Mutual Fund Performance and Flows:
The Effects of Liquidity Service Provision and Active Management

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Abstract

Existing literature documents that actively managed mutual funds on average underperform their passive benchmarks, and yet investors continue to put their money into mutual funds. In this paper, we propose a framework to disentangle the effects of liquidity service provision and active management on fund performance and flows. To examine the effect of liquidity service provision, we benchmark passive mutual funds against matching ETFs. Our results show that liquidity service accounts for a substantial portion of fund underperformance and provides a net premium to investors with relatively small investment amount and short investment horizon. In particular, large and established funds have an advantage in liquidity service provision due to economies of scale. Nevertheless, the results based on fund flows show that investors do not fully recognize the impact of liquidity service on fund performance. To further examine the effect of active management, we benchmark active funds against passive funds with the same styles. Our findings support the argument that large funds face diseconomies of scale in producing alpha. Interestingly, we find evidence that investors recognize the impact of active management on fund performance when selecting mutual funds.

Key words: Open-End Mutual Funds; Liquidity Service Provision; Active Management; Fund Underperformance; Fund Flows.

JEL Classification: G20; G23; G10; G11

"*Research generally has failed to find that mutual funds generate positive returns above what can be motivated by the level of risk; once fund fees are taken into account, their asset management often yields negative excess returns. The recent growth of index funds, which collect all stocks in passively managed portfolios, follows that insight.*"

"The Prize in Economic Sciences 2013 - Advanced Information (*nobelprize.org*)"
October 15, 2013

I. Introduction

One puzzle documented in the mutual fund literature is that actively managed mutual funds on average underperform their passive benchmarks,[1] and yet investors continue to put their money into mutual funds.[2] Existing literature has provided a number of explanations to both aspects of the puzzle. For example, Carhart (1997) shows that expenses, turnover and load fees have adverse effects on fund performance. Wermers (2000) shows that 0.7% of the difference between raw and net returns of mutual fund stock holdings can be attributed to the underperformance of non-stock holdings and 1.6% is due to expenses and transaction costs. The explanation provided in Gruber (1996) for the continuing growth of actively managed mutual funds is that since open-end funds are priced at net asset value (NAV), investors have incentives to invest in funds with superior management ability. Indeed, he provides evidence that investors in general have the ability to predict fund performance by moving money toward good performers and away from poor performers. Zheng (1999) uses a sample of 1,826 stock mutual funds during the period of 1970-1993 and confirms the positive fund flow and performance relation.

[1] Jensen (1968) is among the first to document underperformance of mutual funds. Using data from 1945-1964, he finds that actively managed mutual funds consistently underperform their passive benchmarks and fail to cover their expenses. Using quarterly return data over the period of 1975-1984, Grinblatt and Titman (1989) show that while certain funds may have superior performance, the higher expenses of these funds eliminate any abnormal return to investors. Based on the portfolio holdings of the same sample of funds, Grinblatt and Titman (1993) find results similar to those based on fund returns. Subsequent studies by, e.g., Malkiel (1995), Ferson and Schadt (1996), Gruber (1996), Carhart (1997), Daniel, Grinblatt, Titman, and Wermers (1997), and Fama and French (2010), provide further evidence on mutual fund underperformance.

[2] In his 1995 AFA presidential address, Gruber (1996) cites that at the end of 1994 more than $2.1 trillion was invested into mutual funds and that equity mutual funds accounted for 40.1% of the assets under management. Since then, the mutual fund industry has experienced further significant growth. According to the 2013 Investment Company Fact Book (http://www.icifactbook.org/fb_ch2.html#index), at 2012 year-end there was $13 trillion in assets under US mutual fund management, 45% in equity funds.

In this paper, we examine the respective effects of liquidity service provision by open-end mutual funds and active portfolio management on fund performance and fund flows.[3] We argue that liquidity service provision and active portfolio management are two distinctive features of mutual funds and it is important to disentangle their respective effects on fund performance and fund flows. First of all, compared to other traded financial securities, mutual funds not only offer an investment product to investors but also offer professional service to investors. The main professional service includes account service, in particular liquidity service. Liquidity service provision makes mutual funds a convenient investment vehicle for investors, especially for inexperienced individual investors. However, mutual funds incur costs in providing liquidity service which ultimately has an adverse effect on fund performance. Edelen (1999) is among the first to examine the adverse effect of liquidity service on fund performance with a focus on the performance of liquidity-motivated or flow-driven trades. He shows that liquidity-motivated trades reduce abnormal returns of mutual funds by 1.5-2%.[4] In this paper, we examine the effect of liquidity service provision on fund performance based on operating costs to mutual funds. Second, as noted in Gruber (1996), investors have incentives to invest in funds with superior management ability in order to achieve higher expected returns. While existing literature provides evidence that active portfolio management generate higher returns,[5] it does not necessarily translate into positive return to investors. This is because trading is costly. In addition, existing literature has examined the effect of active portfolio

[3] By liquidity service provision, we refer to the fact that open-end no-load mutual funds allow investors to redeem their shares or purchase shares from a fund at no or little direct cost. We note that some funds charge their investors a purchase fee when the shareholders purchase their shares. Very often funds charge their shareholders a redemption fee when the shareholders redeem their shares within certain time period of their investment, e.g., one year.

[4] Using a much larger and broader sample, Dubofsky (2010) examines fund portfolio trading triggered by investor flows but finds a smaller effect than that in Edelen (1999).

[5] Several studies show that mutual fund managers have superior abilities in picking stocks. For instance, Elton, Gruber and Blake (1996) demonstrate that manager can construct a portfolio that would persistently outperform the index portfolio over the 3-year period. Wermers(2000) and Chen, Jegadeesh, and Wermers (2000) also show managers of high-turnover funds exhibit superior stock holdings returns than the ones of low-turnover funds suggesting that managers of the former have stock picking talents.

management on fund performance and flows without explicitly taking into account of the effect of liquidity service provision. We argue that since many fund characteristics reflect the effect of both liquidity service provision and active portfolio management, it is important to disentangle the respective effects of liquidity service provision and active portfolio management.

To disentangle the respective effects of liquidity service provision and active portfolio management on fund performance and flows, we propose the following framework. First, we benchmark passive mutual funds against matching ETFs. Second, we benchmark active funds against passive funds with the same styles. The comparison between passive index mutual funds and matching index ETFs allows us to focus on the effect of liquidity service provision on mutual fund performance and investor behavior. This is because the main difference between passive index mutual funds and matching index ETFs is the liquidity service provided by mutual funds. Thus, variations in net returns to mutual fund investors are mainly driven by operating costs incurred by funds in providing liquidity service in particular and investor account service in general. The comparison between active mutual funds and matching passive index funds further illustrates the impact of active portfolio management on fund performance along with liquidity service provision. Under this setting, both active mutual funds and passive funds provide investors liquidity service, but only active mutual funds can enhance fund performance through active portfolio management. By decomposing the effect of liquidity service and that of active portfolio management, we are able to shed new light on the relation between fund abnormal returns and various fund characteristics, one of the contentiously debated issues in the existing literature. A further advantage of our framework is that when evaluating mutual fund performance, we benchmark mutual fund performance against investable alternatives instead of artificial benchmarks. As pointed out by Berk and van Binsbergen (2013), benchmarks such as the Fama and French three-factor model or the Carhart four-factor model do not represent actual investable alternatives. Specifically, in our setting

we benchmark passive index mutual funds against matching index ETFs based on common underlying indexes. Further, we benchmark active mutual funds against matching passive funds based on common investment objectives.

The main data used in our analysis includes CRSP Survivor-Bias Free U.S. Mutual Fund Database for fund characteristics, Thomson Reuters Mutual Funds Holdings Data for detailed information on mutual fund holdings, TrimTabs data for daily fund flows, and CRSP stock database for daily stock prices and bid-ask spreads. Our sample includes US domestic passive index mutual funds and active mutual funds from 2003 to 2012.

The comparison between passive index mutual funds and matching index ETFs shows that higher expense ratios and transaction costs associated with unexpected daily fund flows are the main sources of index mutual fund underperformance. Cash holdings by index mutual funds explain a minimal portion of underperformance. We also regress underperformance of index mutual fund against various fund characteristics. As expected, expense ratios and fund turnover contribute significantly to underperformance. Interestingly, underperformance is negatively correlated with fund size and fund age. This is evidence that large and established funds have the advantage of economies of scale in providing liquidity service. This finding is consistent with empirical evidence on the relation between fund size and trading costs as documented in Christoffersen, Keim, and Musto (2006). In addition, we show that liquidity service provides investors incentives to invest in open-end mutual funds. In particular, liquidity service provides a net premium to investors with relatively small investment amounts and short investment horizons.

One of the interesting findings of our analyses on passive index funds is that we observe a significantly positive relation between fund flows and fund performance despite the lack of managerial skills. This confirms the argument in Berk and Green (2004) that a positive relation between fund flow and fund performance is not necessarily driven by the superior ability of fund

managers. Chasing past performance does not necessarily mean that investors are irrational even when there is a lack of persistence in fund performance. Nevertheless, when examining the determinants of fund flows, we observe that flows are negatively related to both fund age and fund size despite the fact that both variables are positively related to net returns to investors. This is evidence that investors do not fully recognize the impact of liquidity service provision on fund net returns.

The analyses based on the comparison between active mutual funds and matching passive funds further show that expense ratios and cash holdings contribute positively to fund underperformance. As pointed out in Chordia (1996), one main reason that mutual funds do not fully invest is the need to hold cash for the purpose of investor redemption. Wermers (2000) documents empirically that non-stock holdings of equity mutual funds lead to 0.7 percentage points in fund underperformance. On the other hand, we find that the discount associated with portfolio liquidity accounts for a minimal portion of underperformance. However, the underperformance of active mutual funds is no longer significantly related to turnover. One possible explanation is that the higher alpha generated by more active funds (Wermers, 2000) offsets the negative effect of turnover on fund performance. In addition, compared to results based on index mutual funds, while operating costs remain lower for established funds than for younger funds, the relation between underperformance and fund size is significantly positive. Existing literature has documented mixed findings on the relation between the performance of active mutual funds and fund size. Note that the results based on index mutual funds suggest that there are economies of scale for larger firms in providing investor service. If larger funds also generate higher alphas, we should see an even more significantly negative relation between fund size and fund underperformance. The findings are consistent with the argument that larger funds face diseconomies of scale in producing alpha.

Again, when examining the determinants of flows to active funds, we find further evidence that investors do not fully recognize the impact of liquidity service provision on fund net returns. Specifically, we observe that flows are negatively related to fund age despite the fact that fund age is positively related to net returns to investors. Consistent with existing literature, our results show that there is a negative relation between fund flows and fund size but a positive relation between fund flows and fund family size. Given the findings that fund performance is negatively related to fund size but positively related to fund family size, we interpret these findings as evidence that investors recognize the effect of active portfolio management on fund performance.

The rest of the paper is structured as follows. Section II describes the mutual fund sample and presents summary statistics. Sections III and IV present empirical results based on the passive sample and active sample, respectively. Section V concludes.

II. Data and Summary Statistics

The main datasets used in our analysis include the CRSP Survivor-Bias-Free US Mutual Fund Database, Thomson Reuters Mutual Fund Common Stock Holdings Database, TrimTabs data on daily fund flow, and CRSP stock database. The CRSP Survivor-Bias-Free U.S. Mutual Fund Database (hereafter the CRSP fund dataset) contains detailed information on fund characteristics such as monthly total net assets, fund net returns, schedules of rear and front load fees, annual turnover and expense ratios, cash and equity holdings, and investment objectives. Thomson Reuters Mutual Funds Holding Data contains detailed information on mutual funds' holdings, including CUSIPs, ticker symbols, company names, and stock shares. We merge the CRSP fund dataset with the holdings dataset using the MFLINK file developed by Russ Wermers through Wharton Research Data Services (WRDS).

Our sample includes all US domestic open-end equity funds in the CRSP fund dataset from January 2003 to December 2012. The main reasons that our sample period starts from 2003 are as

follows. First, index mutual funds became popular only in the early 2000s. Second, market microstructure experienced drastic changes in the early 2000s and trading costs were substantially reduced (Chordia, Roll, and Subrahmanyam, 2011; Angel, Harris, and Spatt, 2013, etc.). Following the previous literature (Elton, Gruber, and Blake, 2001; Evans, 2010), we exclude the first three years of history for each share class to eliminate potential incubation bias. In addition, we limit our attention to funds with TNA greater than $10 million across all share classes and fund classes with assets under management greater than $2 million because smaller size funds tend to have a larger degree of survivor bias. Finally, we restrict our sample to funds with available data on expense ratios.

To identify the passive subsample, we use the variable *index_fund_flag* in CRSP fund database. For our actively managed subsample we focus only on *Growth*, *Income*, and *Growth and Income* funds as identified by the CRSP's investment style variable. Share classes are categorized as no-load, front-end load, and back-end load classes based on their load, fee structure, and name search. More details on share class identification and subsample selections can be found in online appendixes and available upon request. Our final sample of passive index mutual funds consists of 37,515 fund-month observations or an average of 312 funds per month over 2003-2012. Our sample of actively managed mutual funds consists of 353,625 fund-month observations or an average of 2,947 share classes per month over our time period.

Table I reports descriptive statistics of mutual funds in our sample based on share classes. We compute various characteristics for each fund and report time series averages of the cross-sectional mean and median for passive mutual funds in Panel A and for active mutual funds in Panel B. Fund age is calculated as the number of years a fund is in the CRSP database. Fund class TNA is share class total net assets at the end of each month. Fund TNA is the fund total net assets at the end of each month. Monthly net return is the monthly return of the share class. Expense ratio is the

percentage of total investment that shareholders pay for the fund's expenses, including 12b-1 fees. Maximum front-end load is the maximum percent charges applied at the time of purchase, and Maximum back-end load is the maximum percent charges applied at the time of redemption. Turnover is defined as the minimum aggregate purchases or sales of securities during the year divided by the average TNA. Cash holding is the percentage of the fund portfolio in cash. Monthly net cash flow is the monthly cash flow of the share class. Normalized monthly net flow is computed as monthly net cash flow divided by the TNA at the beginning of the month. Monthly flow volatility is the standard deviation of monthly normalized net cash flow over the past 12 months.

In our empirical analysis, we focus on no-load share classes. The justification is that investors of front-end and back-end load funds likely dedicate their investment decisions to their brokers and as such fund flows may not reflect investors' decisions. The average number of funds in our passive sample is 312 share classes per month, with an average of 258 no-load, 38 front-end load and 16 back-end load funds. The average number of actively managed funds is 2,947 share classes per month, with an average of 2,001 no-load, 627 front-end load and 319 back-end load funds. Panel A shows that the average age of the passive funds is 7.79 years. The size of each share class shows significant variation. With $1.02 billion in TNA per month for the overall passive sample, no-load funds are on average much larger in size than front-end or back-end share classes. The average monthly net returns for passive funds, no-load, front-end, and back-end load funds are 0.72%, 0.73%, 0.75% and 0.74%, respectively. The average expense ratios for all passive funds, no-load, front-end load, and back-end load funds are 0.63%, 0.58%, 0.96%, and 1.60%, respectively. The average maximum front-end load fee and maximum back-end load fee for all passive funds are 2.94% and 0.73% on average, respectively. Front-end and back-end load passive funds charge 4.86% and 4.75% on average, respectively. The average portfolio turnover ratio is 17.68% per year for the overall sample and indicates significant fund growth. No-load funds have 17.80% turnover

while front-load and back-end load have 16.27% and 13.14% on average, respectively. The average passive fund holds no more than one percent in cash, with 0.43% for no-load, 0.81% for front-end and 0.62% for back-end load funds. On average, there is a positive net cash flow of $6.13 million for the overall passive sample and $6.87 million for no-load funds. Front-end load and back-end load funds, however, have negative monthly net cash flow of $-0.63 and $-1.35 million on average, respectively. On average, the normalized monthly net cash flow is positive for all share classes except for the back-end load share class. Finally, Panel A shows that the average monthly fund flow volatility per month is 10.15% for all funds.

From Panel B we observe that average active mutual fund age, at 11.46, is greater than average passive fund age. The average TNAs for actively managed funds, no-load, front-end, and back-end load funds are $661.77, $656.13, $952.66, and $163.58 million, respectively. The average monthly net return of all actively managed funds, at 0.62%, is lower than that of passive funds. The average monthly net returns for no-load, front-end load and back-end load are, 0.63%, 0.62%, and 0.57%, respectively. As expected, relative to passive funds, the expense ratios are much higher for actively managed funds. On average, expense ratio of actively managed funds is 1.30% per month, with 1.22% for no-load and front-end load funds, and 1.92% for back-end load funds. The average maximum front-end and back-end loads are 3.88% and 1.51%, respectively. Front-end and back-end load active funds charge 5.26% and 4.81% on average, respectively. The average portfolio turnover ratio is 63.45% per year. On average, no-load funds have 62.65% turnover while front-load and back-end load funds have 65.67% and 63.80% turnovers, respectively. The average active fund holds more cash than the average index mutual fund, with 3.01% for no-load, 2.90% for front-end, and 2.64% for back-end load funds. On average, there is a negative net cash flow of $-0.20 million for the overall active sample and $0.39 million for no-load funds. Front-end load and back-end load funds also have negative monthly net cash flow of $-0.68 and $-2.74 million on average,

respectively. On average, the normalized monthly net cash flow is positive for all share classes except for the back-end load share class. Finally, Panel B shows that the average monthly fund flow volatility is 9.50% for no-load funds, 8.09% for front-end load and 4.90% for back-end load funds.

Passive Index Mutual Funds and Matching ETFs For each no-load passive index mutual fund, we identify all index ETFs tracking the same underlying index. For instance, Dreyfus Midcap Index mutual fund tracks the S&P MidCap 400 Index. This index is also tracked by the following three index ETFs: Vanguard S&P Mid-Cap 400 ETF, SPDR MidCap Trust ETF (Series 1), and iShares Core S&P Mid-Cap ETF. Our primary sources for determining mutual funds' underlying benchmark indices and their matching ETF(s) are the websites of the respective sponsoring families, SEC's EDGAR and ETF Database (www.etfdb.com). The final matching sample consists of 335 unique index mutual funds with at least one matching index ETF. There are 54 unique matching index ETFs and 51 unique benchmark indices.

Panel A of Table II reports summary statistics of the no-load index mutual funds and matching index ETFs. The table reports the time series of average cross-sectional means and medians of each variable from 2003 to 2012. For index mutual funds, the cross-sectional mean and median are calculated across different benchmarks. There are on average 231 index mutual funds and 38 matching index counterparts per month. Index mutual funds have slightly lower average monthly TNA, with $5,465.97 million per month, than matching index ETFs, with $5,841.27. As expected, the average expense ratios are higher for index mutual funds (0.64%) than for matching ETFs (0.20%). Consequently, index mutual funds have lower average monthly net returns than their counterparts (0.89% vs. 1.12%). Index mutual funds have higher annual turnover ratio of 24.31% whereas index ETFs' turnover ratio is at 19.43%. Cash holdings are 0.41% for index mutual funds and 0.13% for index ETFs.

For index mutual funds, all daily cash flow related variables are computed by merging our main sample with TrimTabs data on common share class tickers. The CRSP fund dataset provides fund tickers but it suffers from a series of shortcomings that are described in detail in Pastor, Stambaugh and Taylor (2014) and Berk and van Binsbergen (2013). We use tickers generously provided by Lubos Pastor and Lucian A. Taylor to merge TrimTabs data with CRSP fund dataset. The average daily net cash flow is $0.046 million per month, normalized net cash flow is 0.06% per day, and daily fund flow volatility is 1.05% per month. For index ETFs, all cash flow related variables in our data are monthly because daily cash flow information for index ETFs is not available from TrimTabs. We use monthly TNA from the CRSP fund database to compute monthly ETF cash flows. We follow the previous literature (e.g., Chen, Goldstein, and Jiang, 2010) to compute monthly net cash flow ($NCF_{i,t}$) and normalized monthly net cash flow ($NormNCF_{i,t}$) as follows:

$$NCF_{i,t} = TNA_{i,t} - TNA_{i,t-1} \times \left(1 + r_{i,t}\right) \quad (1)$$

$$NormNCF_{i,t} = NCF_{i,t} / TNA_{i,t-1} \quad (2)$$

where $TNA_{i,t}$ is the total net assets (TNA) of fund i at the end of month t. Monthly Net Cash Flow is larger for ETFs than for mutual funds ($39.80 vs. $7.52 million). However, after adjusting for TNA, the Normalized Monthly Net Cash Flow becomes larger for index mutual funds (4.13% vs. 1.70%). Hence, mutual funds have greater size adjusted net flow per month than corresponding ETFs. In addition, index mutual funds experience greater monthly flow volatility than index ETFs (26.16% vs. 8.26%).

We obtain index ETFs' daily prices and bid-ask spreads from the CRSP daily stock file to compute daily quoted spreads and daily effective spreads. The quoted spread is absolute value of $\frac{\left(ask_{i,t} - bid_{i,t}\right)}{0.5 \times \left(ask_{i,t} + bid_{i,t}\right)}$ (Amihud and Mendelson, 1986; Stoll and Whaley, 1983). The direct effective

spread is calculated as the absolute value of $\frac{price_{i,t} - 0.5 \times \left(ask_{i,t} + bid_{i,t} \right)}{price_{i,t}}$ (Lee and Ready, 1991). Daily bid-ask spread is equal to the difference between ask and bid prices. An average ETF has $0.07 per day in bid-ask spread, 0.10% per day in quoted spread and 0.09% in effective spread.

Actively Managed Funds and Matching Passive Funds For each no-load active mutual fund class, we identify all matching passive funds based on common investment objectives: *Growth*, *Income*, and *Growth and Income*. The final matching sample consists of 4,212 unique active mutual funds with at least one corresponding passive mutual fund.

Panel B of Table II reports summary statistics for actively managed no-load mutual funds and matching passive funds. Each month we compute the means and the medians for each of the variables across funds within each investment objective and then average across different investment objectives. For details on variable calculations please refer to Table I and Table IV. There are on average 2,001 no-load active mutual funds and 83 matching passive funds per month. Fund Class TNA is significantly lower for the active funds than for the passive funds because active mutual funds have a larger number of shares within the fund than its passive counterparts. Further, active funds have higher annual expense ratios than matching passive funds: 1.22% vs 0.50%. Consequently, net returns to investors of active funds are lower than matching passive funds: 0.63% vs 0.76%. As expected, turnover and cash holdings are much higher for active mutual funds, suggesting that active funds bear higher costs associated with active trading and liquidity service provision. Monthly net cash flow is significantly higher for passive mutual funds at $11.65 million. When adjusting for size, the difference is not that revealing with 1.34% for active and 3.03% for passive mutual funds. Finally, Panel B of Table I also presents daily flow variables for both fund types. We observe negative values for daily net cash flow as well as normalized daily net flow, which is driven by the large funds in the TrimTabs data.

III. Empirical Analysis: Passive Index Funds vs. Index ETFs

A. Passive Index Mutual Funds vs. Index ETFs

We begin our analysis with the comparison between index mutual fund and matching index ETFs. Exhibit 1 illustrates differences and similarities between no-load index mutual funds and index ETFs in terms of (a) services provided to the investors, (b) costs to investors, and (c) effects on fund performance. Index mutual funds and matching index ETFs are essentially offering the same underlying Investment Product. For example, an investor would invest in the same portfolio through Vanguard 500 Index Inv. (VFINX) or Vanguard S&P 500 ETF (VOO) as both track the S&P 500 index. The net return to investors, however, is likely different due to differences in expenses and costs of investing in each product.

Exhibit 1. Services provided by Index Mutual Fund vs Index ETF

	Index Mutual Fund			**Index ETF**		
Service	**Available to Investors**	**Costs to Investors**	**Effect on Fund Performance**	**Available to Investors**	**Costs to Investors**	**Effect on Fund Performance**
(1) Investment Product	**Yes**			**Yes**		
(a) Product Establishment		Expense Ratio	Negative		Expense Ratio	Negative
(b) Professional Management		Expense Ratio	Negative		Expense Ratio	Negative
- Diversification and divisibility		Expense Ratio	Negative		Expense Ratio	Negative
(c) Advertising		Expense Ratio (12b-1)	Negative		Expense Ratio	Negative
(2) Investor Account Service	**Yes**					
(a) Recordkeeping		Expense Ratio	Negative			
(b) Liquidity Service		Expense Ratio	Negative			
- Shared Liquidity		None	None			
- Expected Net Flow		Cash Holdings	Negative			
- Unexpected Net Flow		Transaction Costs	Negative			

(3) Tradability of Investment Product		**Yes**	Transaction Costs	None

The key difference between index mutual funds and index ETFs is that index mutual funds provide Account Service to Investors, which includes Recordkeeping and Liquidity Service. Liquidity Service allows investors of open-end funds to redeem their shares or purchase new shares in a fund based on day-end NAV at no or little direct cost. We can break down Liquidity Service into three specific attributes: Shared Liquidity, Expected and Unexpected Net Flows. One advantage of Liquidity Service is that it is shared by all investors. The daily flow can be offset partially by outflow, or vice versa. Such Shared Liquidity is free to the investors and incurs only administrative costs to the funds. Expected Net Flows are addressed by holding cash to satisfy expected redemption demand or acquisition of mutual fund shares. Commonly referred as "cash drag", these costs include direct and indirect costs to the fund (Yan, 2006; Wermers, 2000). Using a model of mutual fund fee structures, Chordia (1996) predicts that mutual funds hold more cash when they face higher redemption uncertainty. In the case of Unexpected Net Flow, the index fund is forced to trade by selling or buying portfolio holdings proportionally in order to satisfy unexpected liquidity demand. The costs of unexpected liquidity provision could be very high if there is a large daily net flow. Regardless of the direction of the flow, the funds incur transaction costs that include brokerage commissions and bid-ask spreads. Transaction costs reduce portfolio value, and as a result, reduce returns to investors. We note that in this setting there is no effect associated with liquidity-motivated trading as examined in Edelen (1999). This is because the underlying portfolio of the fund is passive and there is no active stock selection by fund manager.

On the other hand, index ETFs offer Tradability of Investment Product. Intraday buying and selling opportunities are available to ETF investors. However, the costs associated with trading are incurred directly by investors. Therefore, these costs have no direct impact on the performance of ETFs.

To summarize, the main distinction between index mutual funds and matching index ETFs is the liquidity service provided by index mutual funds. Thus, any variations in net returns to mutual fund investors are mainly driven by operating costs incurred by funds in providing liquidity service in particular and investor account service in general. This comparison provides an ideal setting to examine the impact of liquidity service provision on the underperformance of index mutual funds and to examine determinants of fund cash flows.

B. Passive Index Funds: Underperformance and Costs of Liquidity Service

B.1. Quantifying Liquidity Service Costs to Mutual Funds

By matching index mutual funds with index ETF(s), we decompose index mutual funds' cost components of liquidity service provision to illustrate the relative contribution of each component to the underperformance of index mutual funds. Table III reports results for each year in a sample period for our subsample of funds with available data on daily cash flows from TrimTabs. Mutual fund underperformance is measured by the difference between annual returns of index mutual fund and the average annual returns of matching ETFs, $Ret^{MF\text{-}ETF}$. On average, index mutual funds underperform matching index ETFs by 81 basis points persistently during our sample period. Since both fund types provide the same investment product (i.e., track the same underlying benchmark index) and have the same expected raw returns, the difference in the net returns can be attributed to the difference in the expenses associated with services provided by mutual funds (see Exhibit 1).

As expected, the main source of the underperformance is the expense ratio of index mutual funds adjusted by the average expense ratios of the matching ETFs, $Exp^{MF\text{-}ETF}$. Index mutual funds charge higher expense ratios than their counterparts because index mutual funds provide additional services that index ETFs do not. These services include recordkeeping and liquidity service. On

average, the difference in expense ratios is 47 basis points, and in each year it is consistently smaller than the absolute value of total mutual fund underperformance.

The second source of the index mutual funds' underperformance is the cost associated with the daily amount of cash held by mutual fund managers. Cash drag is calculated as the average monthly cash holdings multiplied by annual benchmark return net of annual risk-free rate. The risk-free rate is the annualized yield on the one-month Treasury bill. In our sample, cash drag is 2 basis points on average.

Finally, the third source of index mutual fund underperformance is the transaction costs associated with unexpected liquidity service provision and is part of the overall costs (see Exhibit 1). The mutual fund manager has to engage in flow-induced trading in the case of the unexpected net cash inflow or net outflow in or out of the fund. Ideally, we need *daily* cash holdings information in order to compare it with the daily flow to estimate transaction costs more precisely. However, due to data limitations we adopt the following rule of thumb. The fund incurs transaction costs whenever the absolute value of the daily flow is greater than 0.25% of the fund's daily total net assets; otherwise no trades occur and funds satisfy redemption demand with available cash holdings. To compute transaction costs associated with the unexpected net flow we use matching index ETFs. Daily flow data for mutual funds is obtained from TrimTabs, daily ETF prices and bid-ask spreads are obtained from the CRSP daily stock file and ETF annual expense ratios are obtained from the CRSP mutual fund dataset. Daily transaction costs consist of brokerage commissions and the bid-ask spread of the corresponding index ETFs. For a fund inflow, an additional cost based on the daily expense of the corresponding index ETFs is also included. The number of shares is equal to the amount of inflow (outflow) divided by the closing daily price of the corresponding index ETFs. The average daily transaction costs are converted into annual costs and scaled by the last month's observed TNA. For index mutual funds with multiple matching ETFs, the transaction costs

are averages of all corresponding index ETFs' costs. Brokerage commissions used in our calculations are obtained from Gao, Livingston, and Zhou (2014)[6] and equal 5.11 or 11.08 basis points per dollar traded. On average, transaction costs equal to 0.051% when brokerage commission equals to the mean values and 0.142% when brokerage commission equals to the values of mean plus one standard deviation.

Mutual fund costs are passed on to the fund investors. As expected, Table III demonstrates that expense ratios and transaction costs of unexpected daily fund flows are the main sources of index mutual fund underperformance. They contribute 57.85% and 6.32%, respectively, to index mutual fund underperformance. Cash holding by index mutual funds explains a minimal portion of underperformance (1.85% on average). As a result, liquidity service provision on average accounts for 66.02% of total mutual fund underperformance. As shown in Table III, the magnitudes of these expenses are significantly lower than the level of mutual fund underperformance. However, transaction costs may be significantly underestimated since we use matching ETFs to compute daily transaction costs instead of actual unobservable costs.

B.2. Determinants of Index Mutual Fund Underperformance

The relationship between mutual fund performance and fund characteristics has received a significant amount of attention in prior literature (see, e.g., Chen, Hong, Huang, and Kubik (2004); Edelen, Evans, and Kadlec (2007); Friesen and Sapp (2007); Keswani and Stolin (2008); Yan (2008), etc.) We contribute to the literature by examining how fund performance is related to variation in fund characteristics. This allows us to examine the effects of liquidity service provision for index mutual funds in a setting where there is no active management component in fund returns. Since the total raw returns of matching index mutual funds and index ETFs are equivalent,

[6] Their study covers the 2001-2011 period, which is close to our sample period. These authors analyze Lipper fund level data on brokerage commissions paid by U.S. mutual funds. The paper provides descriptive statistics of the average for brokerage commissions paid by U.S. mutual funds for the mean.

variations in net returns to investors are mainly driven by costs incurred by funds. As such, the additional costs for mutual funds should be mostly, if not fully, associated with investor account service.

We perform the following regression of index mutual fund underperformance against various fund characteristics:

$$\begin{aligned} r_{i,t}^{ETF-MF} = \; & \gamma_1 \left(EXP_{i,t-1}^{MF-ETF} \right) + \gamma_2 TURN_{i,t-1}^{MF} + \gamma_3 AGE_{i,t-1}^{MF} + \\ & + \gamma_4 \ln\left(FundSIZE \right)_{i,t-1}^{MF} + \gamma_5 \left(\ln\left(FundSIZE \right)_{i,t-1}^{MF} \right)^2 \\ & + \gamma_6 \ln\left(FamSIZE^* \right)_{i,t-1}^{MF} + \gamma_7 \left(\ln\left(FamSIZE^* \right)_{i,t-1}^{MF} \right)^2 + \gamma_8 CASH_{i,t-1}^{MF} + \\ & + \gamma_9 FundExFLOW_{i,t-1}^{MF} + \gamma_{10} ExFLOWVOL_{i,t-1}^{MF} + \\ & + \gamma_{11} FundExRET_{i,t-1}^{MF} + \gamma_{12} ExRETVOL_{i,t-1}^{MF} + \varepsilon_{i,t} \; , \end{aligned} \tag{3}$$

where $r_{i,t}^{ETF-MF} = -\left(r_{i,t}^{MF} - r_t^{ETF} \right)$ denotes index mutual fund underperformance, measured as the *negative* of the difference between monthly net returns of index mutual funds and the average monthly returns of matching ETFs, $-Ret^{MF-ETF}$. We follow the existing literature and include common determinants of fund performance[7], namely expense ratio, turnover ratio, fund age, fund size and its squared term, family size and its squared term, cash holdings, fund excess flow and excess flow volatility, fund excess return and excess return volatility. We measure fund size as the logarithm of the month-end total net asset. We also use fund size squared to test the possibility of decreasing returns to scale. Since fund family size and fund size are highly correlated, in our analysis we use residuals from the cross-sectional regression of log fund family size against log fund size. We measure fund excess flow as the average of monthly normalized net cash flow over the past twelve months adjusted by the normalized net cash flow of matching ETFs. Similarly,

[7] Just to list a few: Gruber (1996), Chen, Hong, Huang, and Kubik (2004), Edelen, Evans, and Kadlec (2007), Friesen and Sapp (2007), Keswani and Stolin (2008), Yan (2008), Bergstresser, Chalmers, and Tufano (2009), Huang, Sialm, and Zhang (2011), and Elton, Gruber, and Blake (2012). The authors in those papers document the following common determinants of mutual fund performance: expense ratio, turnover, total load, fund size (or log of fund size), fund family size (or log of fund family size), past performance, return volatility, fund flow, fund flow volatility, age (or log of age), etc.

excess flow volatility is the standard deviation of monthly normalized net cash flow over the past twelve months adjusted by the standard deviation of monthly normalized net cash flow of matching ETFs. We compute fund excess return and excess return volatility as the fund's cumulative return over the past twelve months adjusted by the cumulative return of matching ETFs and the standard deviation of monthly fund net return over the past 12 months adjusted by the standard deviation of monthly fund net return of matching ETFs. For derivations of the remaining variables, please refer to Table I and Table II. Table IV reports the results of the pooled regression in (3). All independent variables are lagged one period and are standardized at each cross-section (month). Models 2 and 3 include fund characteristics: the difference in expense ratios between index mutual funds and the average expense ratios of matching ETFs, turnover, age, log fund size and log fund size squared, log family size and log family size squared. Models 4 and 5 extend the first two models by including fund flow related variables. Finally, Models 6 and 7 add fund portfolio characteristics to the previous model specifications, such as past excess performance and excess return volatility[8].

As expected, the difference in expense ratios, $Exp^{MF\text{-}ETF}$, is the largest contributor to the index mutual fund underperformance across all proposed models. The estimate ranges from 0.346 to 0.401 with 1% significance across all proposed models. This suggests that by providing additional services to investors, such as liquidity and recordkeeping services, index mutual funds charge higher expense ratios, which degrade their performance relative to their matching ETFs.

Cash holdings, which are used to estimate costs associated with expected net cash flow, i.e., cash drag, have a minimal impact (negative and statistically insignificant in full model specifications) on the fund performance. In particular, in Model 6 a one percent increase in cash holdings results in 0.001% increase in the net return difference between index mutual fund and index ETFs.

[8] For each determinant we run an univariate regression and obtain high statistical significant levels for each. Results are not presented in the table but are available upon request.

Turnover adversely impacts fund performance perhaps due to its effect on trading costs. As previously pointed out, a manager has to engage in trading whenever it faces unexpected net cash flow. In our analysis, the positive magnitude and statistical significance of the turnover ratio are consistent across all models.

Interestingly, underperformance is negatively correlated with fund size, albeit with a nonlinear relation, and with fund age. This is evidence that large and established funds have an advantage in providing investors account service in general and liquidity service in particular due to economies of scale. The finding is consistent with empirical evidence on the relation between fund size and trading costs as documented in Christoffersen, Keim, and Musto (2006)[9]. Similarly, Edelen, Evans, and Kadlec (2007) by using quarterly mutual fund trades estimate transaction costs to infer trading costs and argue that trading costs are a major source of diseconomies of scale. On the contrary, Chan, Faff, Gallagher, and Looi (2009) study 34 Australian funds that self-reported their transaction data, and they find no significant impact of size on trading costs. However, family size is not significantly related to index mutual fund underperformance. In all model specifications, except the univariate models, log family size has negative but statistically insignificant relation with fund underperformance. The multivariate specification also demonstrates that lagged normalized fund excess flow and normalized fund excess flow volatility do not exhibit a statistically significant effect on mutual fund underperformance, although each of these variables is statistically significant in the univariate regressions. Finally, higher fund excess return and higher excess return volatility lead to higher index mutual fund underperformance, suggesting that liquidity service provision is more costly for funds with higher past returns and higher variations in returns.

[9] Christoffersen, Keim, and Musto (2006) examine the relation between trading costs and size of mutual funds using data for Canadian mutual funds, which are required to report all trades. They measure trading costs as the difference between a fund's net price and the value-weighted average price. This includes both transaction costs and price impact. They find that larger mutual funds have lower trading costs than smaller funds.

C. Liquidity Service Premium to Investors and Determinants of Fund Flows

C.1. Quantifying Liquidity Service Premium to Investors

Figure 1 compares the costs of investing in index mutual funds versus matching index ETFs. As illustrated in each panel, the differences in the costs vary across different initial investment amounts (in dollars) and investment horizons. Both fund types track the S&P 500 benchmark index. The four panels correspond to semi-annual, annual, 3-year and 5-year investment horizons respectively. For both index mutual funds and corresponding index ETFs, the costs are calculated as the average cost of investing in all funds tracking the S&P 500 index. The cost of investing in mutual funds is calculated as the expense ratio over the corresponding investment horizon times the initial investment amount. The cost of investing in ETFs includes round-trip costs of trading ETF shares in addition to annual expense ratios. In particular, an investor faces a brokerage commission fee every time she acquires or sells ETF share(s), and consists of fixed and variable amounts depending on the size of the trade. We borrow the discount commission schedule from Korajczyk and Sadka (2004), and Lesmond, Schill and Zhou (2004) for broker-assisted trades. This schedule's fees are significantly higher than the average commission charged by online brokerage houses but, as argued by Lesmond, Schill and Zhou (2004), it represents average rates over the overall sample period. In addition, the ETF investor also incurs variable costs of bid-ask spread for every ETF share she buys or sells. The average expense ratio across all index ETFs is 0.08% per year whereas for all index mutual funds is 0.52% per year. The average price per ETF share is $102 and average bid-ask spread is $0.02 per share. For details on the round-trip costs of trading ETF shares, please refer to Section C1.

Figure 1 demonstrates a strong dominance of index ETF transaction costs for the six-month holding period. However, this dominance reverses when the horizon increases. For one- and three-year horizons the dominance varies between the two types of funds depending on the investment

level. The figure suggests that an index mutual fund is preferable for the investor with shorter investment horizons and/or smaller investment amounts. On the other hand, an index ETF is preferable for longer investment horizons and/or larger investment amounts.

C.2. Determinants of Cash Flows to Passive Mutual Funds

There is extensive literature on the determinants of mutual fund cash flow (see, e.g., Chevalier and Ellison (1997); Sirri and Tufano (1998); Jain and Wu (2000); Barber, Odean, and Zheng (2005); Huang, Wei, and Yan (2007); Bergstresser, Chalmers, and Tufano (2009); Christoffersen, Evans, and Musto (2013); Del Guercio and Reuter (2014), etc.) We contribute to the literature by examining the relation between investors' cash flows and fund characteristics in the presence of liquidity service and in the absence of active management.

We perform the following regression of index mutual fund cash flows against various fund characteristics:

$$\begin{aligned} NCF_{i,t}^{MF-ETF} = \; & \beta_1 EXP_{i,t-1} + \beta_2 \left(EXP - 12b1\right)_{i,t-1} + \beta_3 \left(12b1\right)_{i,t-1} + \beta_4 AGE_{i,t-1} + \\ & + \beta_5 \ln\left(FundSIZE\right)_{i,t-1} + \beta_6 \left(\ln\left(FundSIZE\right)_{i,t-1}\right)^2 + \\ & + \beta_7 \ln\left(FamSIZE^*\right)_{i,t-1} + \beta_8 \left(\ln\left(FamSIZE^*\right)_{i,t-1}\right)^2 + \\ & + \beta_9 FundExRET_{i,t-1} + \beta_{10} ExRETVOL_{i,t-1} + \\ & + \beta_{11} FundExFLOW_{i,t-1} + \beta_{12} ExFLOWVOL_{i,t-1} + \varepsilon_{i,t} \quad , \end{aligned} \tag{4}$$

where $NCF_{i,t}^{MF-ETF}$ denotes the normalized monthly net cash flow adjusted by the average normalized monthly net cash flow of matching index ETFs. We follow the exiting literature and include common determinants of mutual fund cash flows, namely expense ratio, marketing expenses, fund age, fund size, family size, cumulative fund net excess return and associated excess

volatility, fund excess flow over last twelve months and its volatility[10]. For details on variable construction please refer to Tables I and IV. (Expense Ratio – 12b1) is the expense ratio net of 12b-1 fees. Marketing expenses are 12b-1 fees. Table V reports the results of the pooled regression in (4). All explanatory variables are lagged one month and are standardized at each cross-section (month). The impact of fund characteristics on fund flows is presented in Models 1 and 2, fund portfolio characteristics are added in Model 3, and flow variables are added in Models 4, 5, 6 and 7. All results described below are consistent and statistically significant at various levels across all five models except marketing expenses, family size and excess return volatility.

As expected, we observe a strong negative relation between cash flow and expense ratio across all regression models. Even after controlling for investment objectives, age, size, flow and return variables, it appears that investors use expense ratio as a major factor in picking or leaving the fund, suggesting that investors recognize the effect of fund expenses associated with liquidity service provision on fund performance. This result is supported when we partition expense ratio into expense ratio net of 12b-1 fess and marketing expenses (12b-1). However, marketing expenses have positive but statistically insignificant impact on fund flows when included in the multivariate analysis which is similar to that found in earlier studies of marketing expenses on fund flows (e.g., Jain and Wu, 2000; Barber, Odean, and Zheng, 2005; Bergstresser, Chalmers, and Tufano, 2009; etc.). While mutual fund investors are discouraged by high levels of operating expenses, they do buy mutual funds that are advertised and promoted to them.

Interestingly, we observe a significantly positive relation between fund flows and fund performance[11]. This confirms the argument in Berk and Green (2004) that a positive relation

[10] We also examine a regression without adjusting the dependent variable by the average normalized monthly net cash flow of the matching index ETFs. The results are consistent but not presented in the paper, and are available upon request.

[11] Papers that document a strong positive relationship between past performance and future cash flows include: Ippolito (1992), Gruber (1996), Goetzman and Peles (1997), Chevalier and Ellison (1997), Sirri and Tufano (1998), Barber, Odean, and Zheng (2005), Del Guercio and Tkac (2002), Lynch and Musto (2003), and Wermers (2003).

between fund flow and fund excess performance is not necessarily driven by the superior ability of fund managers. Chasing past performance does not necessarily mean that investors are irrational, even when there is a lack of persistence in fund performance. Nevertheless, when examining the determinants of fund flows, we observe that flows are negatively related to both fund age and fund size (although non-monotonic) despite the fact that both variables are positively related to net returns to investors[12]. This is evidence that investors are not fully rational in recognizing the effect of liquidity service provision on fund net returns. This result could be driven by more aggressive advertising campaigns by younger funds than their older counterparts. In addition, larger funds stop benefiting from the economies of scale as suggested by the convexity of the relation between fund size and fund flows. It is possible that investors may be attracted to smaller funds because they tend to charge lower expense ratios. However, as the fund gains popularity and establishes itself, it starts to charge higher expense ratios and, therefore, discourages new investors from entry. On contrary, results on family size suggest that investors are attracted to larger fund families. However, the marginal effect of family size on fund flows is negative and statistically significant suggesting the relation is nonlinear. Finally, index mutual funds with the history of high levels of fund excess flow and lower levels of excess flow volatility relative to its benchmarks continue to attract more investors.

IV. Empirical Analysis: Active Funds vs. Passive Funds

A. Actively Managed Funds vs. Passive Funds

Exhibit 2. Services provided by Active Mutual Fund vs Passive Mutual Fund

Active Mutual Fund	Passive Mutual Fund

[12] Papers that document a negative relationship between fund size and future cash flows include: Sirri and Tufano (1998), Del Guercio and Tkac (2002), Barber, Odean, and Zheng (2005), Bergstresser, Chalmers, and Tufano (2009), Christoffersen, Evans, and Musto (2012), and Del Guercio and Reuter (2014).

Service	Available to Investors	Costs to Investors	Effect on Fund Performance	Available to Investors	Costs to Investors	Effect on Fund Performance
(1) Investment Product	**Yes**			**Yes**		
(a) Product Establishment		Expense Ratio	Negative		Expense Ratio	Negative
(b) Professional Management		Expense Ratio	Negative		Expense Ratio	Negative
- Diversification and divisibility		Expense Ratio	Negative		Expense Ratio	Negative
(c) Advertising		Expense Ratio (12b-1)	Negative		Expense Ratio	Negative
(2) Investor Account Service	**Yes**			**Yes**		
(a) Recordkeeping		Expense ratio	Negative		Expense ratio	Negative
(b) Liquidity Service		Expense ratio	Negative		Expense ratio	Negative
• Shared Liquidity		None	None		None	None
• Expected Net Flow		Cash Holdings	Negative		Cash Holdings	Negative
• Unexpected Net Flow		Transaction Costs	Negative		Transaction Costs	Negative
		Liquidity-Motivated Trading Edelen (1999)	Negative			
		Portfolio Liquidity Discount	Negative			
(3) Active Management Service	**Yes**					
• Portfolio Alpha		Expense Ratio	Positive			
• Fund Active Trading		Transaction Costs	Negative			

B. Actively Managed Funds: Cost of Liquidity Service and Underperformance

B.1. Quantifying Cost of Liquidity Service for Actively Managed Funds

In this section, we examine the sources of underperformance of active mutual funds relative to passive funds and decompose the underperformance into several components: differences between expense ratios, cash drag, transaction costs, and portfolio liquidity. We discuss cash drag, transaction costs, and portfolio liquidity measures in the next three sections.

Cash Drag. Cash drag and underinvestment have been studied in the previous literature. For example, Yan (2006) and Chordia (1996), among many others, discuss the association between cash holdings and fund characteristics. Yan (2006) develops a static model of optimal cash holdings and tests his model empirically using the US equity mutual funds over 1992-2001 time span. He finds that small-cap funds with higher transaction costs, funds with large recent fund inflows, and funds with more volatile fund flows hold more cash. Chordia (1996) argues that no-load mutual funds face a greater degree of uncertainty of redemption demand than load mutual funds, and as consequence, tend to hold more cash, which in turns adversely affects fund performance. According to Simutin (2013), active mutual funds use abnormal cash holdings to satisfy fund outflows and to avoid fire sales. We follow Yan (2006) and Simutin (2013) to estimate cash holdings of actively managed no-load mutual funds. By using a cash holdings model, we use expected cash holdings by mutual funds in our analysis.

Each month, we perform cross-sectional regressions of fund quarterly cash holdings against various fund characteristics and compute expected cash holdings of mutual funds as follows:

$$\begin{aligned} CASH_{i,t} = \alpha + & \beta_1 EXP_{i,t-1} + \beta_2 TURN_{i,t-1} + \beta_3 AGE_{i,t-1} + \beta_4 SIZE_{i,t-1} + \beta_5 SIZE^2_{i,t-1} \\ & + \beta_6 FLOW_{i,t-1} + \beta_7 FLOWVOL_{i,t-1} + \beta_8 CASHVOL_{i,t-1} \\ & + \beta_9 RET_{i,t-1} + \beta_{10} YIELD_{i,t-1} + \beta_{11} MRTBETA_{i,t-1} + \\ & + \beta_{12} d^{GROWTH}_{i,t-1} + \beta_{13} d^{GR\&INC}_{i,t-1} + \beta_{14} d^{INCOME}_{i,t-1} + \varepsilon_{i,t} \quad , \end{aligned} \tag{5}$$

where $EXP_{i,t-1}$ is the expense ratio; $TURN_{i,t-1}$ is the fund turnover ratio; $AGE_{i,t-1}$ is the fund age; $SIZE_{i,t-1}$ is the logarithm of the month-end total net assets; fund size squared is the square of fund size; $FLOW_{i,t-1}$ is the average fund flow over the past twelve months; $FLOWVOL_{i,t-1}$ is the standard deviation of the fund flow over the past twelve months; $CASHVOL_{i,t-1}$ is the standard deviation of the fund cash holdings over the past twelve months; $RET_{i,t-1}$ is the cumulative monthly net return over the past twelve months; $YIELD_{i,t-1}$ is the month-end income yield; $MRTBETA_{i,t-1}$ is the beta estimate in the CAPM based on fund monthly returns over the last 36 months; $d_{Growth,}$ $d_{Growth\&Income,}$

and d_{Income} are investment objective dummies that are set equal to 1 if the fund investment style is growth, growth and income, and income, respectively, and zero otherwise. Turnover, fees, net return, yield, fund age, cash holdings and expenses are constructed using CRSP fund monthly data. Fund flow variables are derived using daily flow data. Market variables are obtained from WRDS and developed by Fama and French. Table VI reports the results of the cross-sectional regression in (5), the time-series average of coefficient estimates, and t-statistics that are based on Newey-West (1987) standard errors. Models 1 and 2 include fund characteristics such as expense ratio, turnover, age, fund size, fund size square. Model 3 add flow variables such as fund flow, fund flow volatility, and cash volatility. Finally, Models 4 and 5 combine all previous variables as well as fund return, yield, market beta, and fund objective dummies.

As expected, older funds, funds with greater expense ratios, greater annual turnover ratios, and/or greater cash volatilities tend to hold more cash. These findings are consistent with Simutin (2013) and robust across all model specifications in Table VI. In the linear specification, size has a positive impact on cash holdings, suggesting that larger funds hold more cash. However, the coefficient for the squared term of size suggests a convex relation between size and the cash holdings. This implies that larger funds hold more cash but with a decreasing proportion as size increases. Past fund flow and fund return have a strong positive effect on cash holdings. On the other hand, high fund flow volatility forces the manager to maintain higher cash balances. Finally, the level of cash holdings is sensitive to the overall risk of the equity portfolio measured by market beta. Funds with a growth investment objective hold more cash than funds with an income oriented objective. To estimate expected monthly cash holdings we use selective estimators from the complete model specification (Model 5). We further use expected cash holdings to compute cash drag in the summary Table VIII as follows. Cash drag is the estimated cash holdings multiplied by the monthly net return net of the risk-free rate (the one-month Treasury bill rate).

Portfolio Liquidity Discount. Mutual funds may include a certain amount of relatively more liquid stocks in their equity portfolios to satisfy unexpected liquidation demand of investors. This aspect is probably especially relevant during distressed market conditions when mutual fund investors tend to redeem their positions out of fear. Under such market conditions, liquidity could be costly. In our analysis, we construct three liquidity measures, namely the Amihud illiquidity ratio, the Gibbs sampler estimate of the effective spread, and dollar turnover. The Amihud illiquidity ratio is computed as the ratio of absolute daily return to the daily dollar trading volume, averaged over rolling 12 month windows (see Amihud (2002) for estimation details). The Gibbs sampler estimate of the effective spread is based on daily returns during rolling 12 months (see Hasbrouck, 2004, 2009 for details of estimation). Dollar turnover is daily dollar trading volume divided by total shares outstanding, averaged over rolling 12 month windows.

We construct a liquidity discount for each active mutual fund in each month as $\beta^{LIQ} \times \left(LIQ_{j,t}^{fund} - LIQ_t^{BMK} \right)$. We first compute the value-weighted liquidity of all stocks held in each fund's portfolio in excess of benchmark liquidity, i.e., $\left(LIQ_{j,t}^{fund} - LIQ_t^{BMK} \right)$. We merge CRSP mutual fund dataset with the Thomson Reuters mutual funds holding data to obtain detailed fund holdings and calculate the above three liquidity measures for each fund portfolio. Since the data are available only until 2011, we limit our analysis from January 2003 to December 2011. The benchmark liquidity is calculated based on the value-weighted CSRP index. The estimates of β^{LIQ} are obtained by performing cross-sectional regressions of stock returns against liquidity measures with other stock characteristics included as control variables as follows:

$$
\begin{aligned}
ret_{i,t} &= \alpha + \beta_1 DTURN_{i,t-1} + \beta_2 \ln ME_{i,t-1} + \beta_3 \ln BM_{i,t-1} + \beta_4 MOM_{i,t-1} + \beta_5 VOLA_{i,t-1} + \varepsilon_{i,t} \\
ret_{i,t} &= \alpha + \beta_1 GIBBS_{i,t-1} + \beta_2 \ln ME_{i,t-1} + \beta_3 \ln BM_{i,t-1} + \beta_4 MOM_{i,t-1} + \beta_5 VOLA_{i,t-1} + \varepsilon_{i,t} \\
ret_{i,t} &= \alpha + \beta_1 ILLIQ_{i,t-1} + \beta_2 \ln ME_{i,t-1} + \beta_3 \ln BM_{i,t-1} + \beta_4 MOM_{i,t-1} + \beta_5 VOLA_{i,t-1} + \varepsilon_{i,t}
\end{aligned}
\qquad (6)
$$

For each liquidity measure, we perform univariate and multivariate regression analyses. Additional explanatory variables include the natural logarithm of the market capitalization of the stock, ln $ME_{i,t-1}$; the natural logarithm of the book-to-market ratio of equity, ln $B/M_{i,t-1}$; the buy-and-hold return over the past twelve months, $MOM_{i,t-1}$; and the standard deviation of a stock's returns over the past 12 months, $VOLA_{i,t-1}$ [13]. All independent variables are lagged one month. Table VII reports the time-series average of coefficient estimates from the regression (6) and t-statistics based on Newey-West (1987) standard errors over the 2003-2011 time period.

All three liquidity measures show statistically significant effects on mutual fund stock returns. For example, a positive estimate of Amihud's illiquidity measure indicates that stocks' illiquidity is rewarded by the market. Similarly, dollar turnover tells us that excessive stock liquidity leads to lower stock returns. Size, book-to-market, and return volatility have signs consistent with previous literature. However, the coefficients have weak explanatory power. Interestingly, over the last decade the momentum effect has been a very weak, if not disappearing, factor in the stock returns. We verify our results for the longer time periods (1970-2012 and 1993-2012) and almost all estimates are statistically significant, including the momentum factor[14].

Transaction costs are calculated based on daily cash flows. Daily flow data is obtained from TrimTabs. Therefore, the summary statistics are limited to observations with valid daily flow information. Transaction costs consist of brokerage commission, average daily bid-ask spread and prices of mutual fund portfolio holdings. The average daily transaction costs are converted to annualized costs, and then scaled by the monthly TNA at the beginning of the year. In our calculations, brokerage commission is obtained from Gao, Livingston and Zhou (2004) and is set to mean values of 0.1491%, 0.1669% and 0.1337% for the active mutual funds with Income, Growth

[13] We also included leverage in the regression analysis for each model specification but these results are unreported in the paper. Results are available upon request.

[14] Fama and French (2008) show that abnormal returns due to momentum exist for microcaps, small stocks, and large stocks when analyzing 1963-2005 time period.

and Income, and Growth investment objectives, respectively. We also report high values of the brokerage commission estimates that are equal to mean values plus one standard deviation. Bid-ask spread is half of the value-weighted "PERMNO" holdings' bid-ask spreads at the end of the last day. The number of acquired or sold shares of fund holdings is the absolute value of daily flow divided by the value-weighted price of all stock holdings during last month. We assume that the manager starts trading whenever the daily flow reaches the 2% of daily NAV threshold.

Table VIII reports underperformance of no-load active mutual funds, as measured by the difference between the annual returns of active mutual funds and the average annual returns of matching passive funds and various cost components of active mutual funds. The table reports the cross-sectional mean of all variables for each year of our sample period. We do not observe strict underperformance because some active funds do beat the market. There are number of years when the majority of active mutual funds actually overperform passive mutual funds. On average, active mutual funds underperform matching passive funds by 46 basis points per year. Gruber (1996)'s estimate is 65 basis points per year when comparing actively managed funds with their appropriate benchmark index. The major contributor to the active mutual fund underperformance is the difference between expense ratios of active mutual funds and the average expense ratios of matching passive funds, $Exp^{MF\text{-}PMF}$. On average, the difference in expense ratios is 69 basis points and on average it accounts for more than 100% of mutual fund underperformance. This result suggests that while active funds on average underperform their passive benchmarks, it seems that they can recover part of the expenses.

Cash drag is the second largest contributor of the active mutual fund underperformance that is derived from the fitted value of main cash holdings regression (Model 5, Table VI). On average, cash drag is 0.12% per year which contributes about 25.41% to the overall underperformance. Similar to the results on passive mutual fund underperformance, during the financial crisis cash

balances earned a higher return than funds' holdings. Wermers (2000) documents empirically that non-stock holdings of equity mutual funds lead to 0.7 percentage points in fund underperformance.

Transaction costs account for about 13.94% of the active mutual fund underperformance, whereas under the "high" brokerage commission scenario (mean plus one standard deviation), transaction costs account for 23.44%. Liquidity discount is an additional factor in the mutual fund underperformance relative to passive mutual fund underperformance. It is the market liquidity sensitivity to monthly returns multiplied by the fund liquidity in excess of the benchmark market portfolios. We find that the discount associated with portfolio liquidity contributes to a minimal portion of underperformance.

B.2. Determinants of Underperformance of Actively Managed Funds

As pointed out earlier, a number of studies have examined the relationship between mutual fund performance and fund characteristics. Chen, Hong, Huang, and Kubik (2004) regress future alpha on a number of variables, including size and past return. They find a negative relationship between alpha and size and a positive relationship with past return and with fund family size. No significant associations were detected with other variables such as expense ratio, turnover, total load, age, or fund flow. Further, Yan (2008) finds alpha to have a negative relationship with size and with lagged fund flow, and a positive relationship with past return and with fund family size. No significant association is found with other variables, such as expense ratio, turnover, total load, and age. Elton, Gruber, and Blake (2012) document that fund performance is positively related to past performance, and negatively related to expense ratio, turnover ratio, and cash flow. They find no statistically significant impact of fund size on performance. Expense ratios are lower for large funds, and decrease as funds get larger.

By matching active mutual funds with passive funds, we eliminate the disadvantage of the previous studies that use artificial benchmarks. The setup allows us to examine how fund

characteristics used by the previous studies are related to performance in the presence of both liquidity service and active management. In addition, the comparison between active fund and passive funds allows us to examine the joint effect of active portfolio management and liquidity service on fund performance.

Note that here fund portfolios are actively managed with specific investment objectives. Thus, variations in net returns to investors are driven by not only various costs incurred by funds but also by differences in returns generated by fund managers with different investment objectives. Active fund returns are benchmarked to investable alternatives, namely matching passive funds. Therefore, the additional costs for mutual funds, including costs of investor account service and costs of portfolio turnover, should be associated with active fund management.

We perform the following regression of active mutual fund underperformance against various fund characteristics:

$$\begin{aligned} r_{i,t}^{PMF-MF} = \; & \gamma_1 \left(EXP_{i,t-1}^{MF-PMF} \right) + \gamma_2 TURN_{i,t-1}^{MF} + \gamma_3 AGE_{i,t-1}^{MF} + \\ & + \gamma_4 \ln\left(FundSIZE \right)_{i,t-1}^{MF} + \gamma_5 \left(\ln\left(FundSIZE \right)_{i,t-1}^{MF} \right)^2 \\ & + \gamma_6 \ln\left(FamSIZE^{*} \right)_{i,t-1}^{MF} + \gamma_7 \left(\ln\left(FamSIZE^{*} \right)_{i,t-1}^{MF} \right)^2 + \gamma_8 CASH_{i,t-1}^{MF} + \\ & + \gamma_9 FundExFLOW_{i,t-1}^{MF} + \gamma_{10} ExFLOWVOL_{i,t-1}^{MF} + \\ & + \gamma_{11} FundExRET_{i,t-1}^{MF} + \gamma_{12} ExRETVOL_{i,t-1}^{MF} + \varepsilon_{i,t} \quad , \end{aligned} \tag{7}$$

where $r_{i,t}^{PMF-MF} = -\left(r_{i,t}^{MF} - r_t^{PMF} \right)$ denotes active mutual fund underperformance, measured as the negative of the difference between monthly net returns of active mutual funds and the average annual returns of matching passive mutual funds, i.e., $-Ret^{MF\text{-}PMF}$. $Exp^{MF\text{-}PMF}$ is the difference between the expense ratios of active mutual funds and the average expense ratios of matching passive mutual funds. Similar to Table IV, we include common determinants of fund performance, namely turnover, fund age, logarithm of fund size, logarithm of family size, cash holdings, fund excess flow, fund excess flow volatility, fund excess return, and excess return volatility. Unlike

Table IV, we also include DTURN, GIBBS, or ILLIQ variables as described in Table VII. Table IX reports the results of the cross-sectional regression in (7) and t- statistics based on Newey-West (1987) standard errors. All independent variables are lagged one period and all variables are standardized at the cross-section (each month) with zero mean and standard deviation of one. The sample period is from January 2003 to December 2012.

Similar to Table IV findings, expense ratio remains as negative contributor to fund performance. Cash holdings also contribute negatively to fund performance, but insignificant once other fund characteristics are controlled for. Fund underperformance is also directly related to fund flow volatility adjusted for the flow volatility of matching counterparts. This is consistent with Rakowski (2010) who documents that a high level of fund flow volatility in response to high investor liquidity demands forces mutual fund managers to trade excessively and leads to differences in performance.

Moreover, fund underperformance is negatively related to past performance and its volatility that is adjusted by the fund return and volatility of matching passive mutual funds. Active mutual funds that perform well relative to its matching passive funds continue to perform well. Similarly, funds with higher levels of return volatility over last periods relative to its counterparts tend to underperform less.

The underperformance of active mutual funds is no longer significantly related to turnover. One possible explanation is that the higher alpha generated by more active funds (Wermers, 2000) offsets the negative effect of turnover on fund performance.

More importantly, while the operating costs remain lower for established funds than for younger funds, the relation between underperformance and fund size now becomes insignificant for all model specification expect model (7) where we control for the Amihud illiquidity measure. The existing literature has documented mixed findings on the relation between the performance of active

mutual funds and fund size[15]. Note that the results based on index mutual funds show that fund size is negatively related to fund underperformance and the relation is convex while family size exhibit concave relation. This is consistent with the existence of economies of scale in providing investor service. If larger funds generate higher alphas, we should see an even more significantly negative relation between fund size and fund underperformance. The insignificant findings are consistent with the argument that larger funds face diseconomies of scale in producing alpha. In addition, the marginal effect of family size on fund underperformance suggest that larger families exhibit decreasing benefits of economies of scale.

C. Determinants of Cash Flows for Actively Managed Funds

In this section we examine active mutual funds' investor cash flows. Using a sample of matched active and passive mutual funds we are able to observe the impact of liquidity service and active management on differences in net cash flows.

We perform the following regression of index mutual fund cash flows against various fund characteristics:

$$\begin{aligned} NCF_{i,t}^{MF-PMF} = \; & \beta_1 EXP_{i,t-1} + \beta_2 \left(EXP - 12b1\right)_{i,t-1} + \beta_3 \left(12b1\right)_{i,t-1} + \beta_4 AGE_{i,t-1} + \\ & + \beta_5 \ln\left(FundSIZE\right)_{i,t-1} + \beta_6 \left(\ln\left(FundSIZE\right)_{i,t-1}\right)^2 + \\ & + \beta_7 \ln\left(FamSIZE^*\right)_{i,t-1} + \beta_8 \left(\ln\left(FamSIZE^*\right)_{i,t-1}\right)^2 + \\ & + \beta_9 FundExRET_{i,t-1} + \beta_{10} ExRETVOL_{i,t-1} + \\ & + \beta_{11} FundExFLOW_{i,t-1} + \beta_{12} ExFLOWVOL_{i,t-1} + \varepsilon_{i,t} \quad , \end{aligned} \tag{8}$$

where $NCF_{i,t}^{MF-PMF}$ denotes the normalized monthly net cash flow adjusted by the average normalized monthly net cash flow of matching passive mutual funds. We include the same common determinants of mutual fund cash flows as in Table V, namely expense ratio, expense ratio net of 12b-1 fees, 12b-1 fees, fund age, fund size, family size, fund net excess return and its volatility,

[15] Yan (2008) finds a negative relationship between alpha and size while Elton, Gruber, and Blake (2012) find no statistically significant impact of fund size on performance.

fund excess flow and its volatility. For details on variable construction please refer to Tables I and IV. Table X reports the results of the cross-sectional regression in (8). All explanatory variables are lagged one month and are standardized at each cross-section (month). T-statistics are based on Newey-West (1987) standard errors.

The interpretation of the results is identical to the passive sample's Table V except that now we find a positive relation with fund size (albeit nonlinear). In addition, the independent variables now have greater explanatory power. Moreover, fund excess return volatility and fund excess flow volatility exhibit a negative and statistically significant impact on the normalized fund flow relative to its investable counterparts. Again, we find further evidence that investors are not fully rational in recognizing the effect of liquidity service provision on fund net returns. These results are consistent even when we do not adjust cash flows against the average of benchmark passive funds.

V. Conclusion

Existing literature documents that actively managed mutual funds on average underperform their passive benchmarks and yet investors continue to put their money into mutual funds. In this paper, we examine to what extent the liquidity service provided by open-end mutual funds explains the puzzle by quantifying the liquidity service premium to investors and the cost incurred by funds. Based on index mutual funds and matching ETFs, we show that liquidity service provides a net premium to investors with relatively small investment amounts and short investment horizons. Liquidity service accounts for a substantial portion of fund underperformance. Large and established funds have advantage in liquidity service provision due to economies of scale. Nevertheless, evidence based on fund flows suggests that investors are not fully rational in recognizing the effect of liquidity service on fund performance. Based on actively managed funds, we quantify three cost components associated with liquidity service: cash drag, cost of transacting fund flows, and portfolio liquidity discount. While the costs incurred by funds for providing

liquidity service on average accounts for only small portions of fund underperformance and fund expenses, such portions are substantially higher during distressed market conditions. Decomposing the effect of liquidity service and active portfolio management, our findings support the argument that large funds face diseconomies of scale in producing alpha.

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Table I

Descriptive Statistics of Mutual Funds

This table reports descriptive statistics of mutual funds. Panel A reports descriptive statistics of passive US mutual funds. Panel B reports descriptive statistics of actively managed US domestic equity funds. Fund characteristics are obtained from the CRSP Survivor-Bias-Free US Mutual Fund Database. Share classes are categorized as *no-load, front-end load* and *back-end load classes* based on their load, fee structure, and name search. *Age* is calculated as the number of years a fund is in the CRSP database. *Fund Class TNA* is share class total net asset at the end of each month. *Fund TNA* is the fund total net asset at the end of each month. *Monthly Net Return* is monthly return of the share class. *Expense Ratio* is the percentage of total investment that shareholders pay for the fund's expenses, including 12b-1 fees. *Maximum Front-end Load* is the maximum percent charges applied at the time of purchase, and *Maximum Back-end Load* is the maximum percent charges applied at the time of redemption. *Turnover* is defined as the minimum aggregate purchases or sales of securities during the year divided by the average *TNA. Cash Holdings* is the percentage of fund portfolio in cash. *Monthly Net Cash Flow* is the monthly cash flow of the share class. *Normalized Monthly Net Cash Flow* is computed as monthly net cash flow divided by the TNA at the beginning of the month. *Monthly Fund Flow Volatility* is the standard deviation of monthly normalized net cash flow over the past 12 months. The table reports time series averages of the cross-sectional mean and median for each variable. N denotes the average number of funds per month. The sample period is from January 2003 to December 2012.

Panel A. Passive Mutual Funds

Fund Characteristics	All Fund Classes		No-Load Class		Front-End Load		Back-End Load	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
N	312		258		38		16	
Age (years)	7.79	7.59	7.66	7.49	9.08	8.99	8.03	7.99
Fund Class TNA ($mil)	1,019.72	339.77	1,145.07	423.68	128.27	105.41	59.89	50.48
Fund TNA ($mil)	4,018.46	1,721.43	4,307.27	2,016.25	437.47	391.83	568.67	578.00
Monthly Net Return (%)	0.72%	0.71%	0.73%	0.72%	0.75%	0.77%	0.74%	0.74%
Expense Ratio (%)	0.63%	0.57%	0.58%	0.49%	0.96%	0.93%	1.60%	1.60%
Maximum Front-end Load (%)	2.94%	2.52%			4.86%	5.03%		
Maximum Back-end Load (%)	0.73%	0.24%					4.75%	4.88%
Turnover (%)	17.68%	15.65%	17.80%	15.52%	16.27%	14.64%	13.14%	12.52%
Cash Holdings (%)	0.42%	0.28%	0.43%	0.33%	0.81%	0.74%	0.62%	0.59%
Monthly Net Cash Flow ($mil)	6.13	2.08	6.87	2.57	-0.63	-0.52	-1.35	-0.95
Normalized Monthly Net Flow (%)	1.87%	0.97%	2.06%	1.12%	1.30%	-0.03%	-1.94%	-1.86%
Monthly Flow Volatility (%)	10.15%	5.34%	10.37%	5.52%	12.19%	5.48%	2.45%	1.92%

Panel B. Active Mutual Funds

Fund Characteristics	All Fund Classes		No-Load Class		Front-End Load		Back-End Load	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
N	2,947		2,001		627		319	
Age (years)	11.46	9.63	10.80	8.97	14.07	11.42	11.05	11.10
Fund Class TNA ($mil)	661.77	82.07	656.13	81.23	952.66	152.49	163.58	38.73
Fund TNA ($mil)	3,247.88	626.53	3,745.23	664.84	2,007.06	518.21	2,889.11	756.40
Monthly Net Return (%)	0.62%	0.61%	0.63%	0.62%	0.62%	0.61%	0.57%	0.56%
Expense Ratio (%)	1.30%	1.22%	1.22%	1.11%	1.22%	1.22%	1.92%	1.95%
Maximum Front-end Load (%)	3.88%	5.39%			5.26%	5.65%		
Maximum Back-end Load (%)	1.51%	0.35%					4.81%	5.00%
Turnover (%)	63.45%	49.24%	62.65%	48.10%	65.67%	52.02%	63.80%	49.70%
Cash Holdings (%)	2.94%	1.79%	3.01%	1.84%	2.90%	1.79%	2.64%	1.67%
Monthly Net Cash Flow ($mil)	-0.20	-0.11	0.39	0.00	-0.68	-0.23	-2.74	-0.48
Normalized Monthly Net Flow (%)	1.02%	-0.33%	1.34%	-0.10%	1.20%	-0.36%	-1.42%	-1.92%
Monthly Flow Volatility (%)	8.67%	1.99%	9.50%	2.35%	8.09%	1.62%	4.90%	1.21%

Table II

Descriptive Statistics of Mutual Funds and Matching Index ETFs

This table reports descriptive statistics of mutual funds and matching counterparts. Panel A reports descriptive statistics of no-load index mutual funds and matching index ETFs. Each index mutual fund is matched with corresponding index ETF(s) based on the common underlying benchmark index. Panel B reports descriptive statistics of no-load active mutual funds and matching passive mutual funds. Each active mutual fund is paired with corresponding passive fund(s) based on the common investment objective. Fund characteristics are obtained from the CRSP Survivor-Bias-Free US Mutual Fund Database. ETF characteristics are obtained from the CRSP stock database. For details on *Age, Fund Class TNA, Fund TNA, Monthly Net Return, Expense Ratio, Turnover, Cash Holdings, Monthly Net Cash Flow, Normalized Monthly Net Cash Flow, and Monthly Flow Volatility,* please refer to Table I. Daily fund flow data is obtained from TrimTabs. *Daily Net Fund Flow* is the daily cash flow of the share class. *Normalized Daily Net Flow* is computed as daily net cash flow divided by the TNA at the beginning of the month. *Daily Flow Volatility* is the standard deviation of daily normalized net cash flow over each month. For index ETFs, *Daily Bid-Ask Spread* is the difference between end-of-the-day ask and bid. *Daily Quoted Spread* is daily spread divided by the mid-point of bid and ask, i.e., $\frac{(Ask_{i,t}-Bid_{i,t})}{(Ask_{i,t}+Bid_{i,t})/2}$. *Daily Effective Spread* is calculated as $\frac{Price_{i,t}-(Ask_{i,t}+Bid_{i,t})/2}{Price_{i,t}}$. The table reports time series averages of the cross-sectional mean and median for each variable. Each month we compute the mean and median for each of the above variables across funds within each investment objective and then average across different investment objectives. For index mutual funds, the cross-sectional mean and median are calculated across different benchmarks. N denotes the average number of funds per month. The sample period is from January 2003 to December 2012.

Panel A. Index Mutual Funds and Matching Index ETFs

Fund Characteristics	Index Mutual Funds		Matching Index ETFs	
	Mean	Median	Mean	Median
N	231		38	
Age (years)	7.75	7.28	6.59	6.25
Fund Class TNA ($mil)	1,571.45	1,263.90		
Fund TNA ($mil)	5,465.97	6,281.76	5,841.27	2,525.11
Monthly Net Return (%)	0.89%	0.89%	1.12%	1.06%
Expense Ratio (%)	0.64%	0.62%	0.20%	0.20%
Turnover (%)	24.31%	23.22%	19.43%	17.01%
Cash Holdings (%)	0.41%	0.40%	0.13%	0.10%
Monthly Net Cash Flow ($mil)	7.52	5.80	39.80	18.83
Normalized Monthly Net Flow (%)	4.13%	3.44%	1.70%	1.11%
Monthly Flow Volatility (%)	26.16%	23.46%	8.26%	5.65%
Daily Net Cash Flow ($mil)	0.046	0.050		
Normalized Daily Net Flow (%)	0.06%	0.05%		
Daily Flow Volatility (%)	1.05%	1.00%		
Daily Bid-Ask Spread ($)			0.07	0.06
Daily Quoted Spread (%)			0.10%	0.09%
Daily Effective Spread (%)			0.09%	0.06%

Panel B. Active Mutual Funds and Matching Passive Mutual Funds

Fund Characteristics	Active Mutual Funds		Passive Mutual Funds	
	Mean	Median	Mean	Median
N	2,001		83	
Age (years)	10.80	8.97	9.42	9.68
Fund Class TNA ($mil)	656.13	81.23	3,364.91	713.02
Fund TNA ($mil)	3,745.23	664.84	9,169.42	1,657.35
Monthly Net Return (%)	0.63%	0.62%	0.76%	0.72%
Expense Ratio (%)	1.22%	1.11%	0.50%	0.35%
Turnover (%)	62.65%	48.10%	18.38%	12.64%
Cash Holdings (%)	3.01%	1.84%	0.36%	0.19%
Monthly Net Cash Flow ($mil)	0.39	0.00	11.65	5.09
Normalized Monthly Net Flow (%)	1.34%	-0.10%	3.03%	0.74%
Monthly Fund Flow Volatility (%)	9.50%	2.35%	14.48%	3.15%
Daily Net Cash Flow ($mil)	-0.150	-0.050	-0.224	-0.140
Normalized Daily Net Flow (%)	-0.02%	-0.02%	-0.01%	-0.01%
Daily Fund Flow Volatility (%)	0.53%	0.28%	0.87%	0.77%

Table III

Underperformance of Index Mutual Funds: Decomposition of Cost Components

This table reports the decomposition of cost components that attribute to index mutual fund underperformance. The analysis is based on a subsample of funds with available data on daily cash flows from TrimTabs. Each index mutual fund is paired with corresponding ETF(s) based on the common underlying benchmark index. Index mutual fund underperformance ($Ret^{MF\text{-}ETF}$) is measured by the difference between annual returns of the index mutual fund and the average annual returns of matching ETFs. $Exp^{MF\text{-}ETF}$ is the difference between expense ratios of index mutual funds and the average expense ratios of matching ETFs. *Cash Drag* is calculated as the average monthly cash holdings multiplied by annual benchmark return net of annual risk-free rate. *Risk-free rate* is the annualized yield on the 1-month Treasury bill. *Transaction Costs* are calculated based on daily cash flows and consist of brokerage commission and bid-ask spread of the corresponding index ETFs. The table reports transaction costs with brokerage commissions set as 0.0511% and 0.1108% per dollar based on Gao, Livingston and Zhou (2004). For details on the transaction costs calculation, please refer to Section C1. The table reports the cross-sectional mean of each variable for each year during our sample period. The table also reports the unique number of index mutual funds, benchmark indices, and index ETFs. The sample period is from January 2003 to December 2012.

Year	Unique number of						Transaction Costs (%)	
	Indexes	Index Funds	Index ETFs	Ret $^{MF\text{-}ETF}$ (%)	Exp $^{MF\text{-}ETF}$ (%)	Cash Drag (%)	Mean Comm. = 0.0511%	High Comm. = 0.1108%
2003	5	16	9	-0.93%	0.41%	0.07%	0.039%	0.051%
2004	5	16	9	-0.58%	0.40%	0.02%	0.019%	0.025%
2005	5	16	9	-0.53%	0.38%	0.00%	0.012%	0.015%
2006	5	16	9	-0.66%	0.34%	0.01%	0.011%	0.015%
2007	5	15	9	-0.68%	0.36%	0.00%	0.015%	0.019%
2008	8	40	12	-0.53%	0.52%	-0.04%	0.061%	0.553%
2009	11	71	15	-1.28%	0.56%	0.04%	0.130%	0.377%
2010	12	80	15	-1.17%	0.63%	0.03%	0.102%	0.128%
2011	12	94	15	-0.83%	0.54%	0.00%	0.059%	0.116%
2012	12	92	15	-0.90%	0.54%	0.02%	0.063%	0.120%
Average	7	44	15	-0.81%	0.47%	0.02%	0.051%	0.142%
					(57.85%)	(1.85%)	(6.32%)	(17.51%)

Table IV

Determinants of Underperformance: Index Mutual Funds

This table reports the results of regressing index mutual fund underperformance against various fund characteristics. Index mutual fund underperformance is computed as the negative value of the difference between monthly returns of index mutual funds and the average monthly returns of matching ETFs, i.e., $-Ret^{MF-ETF}$, and Exp^{MF-ETF} is the difference between expense ratios of index mutual funds and the average expense ratios of matching ETFs. For details on *Turnover*, *Age*, and *Cash Holdings*, please refer to Table I. *Log Fund Size* is the logarithm of the month-end total net asset. *Log Fund Size Square* is the square of fund size. *Log Family Size** is the residuals from regressing the logarithm of fund family size on the logarithm of fund size. *Log Family Size Square** is the square of log family size. *Fund Excess Flow* is the average of monthly normalized net cash flow over the past twelve months adjusted by the normalized net cash flow of matching ETFs. *Excess Flow Volatility* is the standard deviation of monthly normalized net cash flow over the past twelve months adjusted by the standard deviation of monthly normalized net cash flow of matching ETFs. *Fund Excess Return* is fund cumulative return over the past twelve months adjusted by the cumulative return of matching ETFs. *Excess Return Volatility* is the standard deviation of monthly fund net return over the past 12 months adjusted by the standard deviation of monthly fund net return of matching ETFs. All independent variables are lagged one period and all variables are standardized at the cross-section (each month) with zero mean and standard deviation of one. The table reports the coefficient estimates, t-statistics, and adjusted R^2 of the pooled regressions. ***, **, and * denotes statistical significance at the 1%, 5%, and 10% levels, respectively. The sample period is from January 2003 to December 2012.

Parameters	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Exp^{MF-ETF}_{t-1}		0.399***	0.401***		0.401***	0.346***	0.348***
		[43.78]	[43.74]		[43.28]	[29.96]	[30.12]
$Turnover_{t-1}$		0.069***	0.044***		0.045***	0.061***	0.036***
		[8.12]	[4.86]		[4.62]	[6.58]	[3.74]
Age_{t-1}		-0.026***	-0.029***		-0.028***	-0.022**	-0.025***
		[3.01]	[3.36]		[3.24]	[2.54]	[2.86]
Log Fund $Size_{t-1}$	-1.007***	-0.151***	-0.484***		-0.488***	-0.152***	-0.497***
	[21.4]	[15.28]	[10.32]		[10.36]	[15.3]	[10.6]
$(Log\ Fund\ Size_{t-1})^2$	0.601***		0.333***		0.336***		0.346***
	[12.36]		[7.14]		[7.18]		[7.42]
Log Family $Size^*_{t-1}$	-0.034***	-0.002	-0.007		-0.007	-0.002	-0.007
	[3.72]	[0.28]	[0.801]		[0.82]	[0.32]	[0.82]
$(Log\ Family\ Size^*_{t-1})^2$	-0.104***		-0.019**		-0.019**		-0.017**
	[11.2]		[2.18]		[2.24]		[2.04]
Cash $Holdings_{t-1}$				0.104***	-0.001	0.002	0.001
				[11.8]	[0.16]	[0.22]	[0.04]
Fund Excess $Flow_{t-1}$					0.013	-0.032*	-0.023
					[0.84]	[1.92]	[1.36]
Excess Flow $Volatility_{t-1}$	.				-0.014	0.032*	0.021
	.				[0.84]	[1.84]	[1.22]
Fund Excess $Return_{t-1}$						-0.086***	-0.086***
						[7.78]	[7.82]
Excess Return $Volatility_{t-1}$						-0.066***	-0.066***
						[7.86]	[7.98]
N (share classes-months)	11,225	11,224	11,222	11,228	11,219	11,219	11,217
Adj.R^2	17.61%	32.72%	33.03%	1.21%	33.02%	33.50%	33.83%

Table V

Determinants of Cash Flows: Index Mutual Funds

This table reports the results of regressing monthly index mutual fund flows against various fund characteristics. The *Normalized Monthly Net Cash Flow* is adjusted by the average of normalized monthly net cash flow of matching index ETFs. For details on *Expense Ratio, Age, Log Fund Size, Log Fund Size Square, Log Family Size*, Log Family Size Square*, Fund Excess Return, Excess Return Volatility, Fund Excess Flow,* and *Excess Flow Volatility,* please refer to Tables I and IV. *Expense Ratio – 12b1* is the expense ratio net of 12b-1 fees. *Marketing Expenses* are 12b-1 fees. All independent variables are lagged one period and all variables are standardized at the cross-section (each month) with mean zero and standard deviation of one. The table reports the coefficient estimates, t-statistics, and adjusted R^2 of the pooled regressions. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The sample period is from January 2003 to December 2012.

Parameters	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Expense Ratio $_{t-1}$	-0.079***	-0.084***	-0.057***	-0.032***	-0.035***		
	[9.24]	[9.52]	[5.04]	[2.62]	[3.08]		
(Expense Ratio - 12b1) $_{t-1}$						-0.061***	-0.075***
						[5.46]	[6.52]
Marketing Expenses $_{t-1}$						0.011	0.012
						[1.18]	[1.46]
Age $_{t-1}$	-0.054***	-0.054***	-0.055***	-0.054***	-0.055***	-0.049***	-0.048***
	[6.18]	[6.24]	[6.41]	[6.22]	[6.28]	[5.56]	[5.5]
Log Fund Size $_{t-1}$	-0.022**	-0.138***	-0.133***	-0.025**	-0.199***	-0.045***	-0.266***
	[2.28]	[3.12]	[3.02]	[2.58]	[4.46]	[4.22]	[5.78]
(Log Fund Size $_{t-1}$) ^{2}		0.117***	0.113**		0.174***		0.217***
		[2.62]	[2.54]		[3.88]		[4.78]
Log Family Size* $_{t-1}$	0.022***	0.022**	0.019**	0.019**	0.015*	0.011	0.003
	[2.88]	[2.46]	[2.36]	[2.42]	[1.78]	[1.38]	[0.36]
(Log Family Size* $_{t-1}$) ^{2}		-0.009	-0.009		-0.015*		-0.021**
		[1.02]	[1.04]		[1.74]		[2.51]
Fund Excess Return $_{t-1}$			0.041***	0.048***	0.047***	0.046***	0.046***
			[3.82]	[4.52]	[4.48]	[4.42]	[4.41]
Excess Return Volatility $_{t-1}$			-0.011	-0.007	-0.007	-0.006	-0.006
			[1.34]	[0.86]	[0.86]	[0.76]	[0.74]
Fund Excess Flow $_{t-1}$				0.061***	0.066***	0.057***	0.062***
				[3.62]	[3.91]	[3.36]	[3.68]
Excess Flow Volatility $_{t-1}$				-0.108***	-0.118***	-0.096***	-0.106***
				[6.46]	[6.98]	[5.66]	[6.22]
N (share classes-months)	11,416	11,414	11,412	11412	11410	11411	11409
Adj. R^2	0.90%	1.00%	1.10%	1.60%	1.70%	1.80%	2.00%

Table VI
Determinants of Cash Holdings of Active Mutual Funds

Each month, we perform cross-sectional regressions of fund cash holdings against various fund characteristics. The sample includes active no-load mutual fund classes with growth, income, and growth and income investment objectives. Fund cash holding is the percentage of fund portfolio in cash. The explanatory variables include *Expense Ratio, Fund Size, Fund Size Square, Turnover, Age, Fund Flow, Fund Flow Volatility, Cash Volatility, Fund Return, Yield, Market Beta,* and fund objective dummies. *Fund Size* is the logarithm of the month-end total net asset. *Fund Size Square* is the square of fund size. *Fund Flow* is the average fund flow over the past twelve months. *Fund Flow Volatility* is the standard deviation of the fund flow over the past twelve months. *Cash Volatility* is the standard deviation of the fund cash holdings over the past twelve months. *Fund Return* is the cumulative return over the past twelve months. *Yield* is the month-end income yield. *Market Beta* is the beta estimate in CAPM based on fund monthly returns over 36 months. $d_{Growth,}$ $d_{Growth\&Income,}$ and d_{Income} are investment objective dummies which are set equal to 1 if the fund investment style is growth, growth and income, and income, respectively, and zero otherwise. The table reports the time-series average of coefficient estimates and *t*-statistics based on Newey-West (1987) standard errors as well as adjusted R^2. ***, **, and * denote statistical significance at the 1%, 5% or 10% level, respectively. The sample period is from the January 2003 to December 2012.

Parameters	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Expense Ratio $_{t-1}$	0.531**	0.558**		0.204***	0.209***
	[2.34]	[2.36]		[3.28]	[3.34]
Turnover Ratio $_{t-1}$	0.006***	0.006***		0.004***	0.003***
	[4.02]	[4.42]		[7.18]	[6.54]
Age $_{t-1}$	0.210***	0.153***		0.101***	0.090***
	[2.84]	[2.76]		[3.44]	[3.26]
Fund Size $_{t-1}$	-0.043	-4.054***		0.084**	-2.251***
	[1.04]	[6.74]		[2.21]	[3.98]
Fund Size^2 $_{t-1}$		0.099***			0.057***
		[6.56]			[4.01]
Fund Flow $_{t-1}$			0.238***	0.132***	0.105***
			[10.56]	[6.50]	[4.52]
Fund Flow Volatility $_{t-1}$			-0.058***	-0.065***	-0.053***
			[6.06]	[3.76]	[3.68]
Cash Volatility $_{t-1}$			0.753***	0.912***	0.916***
			[18.82]	[19.96]	[20.08]
Fund Return $_{t-1}$				0.044***	0.046***
				[4.22]	[4.36]
Yield $_{t-1}$				-0.036	-0.042
				[0.54]	[0.58]
Market Beta $_{t-1}$				-0.033***	-0.032***
				[9.90]	[9.96]
d_{Growth}				0.002	0.002
				[1.62]	[1.44]
$d_{Growth\ and\ Income}$				-0.002	-0.001
				[0.38]	[0.08]
d_{Income}				-0.001***	-0.001***
				[3.71]	[3.61]
Intercept	0.026***	0.431***	0.021***	0.025***	0.261***
	[3.36]	[6.98]	[12.5]	[2.80]	[4.74]
N	1,571	1,570	1,617	980	979
Adj.R^2	2.28%	1.89%	8.63%	18.83%	20.03%

Table VII

Fama-MacBeth Regressions of Stock Returns on Liquidity Measures

Each month, we perform cross-sectional regressions of stock returns against liquidity measures with other firm characteristics included as control variables. *DTURN* is the dollar trading volume calculated as the average monthly product of stock price and share turnover over the past 12 months. *GIBBS* is the Hasbrouck (2004) liquidity measure. *ILLIQ* denotes the Amihud (2002) illiquidity ratio which is calculated as the average of the ratio of the absolute daily return divided by daily dollar trading volume over the past 12 months. Control variables include *Ln ME,* the logarithm of the market capitalization of the stock, *Ln B/M,* the natural logarithm of the book-to-market ratio of equity, *Momentum,* the buy-and-hold return over the past twelve months, and *Return Volatility,* the standard deviation of a stock's returns over the past 12 months. All independent variables are lagged one month. The table reports the time-series average of coefficient estimates and *t*-statistics based on Newey-West (1987) standard errors as well as adjusted R^2. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. The sample period is from January 2003 to December 2011.

Parameters	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
DTURN $_{t-1}$	-0.458*	-0.236*				
	[1.81]	[1.66]				
GIBBS $_{t-1}$			0.298*	0.238**		
			[1.84]	[2.38]		
ILLIQ $_{t-1}$					0.234***	0.233***
					[2.78]	[3.74]
Ln ME $_{t-1}$		-1.159		-0.926		-0.996
		[1.46]		[1.34]		[1.28]
Ln B/M $_{t-1}$		0.002*		0.002*		0.002*
		[1.76]		[1.74]		[1.66]
Momentum $_{t-1}$		-0.003		-0.003		-0.003
		[0.64]		[0.64]		[0.62]
Return Volatility $_{t-1}$		-0.011		-0.024		-0.023
		[0.58]		[1.29]		[1.30]
Intercept	0.013**	0.025**	0.006	0.021**	0.009	0.022**
	[2.44]	[2.46]	[1.08]	[2.44]	[1.41]	[2.34]
N	4,627	4,266	4,604	4,234	4,626	4,266
Adj. R^2	1.58%	4.67%	0.60%	4.44%	0.29%	4.42%

Table VIII

Underperformance of Active Mutual Funds: Decomposition of Cost Components

This table reports underperformance of no-load active mutual funds, as measured by the difference between active mutual fund returns and matching passive fund returns, and various cost components associated with active mutual funds. Each active mutual fund is paired with the corresponding passive fund(s) based on common investment objective. $Ret^{MF\text{-}PMF}$ is the difference between annual returns of active mutual funds and the average annual returns of matching passive funds. $Exp^{MF\text{-}PMF}$ is the difference between expense ratios of active mutual funds and the average expense ratios of matching passive funds. *Cash Drag* is calculated as the expected cash holdings multiplied by fund excess return. *Liquidity Discount* is computed as the market liquidity sensitivity to monthly returns multiplied by the fund liquidity in excess of benchmark market portfolios. *Transaction Costs* are calculated based on daily cash flows. Daily flow data is obtained from TrimTabs. Transaction costs are calculated based on daily cash flows and consists of brokerage commission, average daily bid-ask spread and prices of mutual fund portfolio holdings. The average daily transaction costs are converted to annualized costs, and then scaled by the monthly TNA at the beginning of the year. Brokerage commission is obtained from Gao, Livingston and Zhou (2004) and is set to 0.1491%, 0.1669% and 0.1337% for the index mutual funds with Income, Growth and Income, and Growth investment objectives, respectively. The table also reports the total number of unique active no-load mutual funds. The table reports the cross-sectional mean of all variables for each year of our sample period.

Year	N of Mutual Funds	% of Underperforming Funds	$Ret^{MF\text{-}PMF}$ (%)	$Exp^{MF\text{-}PMF}$ (%)	Cash Drag (%)	Transaction Costs (%)		Liquidity Discount			
						Mean Comm.	High Comm.	DTURN (%)	GIBBS (%)	ILLIQ (%)	Average (%)
2003	88	65%	-0.47%	0.69%	0.32%	0.06%	0.001	0.0002%	0.0258%	0.0031%	0.0097%
2004	107	53%	-0.06%	0.63%	0.35%	0.02%	0.04%	0.0006%	0.0029%	0.0001%	0.0012%
2005	105	25%	0.21%	0.60%	0.15%	0.02%	0.04%	0.0006%	0.0015%	-0.0013%	0.0003%
2006	106	37%	-0.84%	0.58%	0.37%	0.03%	0.05%	0.0005%	0.0011%	-0.0019%	-0.0001%
2007	118	68%	-0.98%	0.63%	-0.02%	0.15%	0.25%	0.0001%	0.0022%	-0.0003%	0.0007%
2008	302	50%	1.40%	0.86%	-0.78%	0.22%	0.35%	0.0000%	0.0061%	0.0007%	0.0023%
2009	464	75%	-0.27%	0.80%	0.27%	0.09%	0.18%	0.0004%	0.0097%	0.0026%	0.0042%
2010	724	73%	-0.93%	0.75%	0.17%	0.03%	0.04%	-0.0006%	0.4720%	0.0015%	0.1576%
2011	758	86%	-1.53%	0.68%	0.04%	0.01%	0.02%	-0.0002%	0.5057%	0.0011%	0.1689%
2012	724	75%	-1.09%	0.69%	0.28%	0.00%	0.01%				
Average	350	60.68%	-0.46%	0.69% (151.00%)	0.12% (25.41%)	0.06% (13.94%)	0.11% (23.44%)	0.0002%	0.1141%	0.0006%	0.0383% (8.37%)

Table IX

Determinants of Underperformance: Active Mutual Funds

This table reports results of cross-sectional regressions of fund underperformance against various fund characteristics. The sample includes no-load active mutual funds. Fund underperformance is computed as the negative value of the difference between annual returns of active mutual funds and the average annual returns of matching passive mutual funds, i.e., $-Ret^{MF\text{-}PMF}$. $Exp^{MF\text{-}PMF}$ is the difference between the expense ratios of active mutual funds and the average expense ratios of matching passive mutual funds. For details on *Turnover, Age, Fund Size, Log Fund Size, Log Fund Size Square, Log Family Size*, Log Family Size Square*, Cash Holdings, Fund Excess Flow, Excess Flow Volatility, Fund Excess Return,* and *Excess Return Volatility,* please refer to Table IV. For details on *DTURN, GIBBS, and ILLIQ,* please refer to Table VII. All independent variables are lagged one period and all variables are standardized at the cross-section (each month) with zero mean and standard deviation of one. The table reports the coefficient estimates and t-statistics based on Newey-West (1987) standard errors as well as adjusted R^2. ***, **, and * denote statistical significance at the 1%, 5%, and10% levels, respectively. The sample period is from January 2003 to December 2012.

Parameters	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Exp^{MF-PMF}_{t-1}	0.022***	0.022***		0.023***	0.024**	0.024**	0.221***
	[3.08]	[3.06]		[4.52]	[2.28]	[2.18]	[5.12]
$Turnover_{t-1}$	0.005	0.005		-0.003	0.021	0.019	-0.020
	[0.38]	[0.38]		[0.28]	[0.42]	[0.38]	[0.26]
Age_{t-1}	-0.012**	-0.012**		-0.012**	-0.026*	-0.026*	-0.064*
	[2.26]	[2.28]		[2.24]	[1.82]	[1.84]	[1.76]
$Log\ Fund\ Size_{t-1}$	-0.001	-0.017		-0.012	0.016	0.015	0.067**
	[0.14]	[0.64]		[0.58]	[0.44]	[0.48]	[1.98]
$(Log\ Fund\ Size_{t-1})^2$		0.017		0.013	-0.013	-0.013	0.085**
		[0.56]		[0.64]	[0.46]	[0.44]	[2.32]
$Log\ Family\ Size^*_{t-1}$	-0.013***	-0.013***		-0.012**	-0.035	-0.034	-0.032
	[2.88]	[2.86]		[2.58]	[1.44]	[1.42]	[0.84]
$(Log\ Family\ Size^*_{t-1})^2$		0.001		0.002	0.022	0.023	0.098***
		[0.16]		[0.38]	[1.24]	[1.24]	[3.30]
$Cash\ Holdings_{t-1}$			0.034**	0.008	0.045	0.046	0.081
			[1.98]	[0.88]	[1.14]	[1.18]	[1.24]
$Fund\ Excess\ Flow_{t-1}$				0.583	-0.422	-0.225	0.564
				[0.36]	[0.22]	[0.12]	[0.62]
$Excess\ Flow\ Volatility_{t-1}$				-0.581	0.299	0.105	0.941
				[0.38]	[0.16]	[0.06]	[1.06]
$Fund\ Excess\ Return_{t-1}$				-0.044**	-0.053**	-0.044**	-0.321**
				[2.06]	[2.56]	[2.11]	[1.98]
$Excess\ Return\ Volatility_{t-1}$				-0.045	-0.044	-0.038	-0.297
				[1.32]	[1.41]	[1.16]	[1.16]
$Dollar\ Turnover_{t-1}$					-0.008		
					[0.38]		
$GIBBS_{t-1}$						-0.001	
						[0.08]	
$ILLIQ_{t-1}$							-0.013
							[0.24]
N (share classes-months)	1,773	1,771	1,914	1,735	1,433	1,433	1,433
Adj. R^2	2.91%	3.30%	2.65%	21.88%	27.42%	24.71%	23.61%

Table X

Determinants of Cash Flows: Active Mutual Funds

This table reports results from cross-sectional regressions of active mutual fund flow determinants against various fund characteristics. The *Normalized Monthly Net Cash Flow* is adjusted by the average of normalized monthly net cash flow of matching passive mutual funds. For details on *Expense ratio, Expense Ratio – 12b1, Marketing Expenses, Age, Log Fund Size, Log Fund Size Square, Log Family Size*, Log Family Size Square*, Fund Excess Return, Excess Return Volatility, Fund Excess Flow,* and *Excess Flow Volatility,* please refer to Tables I and V. All independent variables are lagged one period and all variables are standardized at the cross-section each month with zero mean and standard deviation of one. The table reports the coefficient estimates and t-statistics based on Newey-West (1987) standard errors as well as adjusted R^2. ***, **, and * denote statistical significance at the 1%, 5%, and10% level, respectively. The sample period is from January 2003 to December 2012.

Parameters	**(1)**	**(2)**	**(3)**	**(4)**
Expense Ratio $_{t-1}$	-0.032***	-0.026***	-0.025***	
	[9.56]	[7.08]	[7.34]	
(Expense Ratio - 12b1) $_{t-1}$				-0.025***
				[4.34]
Marketing Expenses $_{t-1}$				-0.013***
				[4.12]
Age $_{t-1}$	-0.038***	-0.041***	-0.028***	-0.027***
	[10.36]	[11.12]	[7.24]	[6.46]
Log Fund Size $_{t-1}$	-0.087***	-0.091***	-0.071***	-0.072***
	[4.91]	[5.10]	[4.82]	[4.80]
(Log Fund Size $_{t-1}$) ^{2}	0.131***	0.128***	0.089***	0.086***
	[6.26]	[6.38]	[5.42]	[5.28]
Log Family Size* $_{t-1}$	0.021***	0.019***	0.019***	0.016***
	[7.34]	[7.31]	[7.26]	[5.22]
(Log Family Size* $_{t-1}$) ^{2}	-0.002	-0.004	-0.006**	-0.006**
	[0.52]	[1.28]	[2.08]	[2.06]
Fund Excess Return $_{t-1}$		0.102***	0.087***	0.088***
		[12.68]	[12.24]	[12.3]
Excess Return Volatility $_{t-1}$		0.013	0.011	0.012
		[1.32]	[1.22]	[1.28]
Fund Excess Flow $_{t-1}$			11.67**	11.67**
			[2.62]	[2.58]
Excess Flow Volatility $_{t-1}$			-11.52***	-11.49**
			[2.60]	[2.56]
N (share classes-months)	1,770	1,755	1,752	1,751
Adj. R^2	0.95%	2.90%	5.12%	5.32%

Figure 1. Costs of Investing in Index Mutual Funds versus Index ETFs

As an illustration, this figure depicts the total costs of investing in the index mutual funds and corresponding ETFs with varying initial investment amounts (in dollars) and investment horizons. Both fund types track the S&P 500 benchmark index. The four panels correspond to, respectively, semi-annual, annual, 3-year and 5-year investment horizons. The cost of investing in mutual funds is calculated as expense ratio over corresponding investment horizon times initial investment amount. The cost of investing in ETFs includes the round-trip costs of trading ETF shares and expenses charged by ETFs. For details on the round-trip costs of trading ETF shares, please refer to Section D1**.**