}\times \%\ \text{Inst. Share C.}_{i,t-1} \\
&+ \varepsilon_{i,t}, \qquad (3)
\end{aligned}
$$

where the dependent variable is fund *i*'s style-adjusted return in month *t*, where style is defined by the CRSP variable *crsp_obj_cd*. The independent variable of interest is *Event Year* that equals one after partial liquidations and zero before. We control for fund characteristics, diversification effect, and exposure to systematic risk that correlate with performance. *Net Return* is monthly net return. All other characteristic variables are constructed the same way as in Equation (2). *Expense Ratio* and *Turnover* are lagged 12 months, *No. of Stocks* is lagged three months (one quarter), and all other characteristics are lagged one month.

Table 4 column (1) reports a univariate regression result, and columns (2)-(4) include fund characteristics as controls. The key finding is that *Event Year* is positive and significant at the 1% level in all model specifications. Specifically, fund style-adjusted return increases by 1.55% (0.129%×12=1.55%, column (1)) on average after size decreases resulting from partial liquidations. Including control variables does not significantly affect either the magnitude or the significance of this effect. The results also show that funds that are small, from a larger family, receive higher flows, and have lower turnover perform better. This finding is consistent with previous studies (Chen, Hong, Huang and Kubik, 2004). Yet, other fund characteristics, such as age, flow volatility, number of stocks held in the fund, etc., do not seem to be correlated with future performance. To alleviate the concern that our results could be driven by partial liquidations that occurred during the financial crisis, we drop partial liquidation events in 2008-2009 and redo the tests in Table 4. Our results hold. These findings are not reported for brevity but are available upon request.

3.3.3. The Impact of Size Ratio on the Size-Performance Relation

Decreasing returns to scale implies that funds that experience a larger negative shock in size are more likely to have better performance after the shock. We test this implication by conducting two analyses. First, we gradually drop the funds that with smaller *Size Ratio*, where *Size Ratio* is defined as the size of liquidated share class over the fund size a quarter before the event. Specifically, we drop funds with the lowest 10% *Size Ratio*, run Equation (3), and report results in column (1) of Table 5. Then we drop the lowest 20% and report results in column (2). So on and so forth, until we keep only the funds with the top 10% and 5% *Size Ratio*, and report results in columns (9) and (10), respectively. We find that *Event Year* is positive and significant at the 1% level in all model specifications. The magnitude of the parameter estimate of *Event Year* increases as we drop funds with lower *Size Ratio*.

We also find that the parameter estimate of *Event Year* gradually increases with some variations from columns (1) to (8). It almost doubles when we drop funds with from 80% to 90% lowest *Size Ratio* (from 0.254 in column (8) to 0.433 in column (9)), then further doubles once we keep only funds with the top 5% *Size Ratio* (from 0.433 in column (9) to 0.816 in column (10)). Based on this finding, we construct a dummy variable, *Size Ratio Dummy*, that equals one for funds with *Size Ratio* higher than 90% (95%). We interact *Size Ratio Dummy* with *Event Year*, add it (*Size Ratio Dummy* × *Event Year*) and *Size Ratio Dummy* to Equation (3), and report results in the last two columns of Table 5. We find that the parameter estimate for *Size Ratio Dummy* × *Event Year* is positive and significant, with a larger magnitude and a higher significant level when we keep only funds with the top 5% *Size Ratio.* This finding shows that funds that experience a larger negative shock in size perform better after partial liquidations. Specifically, the monthly style-adjusted return is 0.213% and 0.434% higher for funds with the top 10% and 5% *Size Ratio*, respectively. Findings in this subsection provide consistent evidence that supports mutual funds having decreasing returns to scale.

3.4. Liquidity Constraints and the Size-Performance Relation

In this subsection, we examine whether liquidity constraint is the underlying factor that drives the size-performance relation in the setting of partial liquidations (Chen, Hong, Huang, and Kubik. 2004; Yan 2008; McLemore, 2019).

3.4.1. Pre-Event Size Test

Smaller funds on average have lower liquidity constraint. Thus, liquidity being the driving factor of decreasing returns to scale also predicts that, holding everything else constant, smaller funds would have higher performance after partial liquidation. To test this prediction, we include the pre-event fund size (*Pre Size*) and its interaction with *Event Year* (*Event Year* × *Pre Size*) in the panel regression model of Equation (3), where *Pre Size* is the average fund size over the 24 months before a partial liquidation. We expect to find that funds having a smaller size before partial liquidation have less liquidity constraint and thus have more capacity to improve performance. Therefore, the parameter estimate for *Event Year* × *Pre Size* is expected to be negative and significant. Table 6 reports the results. Fund performance is monthly style-adjusted returns. We find strong evidence that is consistent with the prediction. The parameter estimate for *Event Year* × *Pre Size* is negative and significant at the 1% level. The pre-event fund size negatively impacts the performance response to size change resulting from partial liquidation.

3.4.2. Fee and Turnover Test

We have shown that fund performance increases after partial liquidation due to decreasing returns to scale and that the underlying mechanism is liquidity constraint. A natural question to ask is whether there are other channels that lead to a higher fund performance after the event. For example, partial liquidation funds may reduce their fees, which would increase the net return that investors receive.

Thus, in this subsection, we first investigate whether expense ratio decreases after partial liquidation using the following multivariate regression:

$$\begin{aligned} Expense\ Ratio_{i,t} = \beta_0 &+ \beta_1\times Event\ Year_{i,t} + \beta_2\times Size_{i,t-1} + \beta_3\times Family\ Size_{i,t-1} \\ &+ \beta_4\times Expense\ Ratio_{i,t-12} + \beta_5\times log(Age_{i,t-1}) + \beta_6\times Turnover_{i,t-12} \\ &+ \beta_7\times Return_{i,t-1} + \beta_8\times Return\ Volatility_{i,t-1} + \beta_9\times Flow_{i,t-1} \\ &+ \beta_{10}\times Flow\ Volatility_{i,t-1} + \beta_{11}\times Market\ Beta_{i,t-1} \\ &+ \beta_{12}\times Front\ Load_{i,t-1} + \beta_{13}\times Rear\ Load_{i,t-1} \\ &+ \beta_{14}\times No.of\ Stocks_{i,t-3} + \beta_{15}\times \%\ Inst.Share\ C._{i,t-1} \\ &+ \varepsilon_{i,t}, \qquad (4) \end{aligned}$$

where the dependent variable is fund *i*'s expense ratio in month *t*. Independent variable of interest is *Event Year* that equals one after a partial liquidation and zero before. Control variables are the same as those in Equation (3). The regression is performed monthly over the two years before and two years after partial liquidations. The first two columns of Table 7 report results for the fee analysis. Column (1) does not have style fixed effect, and column (2) includes style fixed effect. We find that *Event Year* is negative and insignificant in both model specifications. On average, fund expense ratio decreases after partial liquidation, but the change is not statistically significant. This finding alleviates the concern that the increases in performance after partial liquidation is driven by decreases in fees.

Table 4 shows that funds' turnover negatively relates to future performance. Funds with lower turnover ratio perform better. Therefore, the increase in fund performance after liquidation could possibly be driven by the decreases in turnover, and partial liquidation funds could cut back on trading to avoid transaction costs after the event. We investigate whether turnover decreases after partial liquidation by running Equation (4) while replacing the dependent variable to fund *i*'s turnover in month *t*. Table 7 columns (3)-(4) report results. We find that, on average, fund turnover marginally increases after partial liquidation. *Event Year* is positive and significant at the 10% level when not including style fixed effect (column (3)) and is insignificant when including the style fixed effect (column (4)). This finding shows that funds trade more actively post partial liquidation, and thus provides evidence that the increase in performance after the event is not driven by decreasing transaction costs from less trading.

4. Robustness Tests for Size-Performance Relation

In this section, we rerun column (4) of Table 4 using alternative performance measures. The first two measures are fund monthly net and gross returns. The results using these two measures are reported in the first two columns of Table 8. In our main tests, we use style-adjusted return to measure fund performance where style is fund self-reported style to CRSP. Now we construct style-adjusted return using an estimated style following Brown and Goetzmann (1997). Specifically, in each month *t* for each fund *i*, we regress monthly net returns on the Fama-French three factors using returns of the previous 24 months, while requiring a minimum of 12 months of data. Then in each month *t*, we sort all funds into four groups based on the median level of SMB and HML loadings: large-value, small-value, large-growth, and small-growth. Specifically, funds ranked in the top (bottom) 50^{th} percentile of both the SMB and HML loadings are classified as large-value (small-growth) funds; funds ranked in the top 50^{th} percentile of SMB loading and the bottom 50^{th} percentile of HML loading are large-growth funds; funds ranked in the bottom 50^{th} percentile of SMB loading and the top 50^{th} percentile of HML loading are small-value funds. Results using this alternative style-adjusted return are reported in column (3) of Table 8. A fourth performance measure is a factor alpha. For each fund *i* in month *t*, we run the CAPM model using the previous 36 months of monthly net returns (with a requirement of a minimum of 12 months of data) to collect the factor loading associated with the monthly excess returns of the market portfolio. We next calculate the model-fitted return for each fund *i* in month *t*+1 using the collected factor loading. The difference between the monthly realized return and monthly fitted return is the monthly fitted factor alpha. Results using the factor alpha are reported in the last column of Table 8.

We find that *Event Year* is positive and significant at the 5% level and above in all model specifications in Table 8. This finding shows that our finding of decreasing returns to scale is robust to different measures of fund performance, including non-adjusted returns, style-adjusted returns, and factor model alphas. For factor alpha, our results are also robust to different estimation windows and different minimum months requirements as well as to different models, including the Fama-French three factor model alpha and the Carhart four-factor alpha.

5. Additional Analysis

5.1. Change in Flow after Partial Liquidation

In this section, we investigate whether and how fund flows change after partial liquidation. Since flow chases performance (Chevalier and Ellison, 1997; Sirri and Tufano, 1998; and Sapp and Tiwari, 2004), we expect that fund flow increases after partial liquidation as their performance increases. Yet, fund flow could decrease post-event if new investors shy away from funds that experienced a recent partial liquidation due to the increasing uncertainty (Falkenstein 1996; Kumar, 2009), and if the existing investors leave these funds for safer options. We compare fund characteristics around partial liquidations in Table 3 and find that flow significantly increases after the event. In this subsection, we test whether this finding is robust to controlling for fund characteristics in a regression setting.

Specifically, we examine the change in fund flow after partial liquidations by running Equation (4) while replacing the dependent variable to fund *i*'s *Flow* in month *t*. Table 9 reports the results. Column (1) does not have style fixed effect and column (2) includes style fixed effect. Consistent with the univariate *t*-test result in Table 3, we find that fund flow increases after partial liquidations. *Event Year* is positive and significant at the 5% level in both specifications. This finding implies that, as a fund restructuring strategy, partial liquidation successfully increases performance and attracts flow post-event. The increases in flows could lead to faster growth post-event.

5.2. Managers Stock Picking Skills

In this subsection, we investigate whether and how managers reposition their portfolios after partial liquidations. Specifically, we compare the performance of stocks that managers keep, sell, and buy. The baseline for comparison is fund holdings on the event date, and the evaluation date is one-year post-event.[6] We identify three groups of stocks: stocks that managers keep are those held on both the event and evaluation dates; stocks sold are those only held on the event date; and stocks bought are those only held on the evaluation date. Then we calculate three factor alphas of each group in the evaluation period and report the results in Table 10 columns (1)-(3).

For example, the CAPM alpha for the "kept" group (column (1)) is the average alpha of all stocks (across all partial liquidation funds) that managers keep within one-year post-event. Stock CAPM alpha is the intercept of the time-series CAPM model for each stock in the evaluation period. Next, we calculate the performance difference among these three groups of stocks. We find that stocks kept perform better than stocks sold (column (4)), and stocks bought have higher factor alphas than stocks kept and sold (columns (5) and (6)). These findings show that managers on average have stock-picking skills, which can be better exercised when liquidation restriction is lower. Our findings are consistent with the literature of skillful fund managers (e.g. Chen, Jegadeesh, and Wermers, 2000; Baker, Litov, Wachter, and Wurgler, 2010).

[6] Results are robust to evaluation date being two-year post-event.

5.3. Fund Size-Performance Relation – Introduction of New Share Classes

The focus of this study is to examine the size-performance relation in fund partial liquidations when fund size decreases. We have documented evidence that is consistent with decreasing returns to scale. Fund performance increases after size decreases resulting from partial liquidations. A natural question to ask, even though seemingly out of scope of the current study, is whether fund performance decreases when new share classes are added to a fund. To complete the analysis around fund share class introduction and elimination, we address this question at the end of the paper.

First, we acknowledge that the introduction of share classes could relate to fund past performance. We find that funds that perform better are more likely to introduce new share classes (untabulated). Thus, the size-performance relation test results could be challenged by the endogeneity concern. Nonetheless, we rerun our main regression in column (4) of Table 4 using a sample of funds that add new share classes and report results in Table 11. This sample includes 3,140 events in 2000-2019. Further supporting diminishing returns to scale, we find that fund performance decreases after size increases resulting from the introduction of new share classes. *Event Year* is negative and significant at the 1% level in all model specifications. Out of these 3,140 events, there are 1,875 events with increases in institution share class, 1,271 events having increases in retail share class, and 255 events where both institution and retail share classes increase. We conduct subsample analysis and find that the results in Table 11 are mainly driven by adding new institution share classes. These results are not reported for brevity but are available upon request.

6. Conclusion

This study examines the determinants of mutual fund partial liquidations and their subsequent impact on fund shareholders, using a sample of 398 partial liquidation events over the period from 2000 to 2019. We find that older and more expensive funds that are from a smaller family and trade less are more likely to partially liquidate their assets. While shareholders of the liquidated share classes could possibly suffer financial losses, shareholders of the remaining share classes benefit from a significant improvement in performance after liquidation, particularly shareholders of the funds that experience a larger negative shock in size. These performance changes provide evidence that supports decreasing returns to scale and could also indicate a wealth transfer effect from shareholders of the liquidated share classes to the remaining share classes. Our findings show that liquidity constraint is the underlying factor that drives the negative size-performance relation. We also document that managers actively reposition their portfolios after partial liquidations. The increase in performance attracts more flow to these event funds. The overall evidence suggests that fund partial liquidation could be fund family's strategic reorganization that seems to be effective.

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Appendix A: Variable Description

Variable	Definition
Age	Fund age in months
Cash Holdings	Percentage of the fund's assets held in cash and cash equivalents
Event Year	A dummy variable that equals one if it is after partial-liquidations and zero if before
Expense Ratio	The ratio of total investment (in percent) that shareholders pay for the share class operating expenses (which includes 12b-1 fees, management fees, administrative fees, and other costs) in the most recently completed fiscal year. In the regressions, expense ratio is at the monthly level, i.e., divide the CRSP reported expense ratio fee by 12
Factor Alpha	For each fund *i* in month *t*, we run the CAPM model using the previous 36 months of monthly gross returns (with a requirement of minimum of 12 months of data) to collect factor loadings associated with the monthly excess returns of the market portfolio. We next calculate the model-fitted return for each fund *i* in month *t*+1 using the collected factor loading. The difference between the monthly realized return and monthly fitted return is the monthly fitted factor alpha
Family Size	The logarithm of the total net asset of a fund family excluding the fund in consideration
Family TNA	The total net asset of a fund family excluding the fund in consideration
Flow	Monthly flow: $Flow_{i,t}=[TNA_{i,t}-(1+R_{i,t})\times TNA_{i,t-1}]/TNA_{i,t}$ where $TNA_{i,t}$ and $R_{i,t}$ are total net assets and monthly net return of fund *i* in month *t*
Flow Volatility	The standard deviation of monthly flows over the previous 12 months
Front Load	The front-end load fee divided by seven (see footnote 9 in Sirri and Tufano (1998) and footnote 13 in Huang, Wei, and Yan (2007)). In the regressions the *Front Load* is at the monthly level and in basis point, i.e., divide the CRSP reported front load by seven, and then by 12
Cumulative Return	The cumulative net returns over previous six months
Gross Return	Monthly gross return is the sum of the CRSP reported monthly net return and 1/12 of the *Expense Ratio*

Appendix A: (continued)

Variable	Definition
Institution Dummy	A dummy variable that equals one if the liquidated share class is an institution share class, and zero otherwise. This is a share-class-level variable
Market Beta	The factor loading on market return by running the Carhart (1997) four-factor model using three years of monthly returns before mergers and three years of monthly returns after mergers (skipping first 12 months after the event month)
Net Return	Monthly net (of expense) returns. CRSP variable *mret*
No. of Share Classes	The number of share classes a fund has
No. of Stocks	The number of stocks held in a fund
Pre Size	The average fund TNA over the 24 months before partial liquidation
Return Volatility	Standard deviation of monthly net returns over the previous 12 months
Rear Load	The rear-end load fee for the share class divided by seven (see footnote 9 in Sirri and Tufano (1998) and footnote 13 in Huang, Wei, and Yan (2007)). In the regressions, the *Rear Load* is at the monthly level and in basis point, i.e., divide the CRSP reported rear-end load fee by seven, and then by 12
Size	The logarithm of the total net asset of a fund in $ millions
Size Ratio	The size of partially liquidated share class over the fund size a quarter before the event
Size Ratio Dummy	A dummy variable that equals one if *Size Ratio* is higher than 90% (95%) and zero otherwise

Appendix A: (continued)

Variable	Definition
"Size×Value" style	Following Brown and Goetzmann (1997), in each month for each fund, we regress fund monthly net returns on the Fama-French three factors using returns of the previous 24 months, while requiring a minimum of 12 months of data. Then in each month, we sort all funds into four groups based on the median level of SMB and HML loadings: large-value, small-value, large-growth, and small-growth. Specifically, funds ranked in the top (bottom) 50^{th} percentile of both the SMB and HML loadings are classified as large-value (small-growth) funds; funds ranked in the top 50^{th} percentile of SMB loading and the bottom 50^{th} percentile of HML loading are large-growth funds; funds ranked in the bottom 50^{th} percentile of SMB loading and the top 50^{th} percentile of HML loading are small-value funds
Style-Adjusted Return (CRSP Style)	Monthly return minus the cross-sectional average return of all funds in the same investment style. Investment style is defined by the CRSP variable *crsp_obj_cd*
Style-Adjusted Return ("Size×Value" Style)	Monthly return minus the cross-sectional average return of all funds in the same investment style. Investment style refers to the "Size×Value" Style
TNA	Total net assets. A measure of fund size in millions of dollars
Turnover	Fund turnover ratio. It is calculated as the minimum (of aggregated sales or aggregated purchases of securities) divided by the average 12-month TNA of the fund
% Inst. Share C.	The number of institution share classes divided by the number of total share classes in a fund

Figure 1. Number of Fund Partial Liquidation

This figure plots the number of fund partial liquidation cases by year (solid line) and the number of full liquidations (dotted line). Partial liquidation refers to one or multiple share classes of a fund being liquidated, yet the fund continues to exist with the remaining share classes. Full liquidation means the whole fund is liquidated. The sample contains 398 partial liquidation funds for the period of 2000-2019. There are 576 full liquidation funds in this sample period.

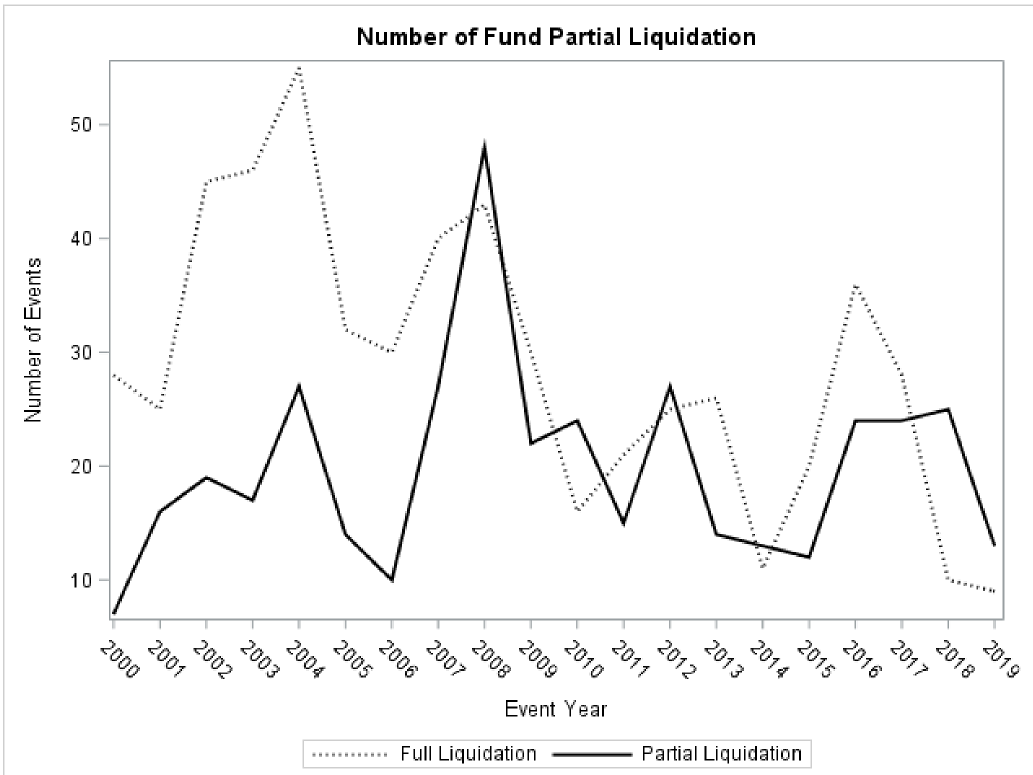

Figure 2. Dollar Amount of Partial Liquidation

This figure plots the total dollar amount that is partially liquidated (solid line) and the average ratio of the partial liquidation amount over the fund total net assets one quarter before the partial liquidation events (dotted line). The sample contains 398 partial liquidation funds for the period of 2000-2019.

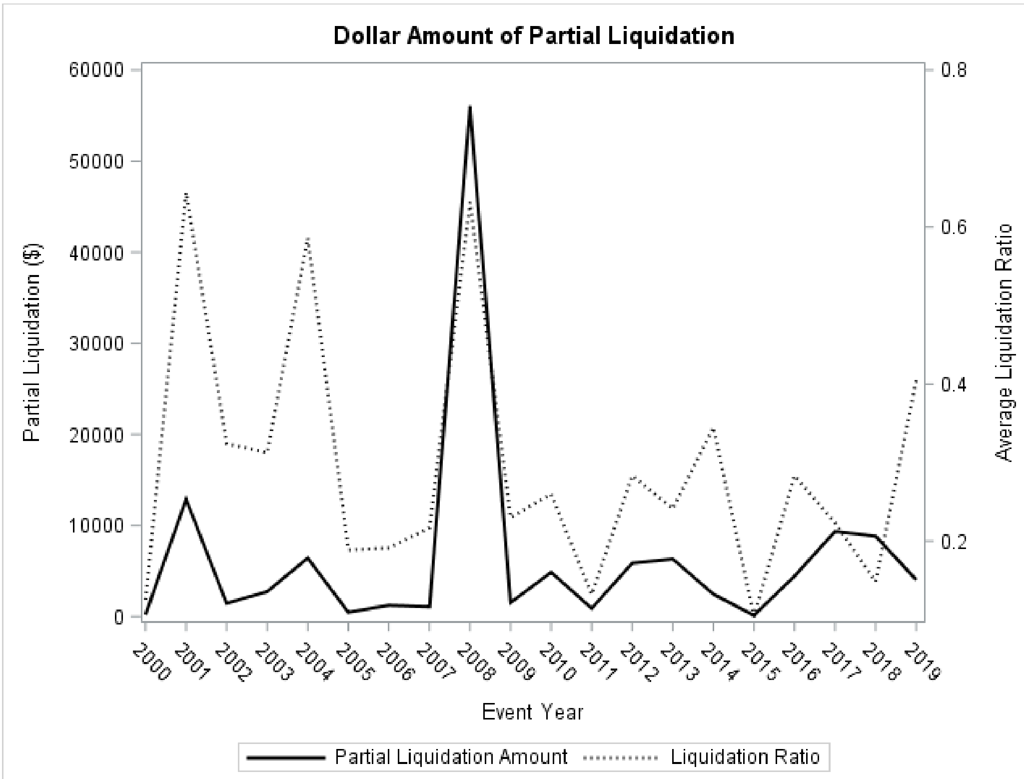

Table 1. Summary Statistics

This table reports characteristics of partial liquidation funds and the other funds not involved in liquidations. For partial liquidation funds, we calculate the fund average characteristic over the six months before partial liquidations and report the time-series average of the cross-sectional mean characteristics in column (1). We report the time-series average of the cross-sectional mean characteristics of the other funds in column (2). Column (3) compares characteristics of partial liquidation funds and other funds, and column (4) reports the *t*-statistics for the differences. See Appendix A for detailed definitions and construction of all variables. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)	(3)	(4)
	Partial Liquidation	Other Funds	Difference: (1)-(2)	T-stats
TNA ($ million)	1,035	1,397	-362**	-2.42
Family TNA ($ million)	26,399	50,318	-23,919***	-5.41
Expense Ratio (%)	1.23	1.20	0.03	0.96
Age (months)	179	168	11	1.24
Turnover (%)	74.88	84.19	-9.31**	-2.58
Cash Holdings (%)	2.60	4.98	-2.38***	-4.90
Ret Volatility (%)	4.41	4.59	-0.18	-0.93
Net Return (%)	0.27	0.57	-0.30	-0.83
Gross Return (%)	0.37	0.68	-0.31	-0.81
Style-Adjusted Return (%)	-0.13	-0.01	-0.12***	-2.75
Factor Alpha	-0.25	-0.09	-0.16***	-3.13
Flow (%)	0.16	0.22	-0.06	-0.19
Flow Volatility (%)	5.06	4.80	0.26	0.56
Market Beta	0.95	0.94	0.01	0.84
Front Load (%)	0.28	0.20	0.08***	5.85
Rear Load (%)	0.09	0.07	0.02***	2.89
No. of Share Classes	5	3	2***	11.11
No. of Stocks	143	119	24*	1.94
% Inst. Share Class	38.03	29.13	8.90***	5.45

Table 2. Determinants of Mutual Fund Partial Liquidation

This table reports the results of examining determinants of mutual fund partial liquidation. We form the dependent and independent variables every year in June and December and use semi-annual observations to test the logistic regression model of Equation (2). The dependent variable equals one if a fund is partially liquidated in the subsequent six months and zero otherwise. Averaged fund characteristics over the prior six months are used to construct the independent variables except for *Performance*, *Return Volatility* and *Flow Volatility*. *Performance* is fund cumulative return over the previous six months. See Appendix A for detailed definition and construction of all variables. Column (1) reports the regression coefficients and column (2) reports the marginal effect. Columns (3) and (4) report the results for the determinants of being a liquidated share class in a partial liquidation fund. In these two columns, all independent variables are share class characteristics. Robust standard errors are reported in parentheses. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)	(3)	(4)
	Partial Liquidation		Share Class Test	
Size	-0.061	0.000	-0.025	0.057
	(0.059)		*(0.029)*	
Family Size	-0.117***	0.000		
	(0.044)			
Expense Ratio	0.756***	0.004	-0.046**	-0.008
	(0.231)		*(0.018)*	
Age	0.223**	0.001	0.022	0.004
	(0.111)		*(0.097)*	
Turnover	-0.271**	-0.002	0.078	0.014
	(0.114)		*(0.099)*	
Cash	-2.774	-0.016	-0.006	-0.001
	(1.695)		*(0.009)*	
Performance	-0.010	0.000	0.314	0.057
	(0.007)		*(0.543)*	
Return Volatility	-0.104**	-0.001	0.013	0.002
	(0.041)		*(0.038)*	
Flow	0.019	0.011	-0.004*	-0.001
	(0.017)		*(0.015)*	
Flow Volatility	-0.024	0.000	-0.033***	-0.005
	(0.149)		*(0.011)*	
Market Beta	0.049	0.000	-0.083	-0.015
	(0.193)		*(0.242)*	
Front Load	-0.129	-0.001	-0.250	-0.045
	(0.105)		*(0.239)*	
Rear Load	0.237**	0.001	1.978***	0.356
	(0.117)		*(0.400)*	
No. of Shares Classes	0.284***	0.002	-0.025	
	(0.046)		*(0.029)*	
No. of Stocks	0.110*	0.001		
	(0.059)			
% Inst. Share C.	-0.469	-0.003		
	(0.471)			
Institution Dummy			-0.533***	-0.096
			(0.178)	
Style×Year Fixed Effect	Yes		Yes	
Observations	33,742		1,392	

Table 3. Change in Characteristics around Partial Liquidation

This table compares characteristics of partial liquidation funds pre- and post-event. Characteristics of interest are the same as those reported in Table 1. For the pre-event (post-event) characteristics, we calculate the average characteristic over the six months before (after) a partial liquidation and report the time-series average of the cross-sectional mean characteristics in column (1) (columns (2)). Column (3) compares the differences between the pre- and post-event mean characteristics and column (4) reports the *t*-statistics for the differences. See Appendix A for detailed definition and construction of all variables. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)	(3)	(4)
	Pre-event	Post-event	Difference: (2)-(1)	T-stats
TNA ($ million)	1035	994	-41	-0.17
Family TNA ($ million)	26,399	28,689	2,290	0.29
Expense Ratio (%)	1.23	1.21	-0.02	-0.40
Age (months)	178	181	3	0.17
Turnover (%)	74.88	71.42	-3.46	-0.58
Cash Holdings (%)	2.60	3.87	1.27	1.32
Ret Volatility (%)	4.41	4.44	0.03	0.12
Net Return (%)	0.25	0.82	0.57**	2.35
Gross Return (%)	0.35	0.93	0.58**	2.31
Style-Adjusted Return (%)	-0.13	0.03	0.16**	2.17
Factor Alpha (%)	-0.25	-0.15	0.10*	1.67
Flow (%)	0.16	1.42	1.26**	1.97
Flow Volatility (%)	5.06	10.33	5.27***	3.46
Market Beta	0.95	0.97	0.02	0.69
Front Load (%)	0.28	0.27	-0.01	-0.53
Rear Load (%)	0.09	0.08	-0.01	-0.61
No. of Share Classes	5	4	-1***	-2.75
No. of Stocks	144	119	-25	-1.26
% Inst. Share Class	38.03	40.60	2.57	0.89

Table 4. Size-Performance Relation

This table reports the results of a panel regression examining the size impact on fund performance. The dependent variable is *Style-Adjusted Return*, which is the difference between fund monthly net return and the value-weight average return of all funds with the same investment style. We identify fund investment style using variable *crsp_obj_cd* in CRSP Mutual Fund Database. The independent variable *Event Year* equals one if it is after partial liquidation and zero if before. Control variables are fund characteristics. See Appendix A for detailed definition and construction of all variables. The regression is performed monthly over the two years before and two years after partial liquidations. Robust standard errors are reported in parentheses. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)	(3)	(4)
Event Year	0.129***	0.129***	0.127***	0.127***
	(0.038)	*(0.038)*	*(0.038)*	*(0.039)*
Size		-0.026*	-0.028**	-0.027*
		(0.014)	*(0.014)*	*(0.014)*
Family Size		0.023**	0.021*	0.022*
		(0.012)	*(0.012)*	*(0.012)*
Exp. Ratio (*t*-12)		-0.060	-0.047	-0.053
		(0.048)	*(0.054)*	*(0.057)*
Log(Age)		-0.033	-0.029	-0.032
		(0.028)	*(0.029)*	*(0.030)*
Turnover (*t*-12)		-0.056**	-0.055**	-0.055**
		(0.028)	*(0.028)*	*(0.028)*
Return			0.007	0.006
			(0.004)	*(0.004)*
Return Volatility			-0.002	-0.000
			(0.002)	*(0.000)*
Flow			1.287***	1.286***
			(0.366)	*(0.366)*
Flow Volatility			-0.002	-0.002
			(0.009)	*(0.009)*
Market Beta			-0.177***	-0.175***
			(0.063)	*(0.063)*
Front Load			0.045	0.043
			(0.051)	*(0.051)*
Rear Load			-0.065	-0.067
			(0.050)	*(0.052)*
No. of Stocks				-0.006
				(0.015)
% Inst. Share C.				-0.019
				(0.085)
Observations	9,232	9,232	9,232	9,232
Adjusted R^2	0.113	0.203	0.427	0.408

Table 5. Size Ratio Tests

This table reports the results of size ratio tests. The dependent variable is *Style-Adjusted Return*, which is the difference between fund monthly net return and the value-weight average return of all funds with the same investment style. We identify fund investment style using variable *crsp_obj_cd* in CRSP Mutual Fund Database. The independent variable *Event Year* equals one if it is after partial liquidation and zero if before. *Size Ratio* is defined as the size of liquidated share class over the fund size a quarter before the event. We drop funds with the lowest 10% *Size Ratio*, run Equation (3), and report results in column (1). Then we drop the lowest 20% and report results in column (2). So on and so forth, until we keep only funds with the top 10% and 5% *Size Ratio*, and report results in columns (9) and (10), respectively. *Size Ratio Dummy* equals one for funds with *Size Ratio* higher than 90% (95%). We interact *Size Ratio Dummy* with *Event Year*, add it (*Size Ratio Dummy* × *Event Year*) and *Size Ratio Dummy* to Equation (3), and report results in the last two columns. Control variables are fund characteristics. See Appendix A for detailed definition and construction of all variables. The regression is performed monthly over the two years before and two years after partial liquidations. Robust standard errors are reported in parentheses. ***, **, and * indicate p<0.01, p<0.05, and p<0.1, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%	90%	95%
Event Year ×											0.213*	0.434***
Size Ratio Dummy											*(0.119)*	*(0.166)*
Event Year	0.158***	0.159***	0.169***	0.102**	0.133**	0.181***	0.222***	0.254***	0.433***	0.816***	0.120***	0.122***
	(0.043)	*(0.046)*	*(0.050)*	*(0.050)*	*(0.056)*	*(0.065)*	*(0.075)*	*(0.091)*	*(0.119)*	*(0.190)*	*(0.042)*	*(0.041)*
Fund Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,982	7,162	6,281	5,488	4,568	3,688	2,950	2,114	1,139	546	8,937	8,937
Adjusted R^2	0.540	0.589	0.695	0.626	0.803	0.885	0.990	0.970	0.812	0.403	0.541	0.59

Table 6. Liquidity Constraints Test

This table reports results of examining whether liquidity is the underlying factor for the negative size-performance relation. We interact the pre-event fund size with *Event Year*. The regression is performed monthly over the two years before and two years after partial liquidations. The dependent variable is *Style-Adjusted Return*, which is the difference between fund monthly net return and the value-weight average return of all funds with the same investment style. We identify fund investment style using variable *crsp_obj_cd* in CRSP Mutual Fund Database. See Appendix A for detailed definitions and construction of all variables. Robust standard errors are reported in parentheses. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

Event Year × Pre Size	-0.073***
	(0.025)
Event Year	0.129***
	(0.039)
Pre Size	0.024
	(0.018)
Family Size	0.016
	(0.012)
Exp. Ratio (*t*-12)	-0.000
	(0.001)
Log(Age)	-0.044
	(0.030)
Turnover (*t*-12)	-0.048*
	(0.028)
Return	1.281***
	(0.366)
Return Volatility	0.039
	(0.862)
Flow	0.005
	(0.004)
Flow Volatility	-0.002
	(0.002)
Market Beta	-0.181***
	(0.063)
Front Load	0.033
	(0.051)
Rear Load	-0.061
	(0.052)
No. of Stocks	-0.007
	(0.014)
% Inst. Share C.	-0.027
	(0.085)
Observations	9,232
Adjusted R^2	0.455

Table 7. Fees and Turnover Tests

This table reports the results of the fund fee test and turnover test. The dependent variable is fund *i*'s expense ratio in month *t* for columns (1)-(2) and is fund *i*'s turnover in month *t* for columns (3)-(4). Independent variable of interest is *Event Year* that equals one after a partial liquidation and zero before. Control variables are the same as in Equation (3). We run the regression model of Equation (4) using monthly observations over the two years before and two years after partial liquidations. Columns (1) and (3) do not have style fixed effect, columns (2) and (4) includes style fixed effect. See Appendix A for detailed definitions and construction of all variables. Robust standard errors are reported in parentheses. ***, **, and * indicate p<0.01, p<0.05, and p<0.1, respectively.

	(1)	(2)	(3)	(4)
	Fees		Turnover	
Event Year	-0.302	-0.197	0.015*	0.010
	(0.217)	*(0.216)*	*(0.009)*	*(0.009)*
Size	-0.847***	-0.819***	-0.005	-0.005*
	(0.081)	*(0.082)*	*(0.003)*	*(0.003)*
Family Size	-0.487***	-0.575***	-0.014***	-0.015***
	(0.068)	*(0.069)*	*(0.003)*	*(0.003)*
Exp. Ratio (*t*-12)	0.917***	0.905***	-0.002	0.009
	(0.003)	*(0.003)*	*(0.013)*	*(0.013)*
log(Age)	0.232	-0.133	-0.001	0.011
	(0.170)	*(0.177)*	*(0.007)*	*(0.007)*
Turnover (*t*-12)	1.246***	1.570***	0.839***	0.814***
	(0.159)	*(0.164)*	*(0.006)*	*(0.006)*
Return	-0.085***	-0.081***	-0.003***	-0.003***
	(0.020)	*(0.020)*	*(0.001)*	*(0.001)*
Return Volatility	0.5822***	0.524***	-0.469**	-0.087
	(0.005)	*(0.005)*	*(0.193)*	*(0.203)*
Flow	-0.210***	-0.201***	-0.227**	-0.247***
	(0.023)	*(0.023)*	*(0.093)*	*(0.091)*
Flow Volatility	-0.152***	-0.156***	-0.002***	-0.002***
	(0.014)	*(0.014)*	*(0.001)*	*(0.001)*
Market Beta	-0.174	-0.245	-0.013	0.018
	(0.359)	*(0.383)*	*(0.014)*	*(0.015)*
Front Load	1.980***	2.323***	0.005	-0.019
	(0.287)	*(0.292)*	*(0.011)*	*(0.012)*
Rear Load	0.448	0.343	-0.009	0.014
	(0.285)	*(0.291)*	*(0.011)*	*(0.012)*
No. of Stocks	-0.227***	-0.014	0.024***	0.023***
	(0.083)	*(0.087)*	*(0.003)*	*(0.003)*
% Inst. Share C.	-3.518***	-3.836***	0.018	0.005
	(0.482)	*(0.499)*	*(0.019)*	*(0.020)*
Style FE	No	Yes	No	Yes
Observations	9,606	9,606	9,606	9,606
Adjusted R^2	0.940	0.941	0.665	0.675

Table 8. Robustness Tests: Size-Performance Relation

This table reports the results of robustness tests examining the size impact on fund performance. The dependent variable is monthly net return, monthly gross return, style-adjusted return using estimated style, and factor alpha in columns (1)-(4), respectively. The independent variable *Event Year* equals one if it is after partial liquidation and zero if before. Control variables are fund characteristics. See Appendix A for detailed definition and construction of all variables. The regression is performed monthly over the two years before and two years after partial liquidations. Robust standard errors are reported in parentheses. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)	(3)	(4)
	Monthly Net Return	Monthly Gross Return	Style-Adjusted Return (“Size×Value” Style)	Factor Alpha
Event Year	0.277**	0.276**	0.127***	0.143***
	(0.109)	*(0.109)*	*(0.039)*	*(0.053)*
Size	-0.130***	-0.130***	-0.027*	-0.021
	(0.037)	*(0.037)*	*(0.014)*	*(0.019)*
Family Size	0.045	0.044	0.022*	0.012
	(0.033)	*(0.033)*	*(0.012)*	*(0.016)*
Exp. Ratio (*t*-12)	0.451***	0.526***	-0.053	-0.046
	(0.167)	*(0.167)*	*(0.057)*	*(0.086)*
Log(Age)	0.270***	0.270***	-0.032	-0.067
	(0.090)	*(0.090)*	*(0.030)*	*(0.043)*
Turnover (*t*-12)	-0.156**	-0.155**	-0.055**	-0.004
	(0.076)	*(0.076)*	*(0.028)*	*(0.038)*
Return	0.150***	0.150***	0.006	1.472***
	(0.016)	*(0.016)*	*(0.004)*	*(0.501)*
Return Volatility	0.080**	0.081**	-0.000	0.029**
	(0.034)	*(0.034)*	*(0.000)*	*(0.012)*
Flow	0.990	0.972	1.286***	1.451**
	(1.186)	*(1.186)*	*(0.366)*	*(0.569)*
Flow Volatility	0.067	0.055	-0.002	-0.000
	(0.373)	*(0.372)*	*(0.009)*	*(0.003)*
Market Beta	-0.736***	-0.737***	-0.175***	-0.102
	(0.203)	*(0.203)*	*(0.063)*	*(0.087)*
Front Load	0.119	0.120	0.043	-0.032
	(0.151)	*(0.151)*	*(0.051)*	*(0.069)*
Rear Load	-0.184	-0.183	-0.067	-0.084
	(0.142)	*(0.142)*	*(0.052)*	*(0.069)*
No. of Stocks	-0.012	-0.012	-0.006	-0.000
	(0.049)	*(0.049)*	*(0.015)*	*(0.020)*
% Inst. Share C.	0.513***	0.509***	-0.019	-0.048
	(0.189)	*(0.189)*	*(0.085)*	*(0.089)*
Observations	9,232	9,232	9,232	9,232
Adjusted R^2	0.278	0.280	0.408	0.292

Table 9. Changes in Flow after Partial Liquidations

This table reports the results of flow analysis around partial liquidation. The dependent variable is fund *i*'s flow in month *t*. Independent variable of interest is *Event Year* that equals one after a partial liquidation and zero before. Control variables are the same as in Equation (3). We run the regression monthly over the two years before and two years after partial liquidations. Column (1) does not have style fixed effect and column (2) includes style fixed effect. See Appendix A for detailed definitions and construction of all variables. Robust standard errors are reported in parentheses. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)
Event Year	0.205**	0.193**
	(0.086)	*(0.086)*
Size	-0.097***	-0.096***
	(0.032)	*(0.033)*
Family Size	0.088***	0.092***
	(0.027)	*(0.027)*
Expense Ratio (*t*-12)	-0.583***	-0.466***
	(0.141)	*(0.151)*
log(Age)	-0.682***	-0.668***
	(0.070)	*(0.074)*
Turnover (*t*-12)	-0.225***	-0.246***
	(0.063)	*(0.066)*
Net Return	0.039***	0.039***
	(0.008)	*(0.008)*
Return Volatility	3.771*	3.823*
	(1.928)	*(2.063)*
Flow	0.282***	0.279***
	(0.009)	*(0.009)*
Flow Volatility	0.007	0.008
	(0.006)	*(0.006)*
Market Beta	-0.208	-0.079
	(0.143)	*(0.153)*
Front Load	-0.078	-0.121
	(0.113)	*(0.117)*
Rear Load	-0.041	-0.050
	(0.111)	*(0.115)*
Number of Stocks	-0.003	-0.014
	(0.033)	*(0.035)*
% Inst. Share C.	-0.402***	-0.412***
	(0.145)	*(0.151)*
Style FE	No	Yes
Observations	9,606	9,606
Adjusted R^2	0.116	0.117

Table 10. Managers' Stock Picking

This table reports results of comparing the performance of stocks that managers keep, sell, and buy. The baseline for comparison is fund holdings on the event date, and the evaluation date is one-year post-event. We identify three groups of stocks: stocks that managers keep are those held on both the event and evaluation dates (column (1)); stocks sold are those only held on the event date (column (2)); and stocks bought are those only held on the evaluation date (column (3)). For example, the CAPM alpha for the "kept" group (column (1)) is the average alpha of all stocks (across all partial liquidation funds) that managers keep in the evaluation period. CAPM alpha is the intercept of running the time-series CAPM model for each stock in the evaluation period. Column (4) reports performance difference between stocks sold and kept; column (5) reports performance difference between stocks bought and kept; and column (6) reports performance difference between stocks bought and sold. Robust standard errors are reported in parentheses. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Kept	Sold	Bought	Sold-Kept	Bought-Kept	Bought-Sold
CAPM	0.773	0.269	1.040	-0.504***	0.266***	0.771***
				(0.087)	*(0.095)*	*(0.087)*
FF3	0.686	0.234	0.919	-0.453***	0.233***	0.685***
				(0.075)	*(0.080)*	*(0.076)*
Carhart	0.695	0.238	0.915	-0.457***	0.220***	0.677***
				(0.070)	*(0.079)*	*(0.072)*

Table 11. Size-Performance Relation – New Share Classes Introduction

This table reports the results of panel regression of size impact on fund performance using a sample of funds that introduce new share classes. The dependent variable is fund performance that is measured as monthly net return (column (1)), monthly gross return (column (2)), style-adjusted return (CRSP style) (column (3)), style-adjusted return ("Size×Value" style) (column (4)) or factor alpha (column (5)). Factor alpha is estimated using the previous 36 months of return while requiring a minimum of 12 months of data. Style-adjusted return is the difference between monthly fund net return and the value-weight average return of all funds in the same investment style. The independent variable *Event Year* equals one if it is after the event and zero if before. Control variables are fund characteristics. See Appendix A for detailed definition and construction of all variables. The regression is performed monthly over the two years before and two years after partial liquidations. Robust standard errors are reported in parentheses. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$, respectively.

	(1)	(2)	(3)	(4)	(5)
	Monthly Net Return	Monthly Gross Return	Style-Adjusted Return (CRSP Style)	Style-Adjusted Return ("Size×Value" Style)	Factor Alpha (fitted CAPM alpha 36-12)
Event Year	-0.140***	-0.140***	-0.033***	-0.046***	-0.108***
	(0.035)	*(0.035)*	*(0.012)*	*(0.013)*	*(0.015)*
Size	-0.132***	-0.133***	-0.034***	-0.036***	-0.020***
	(0.014)	*(0.014)*	*(0.005)*	*(0.005)*	*(0.006)*
Family Size	0.029***	0.028***	0.017***	0.008**	0.007
	(0.011)	*(0.011)*	*(0.004)*	*(0.004)*	*(0.005)*
Exp. R. (*t*-12)	0.067	0.140**	-0.047**	-0.060***	-0.010
	(0.055)	*(0.055)*	*(0.019)*	*(0.021)*	*(0.024)*
Log(Age)	0.177***	0.177***	0.014	0.003	-0.008
	(0.027)	*(0.027)*	*(0.009)*	*(0.010)*	*(0.012)*
Turnover (*t*-12)	-0.046***	-0.046***	-0.015***	-0.023***	-0.009*
	(0.012)	*(0.012)*	*(0.004)*	*(0.005)*	*(0.005)*
Return	8.898***	8.894***	0.215**	0.006***	0.567***
	(0.296)	*(0.296)*	*(0.101)*	*(0.001)*	*(0.130)*
Return Vol.	0.008*	0.009*	0.003*	0.000	-0.018***
	(0.005)	*(0.005)*	*(0.002)*	*(0.000)*	*(0.002)*
Flow	-0.155	-0.172	0.002*	0.580***	-0.244*
	(0.324)	*(0.324)*	*(0.001)*	*(0.113)*	*(0.142)*
Flow Volatility	0.163	0.136	0.000	-0.003*	-0.002
	(0.973)	*(0.973)*	*(0.000)*	*(0.002)*	*(0.004)*
Market Beta	-0.550***	-0.549***	-0.038**	-0.062***	-0.027
	(0.053)	*(0.053)*	*(0.018)*	*(0.020)*	*(0.023)*
Front Load	2.340	2.341	-1.377***	-0.994*	-1.848***
	(1.472)	*(1.472)*	*(0.503)*	*(0.560)*	*(0.646)*
Rear Load	-0.194***	-0.192***	-1.724*	-1.956*	-0.017
	(0.029)	*(0.029)*	*(0.973)*	*(1.085)*	*(0.013)*
No. of Stocks	-0.014	-0.014	-0.005	-0.006	-0.009*
	(0.012)	*(0.012)*	*(0.004)*	*(0.005)*	*(0.005)*
% Inst. Share	-0.096	-0.098	-0.019	-0.007	-0.051
	(0.091)	*(0.091)*	*(0.031)*	*(0.035)*	*(0.040)*
Observations	86,918	86,918	86,918	86,918	86,918
Adjusted R^2	0.011	0.096	0.124	0.206	0.202