“Old” Money Matters: The Sensitivity of Mutual Fund Redemption Decisions to Fund Characteristics†

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Abstract

This paper studies the relation between mutual fund flows and a range of fund characteristics, with a particular emphasis on redemption decisions. The paper establishes three key results. First, individual mutual fund investors are sensitive to tax considerations. They are reluctant to sell mutual funds that have appreciated in value and are willing to sell losing funds. Further, taxable investors’ redemption decisions are sensitive to proxies for future distribution behavior of the fund. Second, individual investors pay attention to the costs of mutual-fund investing as redemption decisions are sensitive to both front-end loads and expense ratios. Third, fund-level inflows and outflows of individual investors are sensitive to past performance, but in very different ways. Inflows are largely driven by “relative” performance, suggesting that new money chases the best performers in an objective, with little relation to the fund’s “absolute” performance. Outflows are exclusively driven by the absolute performance of the fund, the relevant benchmark for tax purposes, with little relation to relative performance. Thus, breaking mutual fund net flows into their two components yields important insights on the behavior of “old” and “new” money.

JEL classification: G11; C41; D14; H20

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1. Introduction

The mutual fund literature has long recognized that investors respond to mutual fund performance, having documented a robust, positive relation between net fund flows and past fund performance (e.g., Ippolito (1992), Chevalier and Ellison (1997), Sirri and Tufano (1998)). Some studies, such as Goetzmann and Peles (1997), suggest that sale decisions are subject to considerable inertia, and it has been the conventional wisdom that the net flow-performance relation stems primarily from the strong performance chasing exhibited by new buys. The existing studies, however, generally face an inherent data limitation in that they rely upon net flows.\(^1\) The Investment Company Institute data suggests that both new purchases and redemptions are substantial and that net flows are differences of two nearly equally large components.\(^2\) Thus, redemptions are potentially an essential ingredient of the relation between net flow and performance. Moreover, inflows and outflows might follow different patterns, which might be obfuscated by aggregation into net flows.\(^3\) Understanding differences across inflows and outflows is important to assessing how a manager’s actions will affect the flow of money entering and leaving the fund.

Why might mutual fund outflows be related to past fund performance? In the U.S., capital gains are taxed on a realization basis, which provides investors an incentive to hold on to mutual fund shares that appreciated in value (thus delaying the payment of taxes) and redeem mutual fund shares whose net asset value (NAV) has fallen in value since purchase. A belief in persistence in actively-managed mutual fund performance, real or imagined (Carhart (1997)), could also lead to investors holding on to funds that have appreciated in value while selling those that have fallen. Both of these motivations predict a negative relation between propensity to sell and past fund performance, although the tax considerations should only be relevant in taxable accounts. If either of these motivations for trade is important to investors when considering whether to redeem mutual fund shares, then outflows could explain at least part of the well-documented relation between fund net

\(^1\) Furthermore, the available net flows usually are aggregate data and thus lack the precision of individual transaction-level data, wherein every purchase and every sale is recorded for a large number of investors. One exception is a series of papers by Johnson (2004, 2006), which utilizes daily transactions of shareholders in one small, no-load mutual fund family.

\(^2\) During the period from 1984 to 2002, redemptions were almost as large as new purchases, accounting for 48.5% of the sum of dollar amounts of new purchases and redemptions. This figure is based on authors’ calculations from the data reported in the 2003 Mutual Fund Factbook (Investment Company Institute, 2004).

\(^3\) The data collection of aggregate fund-level inflows and outflows, available from the SEC in electronic form since the mid-1990s, is onerous and very few studies have pursued it (e.g., Edelen (1999), Bergstresser and Poterba (2002), O’Neal (2004), and Cashman, Deli, Nardari, and Villupuram (2006)), and then only, with the exception of Cashman, Deli, Nardari, and Villupuram (2006), for a relatively small number of funds (up to 200).
flow and fund return, as a negative relation between fund outflows and past performance is consistent with a positive relation between net fund flows and past performance.

On the other hand, a mounting body of research finds that psychological considerations seem to play an important role in individuals’ trading decisions. For example, the disposition effect—the propensity to cash in gains and aversion to realize losses (Kahneman and Tversky (1979) and Shefrin and Statman (1985))—is a dominant determinant of individual investors’ decisions to sell common stock shares (e.g., Odean (1998) and Grinblatt and Keloharju (2001)), leading to a pronounced positive correlation between past performance and subsequent sales in the domain of stocks. However, these studies focus only on individual stocks, and there is little research inquiring whether such findings carry over to other investment vehicles, such as mutual funds, where the motivations for trade may be quite different. If the disposition effect were important in mutual fund sales (as it is in stock sales), inflows into the fund would need to be “super-sensitive” to past performance to counter the “old” money leaving the fund following good fund performance.

The change of the fund NAV is unlikely to be the only determinant of individual redemption decision. For example, tax-sensitive investors may focus not only on the direct tax consequences related to the appreciation of the fund NAV since purchase, but also on fund characteristics that could provide information regarding future fund distribution policy (such as turnover, past distribution behavior, and capital gains overhang). The future distribution policy of the fund is potentially relevant for taxable investors because the tax rate on distributions received generally will be greater than the tax rate on capital gains realized by the investor in the future upon sale.

Another strand of the literature (e.g., Barber, Odean, and Zheng (2005)) focuses on the effect that costs of investment such as expenses and loads might have on mutual fund net flows. However, just as with fund performance, useful insights may be gleaned by breaking net flows into their two components. For example, expense ratios might have no relation with net flows, yet could have strong positive effects both on “new” money flowing into the fund (e.g., high expenses could partly be used for advertising to help attract new investors or could be interpreted as a signal of quality of fund management or services provided by the fund family) and “old” money flowing out of the fund (e.g., in response to the higher ongoing costs of maintaining the investment).

This paper studies the relation between mutual fund flows and a range of fund characteristics (such as past performance, proxies associated with potential future fund-driven tax liabilities, and costs of investment), with a particular emphasis on redemption decisions. We use detailed brokerage data for a large sample of individual investors over the period from 1991 to 1996 to study individual investors’ fund share redemption decisions in both taxable and tax-deferred settings. We proceed to
aggregate the brokerage-level data by quarter and by mutual fund to decompose fund net flows into fund inflows and fund outflows (as well as to decompose the latter into fund outflows in taxable accounts and tax-deferred accounts).

We establish three key findings. First, individual mutual fund investors are sensitive to tax considerations. We find that, consistent with tax-motivated trading, and in stark contrast with individual investor behavior in regard to common stocks (Odean (1998) and Grinblatt and Keloharju (2001)), there is a negative relation between the likelihood of sale and past mutual fund performance (pronounced only for mutual funds held in taxable accounts). That is, investors holding mutual funds in taxable accounts are reluctant to sell funds that appreciated in value and willing to sell funds that have fallen in price. A comparison of trades in taxable and tax-deferred accounts suggests that the negative relation can be explained by tax-motivated trading (i.e., capital gains lock-in and tax-loss selling). Indeed, in the absence of tax-motivated trading, there is no statistically significant relation between fund performance since purchase and subsequent sales of mutual funds in tax-deferred accounts. Thus, on net, psychological motivations appear to play much less of a role in the domain of individuals’ mutual fund investments than they do in the domain of investment into individual stocks. The evidence of tax-motivated selling behavior is present both at the individual-transaction level as well as at the aggregated-fund-outflow level.

Further, taxable investors’ redemption decisions are sensitive to proxies for future distribution behavior of the fund. For example, in taxable accounts, the fund turnover ratio, the historical share of total fund returns distributed to the fund investors over the preceding five years, and the fund capital-gains overhang—three proxies for future distribution behavior of the fund—are all positively related to the probability of redemption. By contrast, turnover does not play a role in redemption decisions in tax-deferred accounts and the relation between redemption probability and past fund distribution policy is significantly stronger in taxable accounts that it is in tax-deferred accounts.4

Another way of interpreting these two sets of results is that both past and future distributions matter to investors. Both increase the probability that “old” money leaves the fund. Past distributions increase the probability of sale by mechanically reducing the NAV_RETURN, whereas proxies for future distributions increase the probability of sale because of likely higher associated future tax liabilities (with both of these effects much stronger in taxable accounts). Thus, tax-related issues

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4 Somewhat curiously, the redemption decision is sensitive to capital-gains overhang not only in taxable accounts, but also in tax-deferred accounts (where tax motivations are absent).
should be considered not only in the context of their effect on inflows (Barclay, Pearson, and Weisbach (1998)), but also in the context of their effect on outflows.

Our second key result is that mutual fund investors are also sensitive to both front-end loads (an “in-your-face” cost of mutual-fund investments) and expense ratios (a more subtle, ongoing cost). The latter yields a finding that differs from the conclusions reported in Barber, Odean, and Zheng (2005), though the differential could be attributed to the fact that we are looking into individuals’ redemption decisions, whereas Barber, Odean, and Zheng (2005) focus on quarterly net fund flows. Thus, as with returns, insights can be gleaned regarding the effect of the cost of investment by looking at components of net flows that might otherwise be overlooked when new money entering the fund and old money leaving the fund are lumped together.

Our third key result stems from quarterly aggregation of individual investors’ buys and sells into quarterly measures of fund-level inflows and outflows (and, thus, net flows, which enables a comparison with most studies in the literature). We find that, broadly speaking, inflows are driven by funds’ relative performance measures, that is, funds’ one-year performance relative to other funds pursuing the same objective, consistent with the well-established notion that new money chases the best performers in an investment objective. On the other hand, outflows are driven by funds’ one-year “absolute” returns (not surprising, given our transaction-level results). This finding is consistent with tax motivations, as it is the absolute change in net asset value per share that is relevant for taxable investors’ tax liability following a sale. Thus, both new money and old money are sensitive to past fund performance, but in very different ways. The rich characterization we find is obscured when inflows and outflows are combined into net flows.

Finally, we also consider the role that the costs of investment play in the context of fund-level flows. We find that fund-level inflows and outflows are each positively related to expense ratios. Thus, there are countervailing effects that a fund manager should consider when changing cost parameters because of the differential response by the “new” money and the “old” money. For example, whereas higher expenses may attract more “new” money into the fund through advertising, they also appear to prompt “old” money to leave the fund sooner than it otherwise would. These issues are important when considering adjustments to the expense ratio because, given the declining likelihood of future sale the longer a person has already held a fund, a dollar saved (that is, investors not leaving the fund) is superior to a dollar earned (that is, attracting new investors to the fund whose holding periods going forward will be shorter on average than those of existing investors).

The remainder of this paper is organized as follows. In Section 2 we review the data and present some summary statistics. Section 3 presents result of analyses that relate probability of sale
of individuals’ mutual fund investments with a range of fund characteristics, including past performance, determinants of future potential tax liabilities, and costs of investing. In Section 4 we aggregate investors’ buys and sells of mutual funds into quarterly measures of inflows and outflows, and analyze the determinants of those flows. Section 5 concludes.

2. Data Description and Summary Statistics

2.1. Data Description

Our primary data set, trades that 78,000 households made in the period from January of 1991 to November of 1996, comes from a large discount broker. Mutual funds are the second most frequently used investment vehicle in the data set, accounting for 18% of the overall value of all the trades investors in the sample made over the six-year period. They are second only to common stocks (which account for around two-thirds of the overall value of the investments in the sample). A number of households have multiple accounts (such as one taxable and one-tax-deferred account); the median number of accounts per household is two. Around 32,300 households made at least one mutual fund purchase during the sample period either in taxable or tax-deferred accounts (IRAs and Keogh plans; retirement plan accounts provided through employment such as 401(k)-type plans are not part of the data set). For a detailed description of the data set see Barber and Odean (2000).

Fund returns and some fund characteristics come from the Center for Research in Security Prices (CRSP) Open-End Mutual Fund Database, whereas other fund characteristics come from Morningstar. Value-weighted CRSP stock market returns (VWCRSP) and individual stock returns come from CRSP.

Consistent with Ivković, Poterba, and Weisbenner (2005), we include in our sample all mutual fund share purchases (and follow the purchase to see whether there is a subsequent sale), with the following exception: in the instances in which multiple buys are followed by a sale, it is not possible to match unambiguously which purchased fund shares actually have been sold without making assumptions such as FIFO (first share bought, first share sold) or LIFO (last share bought, first share sold), which by itself could drive the results. The exclusion of multiple buys preceding an “ambiguous” sale reduces the number of purchases in the sample by around 20 percent.

For example, in an upward market (as generally was the case during much of the sample period) fund shares purchased first in a string of purchases would have a larger appreciation in value since purchase than the last share in a string of purchases. Therefore, assuming FIFO would induce a positive relation between redemption probability and past fund performance.
Also, in the instances in which multiple sales follow a single purchase only the first sale is admitted into the sample, which means that our analyses may slightly understate the actual holding periods for these mutual fund investments. However, that bias is negligible because the vast majority of mutual fund sales in the sample (89 percent) are complete liquidations of the respective mutual fund positions.

2.2. Summary Statistics

Table I, Panel A presents summary statistics on mutual fund purchases and subsequent sales in our sample. Applying the criteria outlined above resulted in 325,185 buys made over the sample period, representing 32,259 households that had at least one mutual fund purchase during the sample period. Thus, households, on average, purchased 10 mutual funds during the sample period. The numbers of mutual fund purchases in taxable accounts and tax-deferred accounts, as well as median dollar amounts of those purchases, are very similar. Approximately one third of the purchases were followed by a sale during the sample period.

As shown in Panel B of Table I, rankings of past one-year performance relative to all funds with the same stated investment objective suggest that investors in the sample chased past performance: by definition, the percentage of the funds ranked in the top quintile in their objective by their one-year return is 20 percent, yet 41 percent of funds purchased belong in this top past performance category. We also report the change in quintile ranking of past one-year returns from the time of purchase to the time of sale. On average, the funds that the investors sold have performed poorly. For example, 33% of funds sold are in a lower past one-year return quintile when sold than when they were purchased (compared to only 19% that were in a higher return quintile). This finding foreshadows our first key result—mutual fund redemption decisions, unlike stock sale decisions, do not seem to be driven by loss aversion and the disposition effect, but, rather, by a desire to hold on to gains and realize losses.

We extract the relevant information regarding sample funds’ investment objectives from the CRSP mutual fund database fields “Objective” and “ICDI Objective.” Our brokerage sample contains transactions covering more than 1,100 different mutual funds across 200 different mutual fund families that span more than 40 different investment objective categories. We will later control for heterogeneity both on the individual-investor level, as well as the mutual-fund-type level, where
we will allow sale decisions to vary by the mutual fund family, the objective of the mutual fund, and whether the fund is actively or passively managed (i.e., is it an index fund).

2.3. Graphical Summary of Hazard Rates and Past NAV Change

Figure 1 presents the hazard rates (i.e., the likelihood of sale during a given month after purchase conditional on having not sold up to that month) of individuals’ sales of mutual fund shares held in their taxable accounts. The two solid lines depict hazard rates conditional upon the fund NAV having increased since purchase (gray solid line) and hazard rates conditional upon the fund NAV having decreased since purchase (black solid line) for each of the first 36 months following the purchase. For the purposes of this figure we restrict our attention to all mutual fund purchases in taxable accounts in January. This strategy allows for identification of end-of-year effects and other patterns potentially related to the calendar month. We obtain the confidence intervals presented in Figure 1 by calculating standard errors that allow for heteroskedasticity as well as correlation across observations associated with the same individual.

The figure identifies two very pronounced empirical facts that differentiate sales of mutual fund shares studied herein from sales of common stocks (Odean (1998), and Grinblatt and Keloharju (2001)). First, in stark contrast with common-stock investments, hazard rates conditional upon losses exceed those conditional upon gains, a finding that suggests the dominance of tax considerations and/or a belief in fund performance persistence over the disposition effect.\(^6\)

Second, hazard rates of selling mutual fund shares in taxable accounts, although declining like the hazard rates for common stocks, are significantly smaller than those for stocks. For example, in the first few months the unconditional hazard rates of selling mutual fund shares is around three or four percentage points, whereas the comparable hazard rate of selling common stocks start as high as 15 percentage points after one month, ten percentage points after two months, and eight percentage points after three months (Ivković, Poterba, and Weisbenner (2005)). This discrepancy between individual investors’ aggregate trading patterns in common stocks and mutual funds suggests that high-frequency traders are not nearly as present in the arena of mutual fund investments. Moreover, the declining hazard rates for mutual fund share redemptions suggest that, in terms how long a dollar invested is expected to stay in the fund, a dollar saved (that is, investors not leaving the fund) indeed is superior to a dollar earned (that is, attracting new investors whose holding periods on average will be shorter than those of existing investors).

\(^6\) To disentangle these competing explanations for the negative relation, in the next section we test for differential trading patterns in taxable and tax-deferred accounts (in which tax motivations do not matter).
3. Analysis of Redemption Decisions

Whereas important, the change in net asset value since purchase, likely is not the only determinant in mutual fund share redemptions. Other factors, such as proxies for the funds’ future distribution behavior or costs of investment, also may play a role. This section carries out detailed analyses of the relation between propensity to sell mutual fund shares and a range of fund characteristics, contrasting redemption behavior in taxable and tax-deferred settings. The characteristics capture direct tax motivations, that is, percentage change in net asset value per share (NAV) since purchase (which we refer to as NAV return, and label as NAV_RETURN), indirect tax motivations such as predictors of future distribution policy (e.g., turnover, past fund distribution policy, and fund overhang), relative performance of the fund over the past year (the percentile ranking within the fund’s Morningstar objective), and costs of mutual fund investments (loads and expense ratios). We focus on the NAV return, that is, the capital appreciation/depreciation of the fund since purchase, as this is the relevant benchmark for tax considerations.

We begin by estimating a Cox proportional hazards model of mutual fund share sales over the sample of all trades in taxable accounts. We estimate the baseline hazard rate non-parametrically (Han and Hausman (1990), Meyer (1990)). The proportional hazards specification assumes that the hazard function for the sale of mutual fund purchase i, t months after the purchase, takes the following form:

\[ h_i(t) = \lambda_0(t) * e^{X_{i,t} \beta}. \]  

Proceeding with a common \( \lambda_0(t) \), however, would impose a constraint that all investors’ trading decisions conform to one general hazard function. Instead, we could allow investor-level heterogeneity by enabling each individual i to have a personal, investor-specific baseline hazard function \( \lambda_i(t) \). This strategy would take into account that, regardless of past performance and other factors, some individuals simply are more likely to trade than others. Investor-specific baselines would help alleviate the concern that investor heterogeneity may be driving the results. For example, suppose that buy-and-hold investors happened to have purchased broad equity index funds (which have performed well over the sample period); the negative relation between past performance and sales could reflect investor heterogeneity rather than tax-motivated trading or belief in fund performance persistence. Loosely speaking, allowing for investor-specific baselines in the present context is similar to the inclusion of individual fixed-effects in a linear regression model.
We address these heterogeneity issues by using an even more encompassing approach—we allow for separate non-parametric baseline hazard rates for each investor-mutual fund type combination. The fund type is defined by the interaction of a funds’ objective with its degree of active management (index funds versus actively managed funds) and its fund family membership. Thus, the regression results concerning past performance, for example, will be identified by how a given individual trades two funds with the same objective, fund family, and degree of active management that have different performance since purchase.

The specification we estimate for observations in taxable accounts is given in Equation (2):

\[ X_{i,t} \alpha = \alpha_1 \times \text{NAV\_RETURN}_{i,t-1} + \alpha_2 \times \text{NAV\_RETURN}_{i,t-1} \times \text{December}_{i,t} + \]

\[ \alpha_3 \times \text{December}_{i,t} + \alpha_4 \times \text{Future\_Distribution\_Controls}_{i,t-1} + \]

\[ \alpha_5 \times \text{Relative\_Performance\_Controls}_{i,t-1} + \]

\[ \alpha_6 \times \text{Cost\_Controls}_{i,t-1} + \varepsilon_{i,t}, \]

where NAV\_RETURN_i,t denotes the relative change in fund NAV since purchase, defined naturally as \( \text{NAV\_RETURN}_{i,t} = \frac{\text{NAV}_{i,t}}{\text{NAV}_{i,p}} - 1 \). NAV_{i,p} denotes the net asset value per share at the time of purchase i and NAV_{i,t} denotes the net asset value per share at the end of month t since purchase. All net asset values per share are adjusted for splits.

The indicator variable December controls for end-of-year effects. Future distribution controls (proxies) are fund turnover, the fraction of total fund returns distributed to investors over the past five years, and fund capital gains overhang. The relative fund performance controls are indicator variables for whether fund one-year performance is in the bottom or the top of the fund returns within the investment objective. Finally, we also consider costs of investment (front-end loads, back-end loads, and expense ratios). Following the analysis of the relation between propensity to sell and NAV change since purchase, we will analyze the other controls, many of which also offer valuable and broad insights into investor redemption behavior.

Investors covered by the data set can have both taxable and tax-deferred accounts (i.e., IRA and Keough plans; investments in 401-k plans are not part of the brokerage sample). Under the assumption that the disposition effect and the belief in fund performance persistence do not differ across investments in taxable and tax-deferred accounts, comparing the propensities to sell across

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7 There are 44 objectives and slightly more than 200 mutual fund families represented in the brokerage sample, leading to just over 72,000 investor-mutual fund type combinations in the taxable account sample. Thus, the hazard model includes 72,000 separate non-parametric baselines (loosely speaking, 72,000 fixed effects). On average, an investor purchases two mutual funds in a particular objective-family-index combination.
mutual fund holdings in the two types of accounts provides a direct way of identifying the impact of taxation because tax considerations should not affect trading decisions in tax-deferred accounts.\footnote{This strategy was used in Ivković, Poterba, and Weisbenner (2005) to study individual investors’ tax-motivated trading of common stocks. A stronger disposition effect in taxable accounts would bias against, whereas a stronger belief in fund performance persistence in taxable accounts would bias in favor of, finding evidence of tax-motivated trading.}

We also estimate regressions over the full sample of taxable and tax-deferred accounts. We introduce a dummy variable \(TAX_i\) that denotes whether the mutual fund investment \(i\) is held in a taxable account and interact the \(TAX_i\) variable with all of the preceding variables:

\[
X_{i,t} \beta = \beta_1 \times NAV\_RETURN_{i,t-1} + \beta_2 \times NAV\_RETURN_{i,t-1} \times December_{i,t} + \beta_3 \times December_{i,t} + Other\ Controls_{i,t-1} * \beta_i + \beta_5 \times NAV\_RETURN_{i,t-1} \times TAX_i + \beta_6 \times NAV\_RETURN_{i,t-1} \times December_{i,t} \times TAX_i + \beta_7 \times December_{i,t} \times TAX_i + Other\ Controls_{i,t-1} * \beta_i \times TAX_i + \epsilon_{i,t}.
\]

Thus, in this regression, estimated over both taxable and tax-deferred accounts, the coefficient \(\beta_i\) represents the sensitivity of the sale decision to past NAV performance since purchase in tax-deferred accounts, the coefficient \(\beta_5\) represents the differential behavior in taxable accounts relative to tax-deferred accounts, and \(\beta_1 + \beta_5\) equals the sensitivity of the sale decision in taxable accounts (which corresponds to the coefficient \(\alpha_i\) from Equation (2)). The model allows for separate non-parametric baseline hazard rates for each investor-mutual fund type combination, introduced separately for an investor’s holdings in taxable and tax-deferred accounts.

In the following subsections, we discuss the results of estimating comprehensive specifications with all the controls included, based on Equations (2) and (3). The results of these regressions are presented in Table II. For presentational convenience, we group our discussion of covariates into those related to fund performance since purchase, indirect tax motivations, relative performance rankings, and costs of investment (Sections 3.1 through 3.4, respectively).

### 3.1. Motivations for Sale Pertaining to Performance since Purchase

The negative relation documented in Figure 1 is consistent with tax-related motivations. At the time of sale, investors whose mutual fund share prices have increased since purchase incur a tax liability based on the differential between the sale price and the purchase price, whereas investors’ capital losses resulting from declining mutual fund share prices can be used to offset capital gains accrued through the pursuit of other investments or used to offset ordinary income (subject to limits). Thus, in taxable environments (but not tax-deferred ones), a realization-based capital gains tax system
provides incentives to sell investments that have fallen in price (“tax-loss selling”) and keep
investments that have risen in price (the “lock-in” effect).

Another plausible explanation for the negative relation between the propensity to sell and
performance since purchase is investors’ potential belief in fund performance persistence. Indeed, if
investors believe that funds’ past fund performance is indicative of their future performance, on the
margin, they would be more likely to sell past losers and hold on to past winners. However, this
should be equally true in taxable and tax-deferred (i.e., IRA and Keough) accounts. Thus, if a belief
in fund performance persistence were important, we would expect to find a strong negative relation
between sale and past performance in both taxable and tax-deferred accounts.

Psychological factors may also play a role in mutual fund share trading decisions. The
disposition effect—a higher propensity to sell the securities that have posted a gain and a lower
propensity to sell the securities that have posted a loss—has been empirically studied in the domain
of individual investors’ common-stock investments in the U.S. (Odean (1998)) and overseas
(Grinblatt and Keloharju (2001)). It is attributed to investors’ unwillingness to dispose of assets that
had declined in value, thereby admitting that their investment insight had failed, and to their
willingness to sell appreciated assets, thereby avoiding the regret associated with watching a once
winning investment turn into a loss (Kahneman and Tversky (1979) and Shefrin and Statman
(1985)). The disposition effect predicts a positive relation, inconsistent with the simple tabulations
presented in Figure 1. However, it may be detectable more easily in tax-deferred accounts (where
taxes and, consequently, tax motivations for trade, are irrelevant).

If tax-motivated trading or belief in fund performance persistence dominate over the
disposition effect in the domain of taxable accounts, investors will be more likely not to sell mutual
fund shares with accrued gains and to sell mutual fund shares with accrued losses (\(\alpha_1 < 0\)). On the
other hand, the disposition effect predicts that investors will be more likely to sell mutual fund shares
with accrued gains and not to sell mutual fund shares with accrued losses, which translates into \(\alpha_1 > 0\). Such a finding would also be consistent with portfolio rebalancing, but rebalancing is unlikely to
play a significant role in the present context. The end of the tax year in December leads to a tax-
induced seasonal prediction of a stronger negative relation in December relative to other months: the

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9 A natural question is what benchmark(s) mutual investors use to gauge the performance of their investments. The domain
of mutual fund investments is replete with many candidates. Aside from the change in net asset value per share since
purchase, the performance of mutual funds is often ranked in relation to the performance of other funds with the same
investment objective over certain periods of time, which we capture with variables characterizing the ranking of the fund
within its investment objective over the one-year period preceding the month of potential sale (see Section 3.3).

10 The data suggest that around 89% of all sales of mutual funds are complete liquidations of the mutual fund position from
the portfolio, rather than partial sell-offs which would be more consistent with the rebalancing motivation.
propensity to postpone the realization of accrued gains until at least the next tax year implies lower probability of sale in December, whereas the desire to capture tax losses in the current calendar year implies a higher probability of sale in December, combining to yield the prediction that $\alpha_2 < 0$.

The results of estimating this model across all taxable mutual fund investments in the sample are presented in the first column of Table II. Consistent with Figure 1, there is very pronounced evidence in support of a negative relation ($\alpha_1 < 0$) throughout the calendar year. The coefficient on NAV\_RETURN is $-0.75$, suggesting that, in months other than December, a 25-percent increase (decrease) in NAV since purchase is associated with a 17 percent decrease (20 percent increase) in probability of sale (calculated as $e^{-0.75 \times 0.25} - 1 = -0.17$ and $e^{-0.75 \times (-0.25)} - 1 = 0.20$, respectively). The coefficient for the interaction term NAV\_RETURN * December is also large and negative ($-1.26$), indicating that tax-motivated trading is the most intense at the end of the year.\textsuperscript{11}

The change in net asset value per share since purchase, NAV\_RETURN, by definition equals total returns since purchase minus total distributions since purchase. In an alternative specification, instead of including only the NAV\_RETURN, we include both total returns since purchase and distributions since purchase in the specification, to check whether it is important to distinguish between the two. The coefficient on total returns since purchase is $-0.75$ (S.E. = 0.22, significant at the 1% level), and the coefficient on total distributions since purchase is 0.88 (S.E. = 0.53, significant at the 10% level). Their sum is statistically indistinguishable from zero ($p$-value = 0.82), implying that if, for example, the fund earns a one percent return, yet distributes it all to the investors (thus resulting in no change in the NAV), there is no net effect on the likelihood of sale. In other words, what matters to investors when deciding to sell mutual fund shares is the change in “price” (NAV\_RETURN), and not whether that “price” stems, from higher/lower total returns since purchase or from lower/higher distributions since purchase. Accordingly, when considering past performance since purchase, we focus on the NAV\_RETURN, the appropriate benchmark for tax considerations.

\textsuperscript{11} Estimates based on Equation (2) do not allow for differentiation by holding period, yet such differentiation may be relevant because the importance of various trading motivations may vary across the holding period, as they do for stocks (Ivković, Poterba, and Weisbenner (2005), and Feng and Seasholes (2005)). To explore the relation between the propensity to sell mutual funds and the holding period, we augment the specification by introducing an indicator variable “w/in 12 months since buy” and interacting it with all of the variables. In unreported results, we find that the relation between past appreciation and the likelihood of sale does not vary with the holding period, indicating that a given return since purchase has the same proportional affect on the probability of sale over both short and long holding periods (of course, as shown in Figure 1, the underlying baseline probability of sale declines with the holding period). We thus continue to focus on the more parsimonious specifications that do not feature differentiation by holding period of the relation between mutual fund share selling decisions and past performance.
However, this is not to say that past distributions do not affect the sale decisions. Indeed, the results also imply that, holding total returns constant, the higher the distributions paid since the fund was bought, the higher the probability the fund is sold (reflecting the mechanical reduction in net asset value per share). Also, as we discuss in Section 3.2, long-term measures of past distribution policy (over the past five-year horizon), which likely signal future distribution policy, also are positively related to the sale decision.

Our results displayed in Figure 1 and Table 2 regarding mutual fund sales (and those we obtain later concerning aggregated, fund-level outflows) are not in agreement with those reported in Johnson (2006). In a study of daily fund-level inflows and outflows for funds from a small, no-load family, Johnson (2006) finds that outflows are related to neither “absolute” nor “relative” short-term performance (that is, performance relative to other funds pursuing the same objective) and thus posits that mutual fund share sales are merely idiosyncratic and are based on investors’ liquidity needs. To the contrary, we find, both at the level of individuals’ mutual fund share selling decisions, and also at the quarterly fund-level aggregation of outflows, a strong and robust negative relation between the decision to sell and a fund’s past absolute performance. Part of the difference in results perhaps lies in differences in the measures of past performance employed—Johnson (2006) does not focus on holding-period returns as we do and instead focuses on fairly short-run performance such as over the past few days, month, quarter, or year (although we do later find a negative relation between outflows and past one-year returns as well). Our data enable us to construct investor-specific holding-period returns, which are likely more relevant for investor decisions.\(^\text{12}\)

Although the results we present up to this point establish a very robust negative relation between propensity to sell and performance since purchase in investors’ taxable accounts, considering only taxable accounts does not enable us to disentangle the contributions of tax motivations from other factors potentially related to redemption decisions such as belief in fund performance persistence and the disposition effect. Accordingly, we estimate a regression, based on Equation (3), that encapsulates trades in both taxable and tax-deferred accounts.

Redemption decisions in tax-deferred accounts do not appear to be related to the NAV change since purchase—the regression coefficient associated with NAV\_RETURN in tax-deferred

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\(^{12}\) Besides differences in past returns included in the analysis, there are also differences in the samples employed. Our results are based on a likely more representative sample that, although it contains fewer investors (32,000) than the sample of “well over 50,000” individual investors employed in Johnson (2006), stretches across a much wider assortment of more than 1,100 funds and 200 fund families (compared to only ten funds from one fund family in the Johnson (2006) sample). It is entirely plausible that the characteristics of the investors who choose to invest directly through a small, no-load fund family may well be different from those of the investors who choose to invest through a large discount broker.
accounts for non-December months (0.23) is small and statistically insignificant. Moreover, the differential between the coefficients associated with the two types accounts is large (−0.98) and statistically significant. 13 This suggests that the negative relation between the likelihood of redemption and past performance is explained by tax-motivated trading. The lack of a relation in tax-deferred accounts is consistent with neither investor belief in fund performance persistence nor the disposition effect being important considerations for trade. Another possibility is that both of these motivations matter, but entirely offset each other (the negative relation resulting from belief in fund performance persistence cancels out the positive relation resulting from the disposition effect).

3.2. Indirect Tax Considerations

An important difference between mutual fund investments and individual stock investments is that there is a more complex and more pronounced role of taxation issues in the domain of mutual fund investments. Mutual fund distributions paid out to investors include both dividends and capital gains realized by the fund. Consequently, distributions paid out to investors are a large fraction of total mutual fund returns. 14

Changes in fund net asset value per share since purchase have tax implications if investors redeem their taxable mutual fund investments (generally, the tax rate on distributions received will exceed that on capital gains realized by the investor in the future upon case). Having discussed the tax implications of NAV changes since purchase (captured by the variable NAV_RETURN) in Section 3.1, we proceed with a discussion of the somewhat more subtle tax implications that may stem from future fund manager’s distribution behavior.

In our empirical analyses we employ three proxies related to future distribution behavior. First, our specifications include fund turnover. According to Frazzini (2006), mutual fund managers exhibit trading behavior consistent with the disposition effect, that is, that they are likely to sell the winners in their portfolios. Thus, turnover should be positively related to future distributions because there will be capital gains realized by such selling of the winners from the fund portfolio.

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13 A potential selection issue might arise because the sample consists of mutual fund trades placed by households that need not have both taxable and tax-deferred accounts. Accordingly, we run these analyses on a more restrictive sample of all mutual fund trades placed by the more than 17,000 households that have both types of accounts. The results are very similar to those reported in Table II, a finding that is not surprising given all of the controls for heterogeneity of investors already included in the model.

14 According to Subchapter M of the Federal Income Tax Code and certain provisions of the Tax Reform Act of 1986, to avoid taxation of the funds themselves, mutual funds need to distribute virtually all ordinary income and net realized capital gains to shareholders in the year in which they are received or realized. Decisions on exactly when the distributions will be made and precisely how much of the fund’s total capital gains will be realized are largely under the control of the mutual fund manager.
Accordingly, on the margin, there should be a positive relation between propensity to sell taxable mutual fund investments (and thereby avoid future distributions) and fund turnover.

Second, managers’ distribution policy might be highly persistent, in which case past distribution behavior might be indicative of future distributions. Thus, we construct our second proxy to reflect the fraction of total returns in the form of distributions over the past five years (months $t-61$ through $t-1$) preceding the month of potential sale $t$.\footnote{It is defined as the ratio $(1 + \text{TOTAL}_\text{RETURN}_{t-61:t-1} - \text{NAV}_\text{RETURN}_{t-61:t-1}) / (1 + \text{TOTAL}_\text{RETURN}_{t-61:t-1})$.} Finally, the fund’s capital gains overhang represents potential capital gains realizations that might be realized, depending on fund manager’s strategy and liquidity needs, in which case they would lead to future distributions and thus trigger a tax liability for the current taxable fund investments. Thus, the relation between propensity to sell taxable mutual fund investments and fund capital gains overhang should be positive.

Our results further reinforce the importance of tax-motivated behavior. In taxable accounts, the fund turnover ratio, the historical share of total fund returns distributed to the fund investors over the preceding five years, and the fund capital-gains overhang are all positively related to the probability of redemption. By contrast, turnover does not play a role in redemption decisions in tax-deferred accounts. Moreover, the relation between redemption probability and historical distributions also is weaker in tax-deferred accounts. Somewhat curiously, the sensitivity of redemption decisions to overhang is virtually identical across the two types of accounts. On net, however, the evidence as a whole suggests that both direct (has the fund “price” gone up or down since purchase) and more subtle, indirect (is the fund likely to pay out high future distributions) tax motivations play an important role in individual investors’ redemption decisions.

Another way of interpreting these results is that both past and future distributions matter to investors. Both increase the probability that “old” money leaves the fund. Past distributions increase the probability of sale by mechanically reducing the NAV\text{\_\text{RETURN}}, whereas proxies for future distributions increase the probability of sale because of likely higher associated future tax liabilities (with both of these effects much stronger in taxable accounts).

3.3. Effects of Relative Performance Rankings

So far, we have focused on the absolute performance of a fund since purchase (which is germane for tax purposes in case of redemption), but also relevant for an investor may be the performance of that fund relative to similar funds in the same objective. Indeed, investors are supplied routinely with the information regarding fund performance over certain investment horizons and may incorporate this
information into their decision-making. The performance measure that we consider, the ranking of recent one-year total returns within the investment objective, is commonly used in the literature (see Chevalier and Ellison (1997) and Sirri and Tufano (1998), for example). To capture the potential nonlinearity in the relation between the propensity to sell and funds’ one-year performance rankings relative to their peers, we model those ranking similarly to Sirri and Tufano (1998) by introducing two dummy variables that indicate whether the fund’s one-year ranking in the universe of funds pursuing the same investment objective (the ranking for the most recent complete calendar quarter comes from Morningstar) is in the bottom quintile or the top quintile, respectively.

Performance rankings, upon controlling for absolute performance since purchase and other covariates, have no effects on the propensity to sell in taxable accounts. Whereas two of the four relevant coefficients do attain statistical significance in tax-deferred accounts, comparisons of the four coefficients across taxable and tax-deferred accounts do not yield any statistically significant differences, thus suggesting that relative rankings over the previous year do not affect taxable mutual investments differently from tax-deferred ones. Thus, the sensitivity of net fund flows to relative performance rankings (documented by Ippolito (1992), Chevalier and Ellison (1997), and Sirri and Tufano (1998)) seems to be driven by inflows, rather than by redemption behavior (which we later confirm in aggregated-flow analyses presented in Section 4).

3.4. Effects of Costs of Mutual-Fund Investment

Up to this point, we have not discussed the role of investment costs (front-end charges, back-end loads, and expense ratios). A priori, one might expect no relation between the propensity to sell and front-end charges (once fund shares are purchased, front-end charges are a sunk cost). On the other hand, expense ratios (costs that investors incur on a regular basis for as long as they hold the fund shares) and back-end loads are costs still ahead of mutual fund investors and they might alter the probability of sale. Higher expense ratios imply a stream of higher costs of investment for as long as the investor owns the fund and thus, ceteris paribus, could be related positively with the probability of sale. By contrast, back-end loads can readily be conceived as deterrents to sale.

Barber, Odean, and Zheng (2005) consider the impact of front-end loads and expense ratios on individual investors’ mutual fund investment decisions, but they limit their attention to the relation between net fund flows aggregated across a large number of individuals investors and lagged values of expense ratios and front-end loads, rather than on individuals’ decisions to sell the mutual fund shares once they had acquired them. Barber, Odean, and Zheng (2005) report that net fund
flows are sensitive to “in-your-face” costs such as front-end loads, yet are not sensitive to more subtle, ongoing costs such as expense ratios.

To explore the impact of investment costs, we consider front-end charges that investors incurred at the time of purchase (expressed as the ratio between the fee charged to the investor and the size of the purchase), a dummy variable indicating the presence of back-end loads at the time of potential sale, and expense ratios charged by the funds immediately preceding the month of potential sale.

Investors appear to view front-end charges as an impediment to sale, potentially because they perceive the front-end charge as a marginal rather than a sunk cost. The effect is more pronounced in taxable accounts, but both types of accounts feature a large and negative coefficient on the front-end load variable, suggesting that a front-end load of five percentage points reduces the monthly likelihood of sale by 75 percent in taxable accounts and 33 percent in tax-deferred accounts.

One might conjecture that this large effect simply reflects investor heterogeneity—households that invest in funds with front-end loads tend to have longer holding periods. However, because the specification allows for considerable heterogeneity through investor-mutual fund type fixed effects, the correlation between front-end loads and the sale decision cannot simply be attributed to buy-and-hold investors purchasing funds with front-end loads. In other words, the regression results are identified by how a given individual trades two funds with the same objective, fund family, and degree of active management that have different front-end loads. This suggests that the front-end load effect does not merely reflect investor heterogeneity and may instead reflect investors’ sunk cost fallacy (i.e., a confusion of sunk and marginal costs). Supporting this interpretation is survey evidence presented in Ivković and Weisbenner (2007): nearly three-quarters of a random sample of 276 mutual fund investors that own funds with front-end loads report the need to hold the fund long enough to justify the front-end load; only one-quarter of the surveyed investors report that, after the fund has been purchased, the front-end load does not affect how long they hold on to the fund.

As for the remaining variables associated with costs of investment, the level of the expense ratio at time of potential sale increases the likelihood that the investor will sell the mutual fund (effects are very similar across taxable and tax-deferred accounts), while the presence of a back-end load seems to have no effect on the sale decision in either type of account. For example, compared to
a fund with no annual expenses, a fund with expenses of 100 basis points per year is 22 percent more likely to be sold \( (e^{19.8 \times 0.01} - 1 = 0.22) \).  

In sum, our results suggest that, for both taxable and tax-deferred accounts, redemption probabilities are sensitive to both front-end loads (an “in-your-face” costs of mutual-fund investments) and expense ratios (a more subtle, ongoing cost). The latter yields a finding that differs from the conclusions from Barber, Odean, and Zheng (2005), though the differential could be attributed to the fact that we are looking into individuals’ redemption decisions, whereas Barber, Odean, and Zheng (2005) focus on quarterly net fund flows.

**TABLE II ABOUT HERE**

**4. Contrasting Determinants of Quarterly Fund Inflows and Outflows**

The preceding section reveals a very rich characterization of determinants of individuals’ mutual fund sale decisions. It is clear that how the fund has performed since purchase affects the sale decision of individual investors. However, whereas the negative relation found between past performance and subsequent sale on the individual-transaction level is consistent with the mutual fund literature that has found a strong positive relation between net flows and past performance by studying aggregate net flows (Ippolito (1992), Chevalier and Ellison (1997), and Sirri and Tufano (1998)), it is not clear how much aggregate outflows actually contribute to the net flow relation relative to inflows. Some studies, such as Goetzmann and Peles (1997), suggest that sale decisions are subject to considerable inertia, and it has been the conventional wisdom that the net flow-performance relation stems primarily from the strong performance chasing exhibited by new buys. Given the significant participation of sales in the net flows (44% in the brokerage sample used in this paper; 48% for the entire mutual fund industry during the same period, according to the ICI (2004) data and authors’ calculations), and the strong relation between propensity to sell and past performance that we analyze in earlier sections, we next assess separately the impact of inflows and outflows on the net flow-performance relation. We also analyze the effects of loads and expenses on “old” and “new” money.

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16 We also ran a specification in which we break the current expense ratio into its two components: the expense ratio at the time of purchase and the change in the expense ratio since purchase. We find that both are positively related to the propensity of sale and are statistically significant, with the coefficient on the change in the expense ratio of 52.0 (S.E. = 16.2) being significantly greater in magnitude than the coefficient for the expense ratio at the time of purchase (17.7; S.E. = 9.2). Thus, investors who bought into a high-expense fund originally are more likely to sell that fund at any point in the future than are investors who bought into a low-expense fund, with investors responding particularly strongly if there was a change in the expense ratio since they made the purchase.
We aggregate all buys and all sells of a fund in a quarter to compute dollar amounts of inflows and outflows, respectively. Generally, inflows and outflows are not readily available to researchers and very few studies have had access to flows disaggregated into inflows and outflows. The only studies to our knowledge that did so are Bergstresser and Poterba (2002), O’Neal (2004), and Cashman, Deli, Nardari, and Villupuram (2006). Bergstresser and Poterba (2002) relate annual inflows and outflows to one-year fund returns relative to the average return in their sample of the 200 largest equity mutual funds, and find that inflows are strongly positively related to relative returns, whereas there is no relation between outflows and relative returns. O’Neal (2004) and Cashman, Deli, Nardari, and Villupuram (2006) also conduct analyses of fund-level inflows and outflows for the 200 largest equity funds, and the entire universe of equity fund inflows and outflows available from EDGAR, respectively. In contrast to Bergstresser and Poterba (2002), both studies find a negative relation between outflows and fund relative performance. Unlike our study, none of the three studies consider both “relative” and “absolute” benchmarks, nor do they break out fund-level flows into those generated by taxable investors and those generated by tax-deferred investors. Consideration of both relative and absolute performance, as well as separation into taxable and tax-deferred flows, allows our results not to be subject to omitted variable bias and provides identification of various competing motivations for trade that was lacking from the previous work.

To obtain measures of flows, we compute the aggregate holdings of mutual funds in the sample at the end of each quarter and use them to scale the dollar inflows and outflows over the next quarter, thus creating relative measures as follows:

\[
\text{Inflow}_{i,q+1} = \frac{\text{Buys}_{i,q+1}}{\text{Positions}_{i,q}}, \quad (4)
\]

\[
\text{Outflow}_{i,q+1} = \frac{\text{Sells}_{i,q+1}}{\text{Positions}_{i,q}}, \quad \text{and}
\]

\[
\text{NetFlow}_{i,q+1} = \text{Inflow}_{i,q+1} - \text{Outflow}_{i,q+1},
\]

where Positions\(_{i,q}\) is the total sum of all households’ holdings of fund \(i\) at the end of quarter \(q\), Buys\(_{i,q+1}\) and Sells\(_{i,q+1}\) are total sums of all sample households’ purchases and sales, respectively, of fund \(i\) in quarter \(q+1\). Finally, NetFlow\(_{i,q+1}\), Inflow\(_{i,q+1}\), and Outflow\(_{i,q+1}\) are net flows, inflows, and outflows for fund \(i\) in quarter \(q+1\), respectively, which we will often refer to as normalized flows.

The choice of quarterly frequency for measurement of individual investor fund inflows and outflows was guided by two reasons. First, shorter horizons, such as monthly measurement of fund inflows and outflows, would lead toward noisier estimates because the individual investors in the sample trade mutual funds relatively infrequently (and there are “only” around 32,000 investors in the sample who invest into mutual funds), and monthly estimates often would have to be based on very few purchases and redemptions. Second, quarterly frequency facilitates comparability with related extant studies such as Barber, Odean, and Zheng (2005).
A fund-quarter observation is admitted into the sample if at least five households held the fund at the end of the preceding quarter. In total, there are 8,771 fund-quarter observations stretching across the nineteen non-overlapping quarters (fourth quarter of 1991 through third quarter of 1996) for which we have both complete sample data and variables describing percentile performance rankings from Morningstar.\(^{18}\) The median number of households that hold a mutual fund at the end of a quarter is 30 (with an average of 101). There typically are between 400 and 500 distinct funds in the sample each quarter (the interquartile range is 387 – 487), and the total number of funds appearing in the brokerage sample that we employ to compute flows is 812. Thus, our analysis is based on a wide cross-section of mutual funds over a six-year period.

Our brokerage-level data provide an estimate of the aggregate inflows and outflows of individual investors. Given that individual investors hold about three-quarters of U.S. mutual fund assets (Investment Company Institute (2004)), their behavior in large part determines total mutual fund flows. Our normalized net flow estimates for the brokerage sample fund observations (computed from investors’ buys, sells, and positions) are very similar to the net flows calculated for the same funds from the CRSP data that represent the aggregate activity of all investors: weighted by assets, they average 2.6 and 2.7 percentage points per quarter, respectively. The correlation between quarterly net flows based on CRSP data and quarterly net flows based on brokerage data is 0.50, which adds some imprecision, but not bias to our regression coefficient estimates, given that we use these flow estimates as dependent variables in our regressions.

### 4.1. Flow-Performance Regressions: A First Look

We begin by relating quarterly fund flow variables to one-year fund returns preceding the quarter, annual expenses, the front-end load, fund turnover, capital gains overhang, indicators for Morningstar 5-star rating (the category Morningstar Rating = 1 is omitted), indicators for the date (quarter), indicators for the fund’s objective and whether the fund is an index fund, as well as fixed effects for the individual funds themselves. The well-known nonlinearity in the flow-performance relations is partially captured by the Morningstar rating indicator variables; later in the section, we implement more detailed ways of addressing the nonlinearity. The primary past performance measure

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\(^{18}\) The Morningstar data available to us begin the coverage of mutual funds at the end of September of 1991, thus making the fourth quarter of 1991 the first quarter in our sample of aggregate inflows, outflows, and net flows.
that we focus on in the present discussion is a fund’s total return over the year preceding the quarter in which we measure flows.\textsuperscript{19}

Results are presented in Table III. The first column features a regression of quarterly net flows, computed from the buys and sells in the brokerage data sample, respectively. The second and third columns feature the decomposition of net flows into inflows and outflows (thus, by construction, every regression coefficient in the first column is equal, modulo rounding errors, to the difference of the coefficients from the second and third columns). Outflows are expressed as positive numbers and a negative coefficient on the past one-year return means less outflows (and hence greater net flows) following the fund’s good absolute performance.

Net flows exhibit considerable sensitivity to past one-year absolute returns. The point estimate of 0.38 is not only highly statistically significant, but is also economically important—a five-percentage point higher absolute return is associated with additional quarterly net flows into the fund of 1.9 percent of fund assets.\textsuperscript{20} The coefficients on other variables included in the regression of net flows generally have their expected sign, though they sometimes lack statistical significance, probably because of the noise present in producing the estimates of flows from the brokerage data (involving relatively few trades, even when aggregated into quarterly observations). The relation between net flow and turnover is positive, consistent with turnover being perceived, on net, as a signal of diligent management. Finally, net flows are also related to relative performance; controlling for past one-year fund return and other covariates, funds with higher Morningstar ratings have higher net flows into the fund.

The decomposition of net flows into inflows and outflows (the last two columns of Table III) foreshadows the results presented in the remainder of this section. The relation between flow and “absolute” performance, that is, total one-year returns, is stronger for outflows—three-fifths of the net-flow sensitivity to absolute returns comes from the outflow side (0.23 / 0.38 = 0.6). Conversely, the relation between flows and “relative” performance (as expressed by Morningstar Rating indicator variables) is pronounced only for inflows. Indeed, Morningstar Rating indicator variables are jointly significant only for inflows, with no relation present for outflows.

\textsuperscript{19} In the course of carrying out the individual-level transaction analyses in earlier sections, it was natural to focus on holding-period returns. In the present analysis of fund-level inflows and outflows, there simply is no direct equivalent of holding-period returns for aggregated purchases. Therefore, we instead focus on the past one-year returns and thereby facilitate direct comparison across net flows, inflows, and outflows.

\textsuperscript{20} For robustness, we also ran the same regression specification using net flows based on CRSP data for the same group of fund observations contained in the brokerage-based data. Overall, there is a good match between the regression coefficients in terms of their sign, magnitude, and statistical significance. In particular, the sensitivities of net flows to past one-year absolute returns are virtually identical (0.37 using estimates of flows based on CRSP vs. 0.38 using brokerage-based flows).
Breaking net flows into their two components yields insights regarding the effect of the expense ratio as well. Whereas, consistent with Barber, Odean, and Zheng (2005), sensitivity of net flows to expense ratios is not statistically significant, both inflows and outflows are positively related with expense ratios. It appears that there are two countervailing phenomena at play (one on the inflow side and one on the outflow side) that effectively cancel out for net flows. Specifically, the effects of marketing (or potentially a perceived signal of managerial quality and/or the service provided by the mutual fund family embedded in high expense ratios) appear to be strong when attracting new buys, and, at the same time, consistent with the results from Section 3, investors are more likely to sell mutual fund with high expense ratios. The economic impact of the expense ratio is fairly strong. For example, a shift in the expense ratio equal to the interquartile range of 0.6% increases the quarterly normalized outflows by 8.4 percentage points ($14.06 \times 0.006 = 0.084$). Finally, both inflows and outflows appear to be negatively related with the front-end load (the aggregate outflow result is consistent with the findings in Section 3.4 in the context of individual sale decisions), although neither estimate reaches conventional levels of statistical significance.

**TABLE III ABOUT HERE**

4.2. Flow-Performance Regressions: Impact of Absolute and Relative One-Year Performance

In this section, we focus primarily on the relation between flows and both “absolute” and “relative” one-year fund performance. Existing literature (e.g., Ippolito (1992), Chevalier and Ellison (1997), and Sirri and Tufano (1998)) suggests that inflows might be driven primarily by “relative” (rather than “absolute”) fund performance because individual mutual fund investors likely chase funds that have outperformed most other funds pursuing the same investment objective. Outflows, on the other hand, might well be driven by “absolute” performance because the asset’s absolute performance is what matters for tax purposes.

Upon modeling one-year performance in a linear fashion (Table IV), we also allow for its nonlinearity by creating decile indicator variables for both the fund’s prior absolute and relative performance (see, e.g., Chevalier and Ellison (1997) and Sirri and Tufano (1998) for similar approaches toward modeling the nonlinearity). For presentational convenience, we bundle together deciles 5 and 6 and omit that category. Further, to avoid clutter, we depart from tabular presentation and instead employ graphs (Figure 2).

Table IV presents results of running essentially the same specifications as in Table III, but broadening the scope of our inquiry to relative performance as well (besides the Morningstar ratings
we included earlier, we now also include the percentile rank of the fund’s past one-year performance relative to other funds pursuing the same objective). For brevity, we report only the coefficients associated with our absolute and relative one-year fund performance measures (the other coefficients are essentially unchanged). In its first row, Panel A restates the coefficients associated with one-year absolute returns from Table III. Augmenting the specification from Table III with one-year percentile rank within the objective (scaled from 0.01 to 1.0, indicating the ranking from worst to best) enables us to assess the above hypothesis directly. Indeed, once both “absolute” and “relative” one-year fund performance measures are included into the model (bottom rows of Table IV), it becomes clear that “relative” performance is an important determinant of net flows, a relation spurred entirely by the strong link between inflows and “relative” performance. For example, a movement of ten percentage points up the relative performance distribution (i.e., 0.10) is associated with a 2.1 percentage-point increase in both inflows and net flows. On the other hand, consistent with Bergstresser and Poterba (2002) and Johnson (2006), we find that outflows are not related to relative one-year performance. Rather, outflows are only sensitive to “absolute” one-year performance, lending support to the hypothesis that taxation issues may drive the relation for outflows.

The data enable us to disentangle outflows from taxable and tax-deferred accounts and thereby assess the latter hypothesis more directly. Panel B features both specifications employed in Table IV (including “absolute” performance only, presented in the top rows of the table, and including both “absolute” and “relative” performance, presented in the bottom rows of the table), estimated separately for outflows from taxable accounts and outflows from tax-deferred accounts. Consistent with tax motivations, the overall negative and marginally significant loading on the “absolute” past performance from the third column of Panel A for outflows is driven by the outflows from taxable accounts. In fact, the sensitivity of outflows to past absolute performance is three times as large (and is statistically significant at the 5% level) once we focus on aggregate outflows from taxable accounts, indicating that taxes indeed matter in the context of the relation between outflows and past performance. As before, “relative” performance is not significantly related to outflow in either type of account.

**TABLE IV ABOUT HERE**

Figure 2 plots the results from regressions that are analogous to those displayed in Table IV (with the inclusion of all of the other controls employed in the previous analyses), only instead of including linear return measures, we now include indicator variables for both absolute and relative
performance deciles (thus allowing for non-linearities in the relations). The figure displays the regression coefficients on the indicator variables from a single specification that features simultaneously all the controls, absolute performance deciles, and relative performance deciles (the omitted group for each performance measure is the combined 5th and 6th deciles of performance and thus the coefficients reflect the flows into a certain performance group relative to the 5-6 decile group) for inflows (light gray bars), outflows (dark gray bars), and net flows (white bars). Chart A (top graph) displays the regression coefficients depicting flow relation with past one-year absolute performance deciles from that specification and Chart B (bottom graph) displays the regression coefficients from the same specification that depict flow relation with the past one-year ranking in the objective.

Essentially, all the conclusions drawn from the specification that employs linear one-year performance measures carry over to the model that allows for nonlinearities. Chart A illustrates that absolute performance is a very powerful determinant of outflows. Moving from the 1st to the 10th decile of absolute performance is associated with a reduction in normalized outflows of 8.2 percentage points (–3.9 – 4.3 = –8.2), which accounts for over one-half of the increase in net flows of 14.6 percentage points as the absolute performance moves from the 1st to the 10th percentile (4.1 – (–10.5) = 14.6). The relation between outflows and absolute performance does not exhibit strong non-linearities (in contrast to the relation between inflows and relative performance).

Chart B particularly accentuates the fact that relative performance is a very powerful determinant of inflows, but is very flat for outflows. The nonlinearity of net flows in regard to top performers (driven entirely by inflows), as measured by the “relative” measure of one-year relative objective rankings, surfaces in the differential between decile 10, the top decile of “relative” performers (regression coefficient of 19.9), and decile 9, the second highest decile of “relative” performers (regression coefficient of 8.1). Indeed, more than one-half of the difference in both net flows and inflows across funds in the 1st and the 10th deciles of relative performance rankings are explained by the difference in the flows between decile 9 and decile 10. This sharp non-linearity for relative performance is highly consistent with the extant literature (e.g., Chevalier and Ellison (1997), and Sirri and Tufano (1998)).

FIGURE 2 ABOUT HERE

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21 The cutoffs for the absolute performance deciles are calculated based on the distribution of one-year returns pooled over the entire sample of mutual funds in the brokerage data. Therefore, the cutoffs are the same throughout the sample regardless of fund objective or quarter.
Thus, these aggregate-level results support well the conclusions from the earlier transaction-level analysis. They also provide some perspective as to the economic importance of the sensitivity of both outflows and inflows to past performance, providing insights that are unattainable by looking at net flows alone. Both inflows and outflows of individual investors are sensitive to past performance, but in very different ways. Inflows are largely driven by “relative” performance, suggesting that new money chases the best performers in an objective, with much less relation to the fund’s “absolute” performance. In contrast, outflows are exclusively driven by the absolute performance of the fund, with little relation to relative performance.

5. Conclusion

This paper studies the determinants of mutual fund flows, with particular attention to individual investors’ mutual fund selling decisions. In stark contrast with investor behavior in regard to common stocks, there is a strong negative relation between probability of sale and past mutual fund performance. Individuals hold on to mutual fund shares that have appreciated since purchase and are willing to sell those that have incurred losses. By comparing trading patterns in both taxable and tax-deferred accounts, we confirm that the negative relation can be explained by tax-motivated trading. Thus, the well-documented relation between net fund flows the fund’s past performance (e.g., Ippolito (1992), Chevalier and Ellison (1997), Sirri and Tufano (1998)) is driven in no small part by the behavior of the fund’s existing investors (not generating outflows following good performance).

Among a mutual fund’s choice variables is how returns should be distributed to investors (unrealized capital appreciation or cash distributions), with implications for taxable investments, and what kinds of fees—loads and expenses—should be charged. Both choices have implications for outflows from the fund. The evidence of tax-motivated trading in taxable accounts encompasses not only the negative relation between propensity to sell and NAV change since purchase, but also increased propensity to sell in response to three other variables that signal potential future tax liabilities—fund turnover, past distribution behavior of the fund, and capital-gains overhang. Thus, not only do individuals seem to be sensitive to direct tax considerations, such as what taxes would be incurred in the event of selling the mutual fund, but they are also sensitive to indirect tax considerations, such as the flow of future distributions.

In regard to the costs of investing, somewhat surprisingly, investors from our sample seem to view front-end charges as impediments to sale. On the other hand, high expense ratios (an ongoing,
not-in-your-face cost) are associated with a substantial increase in the probability of redemption, particularly if the expense ratio has increased since the investor purchased the fund.

Finally, we also use the brokerage data of individual investors to aggregate buys and sells of mutual funds to create fund-level quarterly measures of inflows and outflows and study the determinants of the flow-performance relation for net flows, inflows, and outflows. We find that, broadly speaking, inflows are driven by funds’ relative performance measures, that is, funds’ one-year performance relative to other funds pursuing the same objective. On the other hand, consistent with tax motivation and pronounced only in taxable accounts, outflows are driven by funds’ one-year “absolute” returns. Thus, breaking net flows into their two components yields important insights on the behavior of “old” and “new” money.
References


Table I: Summary Statistics of Mutual Fund Purchases and Sales

Sample consists of 32,259 households that had at least one mutual fund purchase during the sample period from January 1991 to November 1996. Panel A presents basic summary statistics (median dollar amount of purchase and number of buys are reported in parentheses). Panel B presents the performance of mutual funds at the time of purchase and at the time of sale.

### Panel A: Basic Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Number of Buys</th>
<th>Average $ Amount of Buys</th>
<th>Average # of Buys per Household, Conditional on Purchase in That Type of Account</th>
<th>Percentage of Buys Sold During the Sample Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Accounts</td>
<td>325,185</td>
<td>8,394 (3,000)</td>
<td>10.1 (4.0)</td>
<td>34</td>
</tr>
<tr>
<td>Taxable Accounts</td>
<td>180,564</td>
<td>9,376 (3,000)</td>
<td>8.5 (3.0)</td>
<td>33</td>
</tr>
<tr>
<td>Tax-Deferred Accounts</td>
<td>144,621</td>
<td>7,169 (3,000)</td>
<td>7.2 (3.0)</td>
<td>35</td>
</tr>
</tbody>
</table>

### Panel B: Distribution of Mutual Fund Purchases and Sales by Past One-Year Return Quintile (Relative to All Funds in Objective)

<table>
<thead>
<tr>
<th>At Time of Purchase (in percent)</th>
<th>Change from Purchase to Sale (in percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (top)</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>20 increase</td>
</tr>
<tr>
<td>3</td>
<td>19 no change</td>
</tr>
<tr>
<td>2</td>
<td>11 decrease</td>
</tr>
<tr>
<td>1 (bottom)</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>100 Total</td>
</tr>
</tbody>
</table>

29
Table II: Relation Between Redemption Decisions and Fund Characteristics

The Cox proportional hazards model employs a non-parametric estimate of the baseline hazard (i.e., the probability of selling the mutual fund in month t after the buy conditional on no prior sale). The model features separate non-parametric baseline hazard rates for each investor-mutual fund type combination, introduced separately for an investor’s holdings in taxable and tax-deferred accounts. The fund type is defined by fund objective, degree of active management (index funds versus actively managed funds), and fund family membership. NAV_RETURN is defined as the relative change in NAV since purchase. The model also incorporates proxies of future fund distribution behavior (fund turnover, the fraction of total fund return over the past five years distributed to the investors, and fund capital-gains overhang). It also includes measures of funds’ ranking of recent one-year total returns within the investment objective. Finally, the model also includes front-end charge incurred at the time of purchase (the ratio between the fee charged to the investor and the size of the purchase), a dummy variable indicating the presence of back-end load at the time of potential sale, and expense ratio charged by the fund at the time of potential sale. Standard errors (shown in parentheses) allow for heteroskedasticity as well as correlation across observations of the same household.

<table>
<thead>
<tr>
<th></th>
<th>Taxable Accounts</th>
<th>All Accounts</th>
<th>Tax-Deferred Accounts</th>
<th>Interaction w/ Taxable</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAV_RETURN</td>
<td>–0.75***</td>
<td>0.23</td>
<td>–0.98***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.20)</td>
<td>(0.30)</td>
<td></td>
</tr>
<tr>
<td>NAV_RETURN*December</td>
<td>–1.26*</td>
<td>–0.90</td>
<td>–0.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.70)</td>
<td>(0.72)</td>
<td>(1.00)</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>–0.17**</td>
<td>–0.15</td>
<td>–0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.10)</td>
<td>(0.13)</td>
<td></td>
</tr>
<tr>
<td>Turnover</td>
<td>0.14***</td>
<td>–0.01</td>
<td>0.16***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.03)</td>
<td>(0.05)</td>
<td></td>
</tr>
<tr>
<td>Fraction of Total Return Distributed Over Past 5 years</td>
<td>0.65***</td>
<td>0.37***</td>
<td>0.28*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.17)</td>
<td></td>
</tr>
<tr>
<td>Overhang</td>
<td>0.38**</td>
<td>0.43***</td>
<td>–0.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.16)</td>
<td>(0.23)</td>
<td></td>
</tr>
<tr>
<td>Previous 1-Year Return in Bottom Quintile of Objective?</td>
<td>0.09</td>
<td>0.22***</td>
<td>–0.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(0.07)</td>
<td></td>
</tr>
<tr>
<td>Prev. 1-Year Ret. in Bottom Quintile of Obj.? * December</td>
<td>0.19</td>
<td>0.20</td>
<td>–0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.19)</td>
<td>(0.26)</td>
<td></td>
</tr>
<tr>
<td>Previous 1-Year Return in Top Quintile of Objective?</td>
<td>–0.06</td>
<td>0.04</td>
<td>–0.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.06)</td>
<td></td>
</tr>
<tr>
<td>Prev. 1-Year Ret. in Top Quintile of Obj.? * December</td>
<td>0.10</td>
<td>0.28**</td>
<td>–0.18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(0.14)</td>
<td>(0.19)</td>
<td></td>
</tr>
<tr>
<td>Front-End Load</td>
<td>–27.5***</td>
<td>–8.0***</td>
<td>–19.4***</td>
<td></td>
</tr>
<tr>
<td>(Fee Charged Normalized by Purchase Amount)</td>
<td>(4.4)</td>
<td>(2.8)</td>
<td>(5.2)</td>
<td></td>
</tr>
<tr>
<td>Back-End Load?</td>
<td>–0.42**</td>
<td>–0.00</td>
<td>–0.42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td>(0.19)</td>
<td>(0.26)</td>
<td></td>
</tr>
<tr>
<td>Expense Ratio at Time of Potential Sale</td>
<td>19.1**</td>
<td>17.6**</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(9.2)</td>
<td>(8.2)</td>
<td>(12.4)</td>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
<td>1,530,206</td>
<td>3,039,083</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Table III: Aggregated Flow-Performance Regression

The table presents regression results of relating quarterly fund flows (net flows, inflows, or outflows) from the brokerage sample to a fund’s absolute performance (expressed as the total return of the fund over the past year), expense ratio, front-end load, back-end load, turnover, overhang, indicator variables for Morningstar rating (Morningstar Rating = 1 is the omitted category), indicator variables for the date (i.e., quarter), indicator variables for the fund’s objective and whether it is an index fund, and fixed effects for the individual funds. Net Flows, Inflows, and Outflows are computed according to Equation (4) from Section 4—the aggregated flows of individual investors in the sample for a given quarter are normalized by total holdings in the fund in the brokerage sample at the end of the prior quarter. Standard errors (shown in parentheses) allow for heteroskedasticity and contemporaneous correlation.

<table>
<thead>
<tr>
<th></th>
<th>Net Flow</th>
<th>Inflow</th>
<th>Outflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Year Total Return</td>
<td>0.38***</td>
<td>0.15</td>
<td>−0.23*</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.18)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>Expense Ratio</td>
<td>16.25</td>
<td>30.30**</td>
<td>14.06*</td>
</tr>
<tr>
<td></td>
<td>(10.69)</td>
<td>(13.89)</td>
<td>(8.20)</td>
</tr>
<tr>
<td>Front-end Load</td>
<td>0.46</td>
<td>−3.66</td>
<td>−4.12</td>
</tr>
<tr>
<td></td>
<td>(2.65)</td>
<td>(2.60)</td>
<td>(2.64)</td>
</tr>
<tr>
<td>Back-end Load</td>
<td>8.39</td>
<td>15.06**</td>
<td>6.66</td>
</tr>
<tr>
<td></td>
<td>(5.82)</td>
<td>(6.40)</td>
<td>(5.03)</td>
</tr>
<tr>
<td>Turnover</td>
<td>0.04**</td>
<td>0.05**</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Overhang</td>
<td>−0.00</td>
<td>0.07*</td>
<td>0.07**</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.04)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Morningstar Rating = 2</td>
<td>0.02</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.09)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Morningstar Rating = 3</td>
<td>0.09</td>
<td>0.16*</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.09)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Morningstar Rating = 4</td>
<td>0.14**</td>
<td>0.22**</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.09)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Morningstar Rating = 5</td>
<td>0.22***</td>
<td>0.29***</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.10)</td>
<td>(0.07)</td>
</tr>
</tbody>
</table>

*p-value of test of joint significance of Morningstar ratings*

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.002***</td>
<td>0.005***</td>
<td>0.442</td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (quarter) Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Objective &amp; Index Fund Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mutual Fund-specific Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.039</td>
<td>0.133</td>
<td>0.187</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>8,771</td>
<td>8,771</td>
<td>8,771</td>
</tr>
</tbody>
</table>

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Table IV: Aggregated Flow-Performance Relation, Introduction of Past One-Year Relative Performance

The table presents regression results of relating quarterly fund flows (net flows, inflows, or outflows) from the brokerage sample to two measures of fund performance and other covariates as in Table III, that is, the expense ratio, front-end load, back-end load, turnover, overhang, indicator variables for Morningstar rating (Morningstar Rating = 1 is the omitted category), indicator variables for the date (i.e., quarter), indicator variables for the fund’s objective and whether it is an index fund, and fixed effects for the individual funds. We do not report the coefficients on the other variables, as they little changed from Table III. The two measures of fund performance are one-year fund total returns (“Absolute” performance) as in Table III, and the ranking of funds’ one-year total return among all funds pursuing the same investment objective (“Relative” performance), scaled to the range from 0.01 to 1.00, where 1.00 indicates the highest performer in the objective and 0.01 indicates the lowest. Results reported in the upper section of the table are based on the “Absolute” performance measure only, whereas those in the lower section are based on both “Absolute” and “Relative” performance measures. Net Flows, Inflows, and Outflows are computed according to Equation (4) from Section 4—the aggregated flows of individual investors in the sample for a given quarter are normalized by total holdings in the fund in the brokerage sample at the end of the prior quarter. Panel A focuses on all accounts, whereas Panel B focuses separately on outflows in taxable and tax-deferred accounts (and also reports differences in the coefficients across the two types of accounts in the final column). Standard errors (shown in parentheses) allow for heteroskedasticity and contemporaneous correlation.

<table>
<thead>
<tr>
<th></th>
<th>Panel A: Net Flow, Inflow, and Outflow in All Accounts</th>
<th>Panel B: Outflow in Taxable Accounts Only and Tax-Deferred Accounts Only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Net Flow</td>
<td>Inflow</td>
</tr>
<tr>
<td>“Absolute” Performance Only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-Year Total Return</td>
<td>0.38***</td>
<td>0.15</td>
</tr>
<tr>
<td>(0.10)</td>
<td></td>
<td>(0.18)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.039</td>
<td>0.133</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>8,771</td>
<td>8,771</td>
</tr>
<tr>
<td>“Absolute” and “Relative” Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-Year Total Return</td>
<td>0.15</td>
<td>−0.08</td>
</tr>
<tr>
<td>(0.10)</td>
<td></td>
<td>(0.19)</td>
</tr>
<tr>
<td>One-Year Rank in Objective</td>
<td>0.21***</td>
<td>0.21***</td>
</tr>
<tr>
<td>(0.04)</td>
<td>(0.015)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.042</td>
<td>0.136</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>8,771</td>
<td>8,771</td>
</tr>
</tbody>
</table>

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Figure 1: Hazard Rates and the Associated 95% Confidence Intervals of Selling Mutual Funds in Taxable Accounts. The figure displays the average hazard rate for mutual fund share purchases conditional on whether the investors’ fund has an accrued capital gain since purchase (gray line) or loss since purchase (black line) entering the month. The figure restricts attention to January fund purchases made in the brokerage sample during the period from 1991 to 1996.
Figure 2: Nonlinear Flow-Performance Relation. The specification, described in detail in Section 4.2, features both measures of “Absolute” performance (Chart A) and “Relative” performance (Chart B) included simultaneously into the regression. For ease of viewing, we split the regression coefficients into two charts. Chart A displays the regression coefficients on past one-year total returns (featured in the specification as indicator variables for the ten performance deciles, computed across all funds over the entire sample period) in the regressions for quarterly inflows, outflows, and net flows. Chart B displays the regression coefficients on relative rankings of past one-year returns within the funds’ investment objectives (featured in the specification as indicator variables for the ten relative ranking deciles, computed each quarter across all funds pursuing the same investment objective) in the regression for quarterly inflows, outflows, and net flows, each based. The omitted group for each performance measure is the combined 5th and 6th deciles of performance (thus the coefficients reflect the flows into a certain performance group relative to the 5-6 decile group). Inflows, outflows, and net flows are computed according to Equation (4) from Section 4—the aggregated flows of individual investors in the sample for a given quarter are normalized by total holdings in the fund in the brokerage sample at the end of the prior quarter (with the ratio expressed in percentage points).