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

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Abstract

This paper shows that individual investors are reluctant to sell mutual funds that have appreciated in value and are willing to sell losers, in stark contrast to their stock trading where the disposition effect dominates. Comparison of trades in taxable and tax-deferred accounts suggests that a good share of this negative relation can be explained by tax-motivated trading, with the remainder of the negative relation consistent with investors' belief in fund performance persistence. Aggregating transaction-level data for a sample of individual investors to construct fund inflows and outflows, we find that 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 little relation to the fund's "absolute" performance. In contrast, outflows are exclusively driven by the absolute performance of the fund, the relevant benchmark for tax purposes, with little relation to relative performance.

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Abstract

This paper shows that individual investors are reluctant to sell mutual funds that have appreciated in value and are willing to sell losers, in stark contrast to their stock trading where the disposition effect dominates. Comparison of trades in taxable and tax-deferred accounts suggests that a good share of this negative relation can be explained by tax-motivated trading, with the remainder of the negative relation consistent with investors’ belief in fund performance persistence. Aggregating transaction-level data for a sample of individual investors to construct fund inflows and outflows, we find that 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 little relation to the fund’s “absolute” performance. In contrast, outflows are exclusively driven by the absolute performance of the fund, the relevant benchmark for tax purposes, with little relation to relative performance.

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

[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] Redemptions were almost as large as new purchases. Indeed, during the period from 1984 to 2002, redemptions amount to 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).

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 the past performance of the fund? 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 mutual fund performance 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 flow and fund return.[4]

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)). While there is evidence that tax considerations also affect trading decisions (Ivković, Poterba, and Weisbenner (2005)), the dominance of the disposition effect over other motivations for trade (such as taxes or a belief in fund performance persistence) leads 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.

Research in psychology and behavioral finance concerning the relation between involvement in decision-making and loss aversion suggests that psychological motivations, such as the disposition effect, may play less of a role for mutual funds than for stocks. Survey evidence (Ivković and

[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 resorted to it (e.g., Edelen (1999) and Bergstresser and Poterba (2002)), and then only for a very small number of funds.
[4] Another potential motivation for trade in both taxable and tax-deferred accounts might be the tendency to rebalance the portfolio—this would lead to a positive relation between propensity to sell and past performance. The data suggest, however, that rebalancing is unlikely to play a significant role in the present context because around 89% of all sales of mutual funds are complete liquidations of the mutual fund position from the portfolio, rather than partial sell-offs that would be more consistent with the rebalancing motivation.

Weisbenner (2006)) suggests that investors generally feel more "involved" with their stock picks than they do with their mutual fund purchases. For one, purchasing mutual fund shares enables investors to step aside and delegate their investment picks to mutual fund managers. Moreover, relative to mutual funds, investors report spending more time researching their stock selections before purchase and to monitoring and evaluating the performance of their stock investments more frequently (Ivković and Weisbenner (2006)).[5] Under such plausible assumptions, factors such as the "illusion of control" (Langer (1975), Isen and Geva (1987), Dunn and Wilson (1990), and Fong and McCabe (1999)) or "myopic loss aversion" (Benartzi and Thaler (1995), Thaler, Tversky, Kahneman, and Schwartz (1997), Gneezy and Potters (1997), and Gneezy, Kapteyn, and Potters (2003)) predict smaller levels of loss aversion regarding mutual fund investments, that is, the lack of dominance of the disposition effect over other motivations for trading. This, in contrast to stock investments, could lead to a net *negative* relation between propensity to sell and past mutual fund performance.

We begin our analyses by studying the determinants of redemption decisions with particular attention to the relation between the sale decision and the fund's past performance. We do this by utilizing detailed brokerage data for a large sample of individual investors over the period from 1991 to 1996. Having established a robust relation in selling patterns on the individual level, we then aggregate the brokerage-level data by quarter and by mutual fund to decompose fund net flows into fund inflows and fund outflows. This strategy enables us to assess the extent to which the well-documented relation between net flow and performance can be explained by the negative relation between past performance and redemptions (as opposed to the sensitivity of *new* money entering the fund to fund returns).

The contribution of this paper may be summarized through three key findings. First, we document that, consistent with tax-motivated trading and a belief in fund-performance persistence, and in stark contrast with individual investor behavior in regard to common stocks (Odean (1998), Grinblatt and Keloharju (2001), Ivković, Poterba, and Weisbenner (2005)), there is a *negative* relation between the likelihood of sale and past mutual fund performance (more pronounced for mutual funds held in taxable accounts). That is, investors holding mutual funds are reluctant to sell funds that appreciated in value and willing to sell funds that have fallen in price.

[5] In 1999, Bank Hapoalim, Israel's largest mutual fund manager, announced its intention to decrease the frequency with which it would mail reports about the performance of its funds from monthly to quarterly; they cited the concern that frequent disclosure of investment performance could lead to excessive trading (cited in Gneezy, Kapteyn, and Potters (2003)).

A comparison of trades in taxable and tax-deferred accounts suggests that a good share of the negative relation can be explained by tax-motivated trading (i.e., capital gains lock-in and tax-loss selling). Though significantly weaker because of the absence of tax-motivated trading, there remains a negative relation between performance and subsequent sales of mutual funds in tax-deferred accounts. Clearly not prompted by tax considerations, this finding is consistent with investors' belief in persistence of mutual fund performance. On net, psychological motivations such as the disposition effect 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 negative relation between the propensity to sell and past appreciation of the fund is extremely robust. It holds after allowing for substantial heterogeneity across individuals as well as the types of mutual funds they purchase (we include the equivalent of individual as well as mutual fund objective and mutual fund family fixed effects in hazard models) and after also including controls for the costs of investing and relative performance rankings. This negative relation further holds both at the individual-transaction level as well as at the aggregated-fund-outflow level.[6]

Our second key result suggests that, controlling for a fund's total return since purchase, the composition of that return matters for sale decisions. In taxable accounts there is strong evidence of tax-motivated behavior: the greater the share of total returns distributed to the investor (thus, mechanically, the tax liability), the greater the probability of redemption. However, no such relation exists in tax-deferred accounts. Given that the greater the share of total returns distributed via distributions implies the greater the tax liability for the investor, this pattern of results is consistent with tax considerations affecting redemption decisions of individual investors.[7] Thus, overhang management and distribution policy 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 final key result stems from quarterly aggregation of individual investors' buys and sells into quarterly measures of fund-level 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.

[6] Our results regarding mutual fund sales/outflows stand in contrast to those reported in Johnson (2006) who finds that outflows are related to neither "absolute" nor "relative" short-term performance. We discuss likely reasons for the difference in Section 3.1.

[7] There could be two channels for the effect of higher distributions in the past on the propensity to sell in taxable accounts. First, higher distributions mechanically reduce an investor's capital gain in the fund (thus reducing the lock-in effect). Second, they also suggest that future total returns may include a high level of distributions that will immediately trigger tax payments.

Thus, both new money and old money are sensitive to a fund's past performance, but in very different ways. The rich characterization we find is obscured when inflows and outflows are combined into net flows.

Although not the central focus of the paper, we also consider the role that the costs of investment play in the redemption decision. Barber, Odean, and Zheng (2005) find that front-end loads depress and annual expenses increase *net* flows into a mutual fund. Our analysis provides the insight that 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 the presence of a front-end load may depress inflows, it also appears to depress outflows (lengthening the holding period of the "old" money);[8] 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 (particularly following an increase in the expense ratio). These considerations are important because, given the declining hazard rate of sale with holding period, 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 on average be shorter 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 with capital appreciation since purchase and fund performance rankings (specifically, rankings of past one-year performance relative to all funds with the same stated investment objective). In Section 4 we consider the role of distributions and costs of investing. In Section 5 we aggregate investors' buys and sells of mutual funds into quarterly measures of inflows and outflows, and analyze the relation between those flows and various measures of fund performance. Section 6 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

[8] This finding holds even after controlling for investor and fund heterogeneity, suggesting that individual investors may not appropriately differentiate between marginal and fixed costs.

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 purchases that did not have matching sells in the sample period, as well as the buys and the sells that we could match unambiguously. Examples of trades that we could not match unambiguously include sales that do not have a preceding purchase by the same household earlier during the sample period, as well as sales that are preceded by multiple buys. 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, were very similar. Approximately one third of the purchases were followed by a sale during the sample period.

TABLE I ABOUT HERE

As shown in Panel B of Table I, rankings of past one-year performance relative to all funds with the same stated objective suggest that investors in the sample chased past performance: by construction, funds ranked into the top quintile in their objective by their one-year return account for 20 percent of all funds, yet 41 percent of funds purchased belong to 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, 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. How Representative is the Sample?

In the context of common-stock investments, Ivković, Poterba, and Weisbenner (2005) and Ivković, Sialm, and Weisbenner (2005) show that the distribution of holding periods for stocks sold, the number of stocks held in a household's portfolio, and the total value of the portfolio of investors with this brokerage house are similar to those characteristic of the broader individual investing public. Nonetheless, mutual funds can be bought and sold through several channels other than a discount brokerage (e.g., full-service broker, insurance company, bank, financial planner, directly through the fund, etc.), raising the concern that individuals who decide to purchase mutual funds through the discount-broker channel may be somehow different. The Investment Company Institute (1994) reports, however, that individuals who purchase mutual funds through a discount broker are not very different from mutual-fund owners in general. For example, the median financial wealth (excluding real estate and assets in employer-sponsored pension plans) and the income of individuals that use discount brokers are $141,200 and $104,100, respectively, compared to median wealth of $144,400 and median income of $91,300 for mutual fund owners in general. Moreover, the demographic attributes (e.g., age, sex, marital status, and educational attainment) of the two groups are virtually identical.

Comparison with Investment Company Institute (ICI) research suggests that the trading propensity of investors who purchase funds through a discount broker is very similar to that of the typical mutual fund investor. The Investment Company Institute (2001) reports that 72% of mutual fund owners did not redeem shares in the 12 months preceding its 1992 survey, whereas in the brokerage-house investor sample 72.3% of mutual-fund owners did not sell any shares during 1992, with an average probability of no sale during a calendar year of 69.1% across the six sample years (1991-1996). In the brokerage sample, we estimate the median holding period of a mutual fund investment to be 55 months. This corresponds fairly closely to the median tenure in a fund before redemption of five years reported by the ICI (1993). Finally, across the entire sample period, our brokerage data suggest that individual investors' sales of mutual fund shares were nearly as large as purchases—sales constituted slightly more than 44% of the overall value of combined purchases and sales of mutual fund shares (with a range from 28.7 to 65.3 percent across the 71 months in the sample). This figure corresponds very closely to 48%, the fraction of redemptions in the combined new sales and redemptions in the entire U.S. mutual fund industry during the sample period (authors' calculations based on the data reported in the ICI 2003 Mutual Fund Annual Report). Thus, the two populations of investors are very similar along several important dimensions.

2.4. Graphical Summary of Hazard Rates and Cumulative Sale Probabilities

Figure 1 presents the hazard rates (i.e., the likelihood of sale during a given month after purchase conditional on having not being sold up to that month) of individual investors' sales of mutual fund shares in their taxable accounts. The two solid lines depict hazard rates conditional upon accruing capital gains entering the month (gray solid line) and hazard rates conditional upon accruing capital losses entering the month (black solid line) for the first 36 months since 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), Grinblatt and Keloharju (2001), Ivković, Poterba, and Weisbenner (2005)). First, in stark contrast with common-stock investments, hazard rates conditional upon losses *exceed* those conditional upon gains, a finding that suggests the absence of a disposition effect with respect to capital appreciation since purchase in favor of a very pronounced capital gains lock-in effect (or, more precisely, the dominance of other reasons for trade such as taxes or belief in fund performance persistence over the disposition effect).[9] 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. Nonetheless, the declining hazard rate 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).

FIGURE 1 ABOUT HERE

3. Relating Probability of Sale with Capital Appreciation Since Purchase

3.1. Motivations for Sale and Basic Analyses

A 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. This is equally true in taxable and tax-deferred (i.e., IRA) accounts.

The negative relation documented in Figure 1 is also 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 and keep investments that have risen in price (the "lock-in" effect).

[9] Ivković and Weisbenner (2006) confirm that this stark difference in trading patterns across stocks and mutual funds holds "within an investor" (as opposed to different investors with different risk preferences investing in different types of assets) and explores why investors trade mutual funds and stocks differently with the use of survey data.

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), Ivković, Poterba, and Weisbenner (2005)) 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)).[10] 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).

At the outset, we seek to confirm the basic results presented in Figure 1 by estimating a Cox proportional hazards model of mutual fund share sales over the sample of all trades in taxable accounts with the minimal set of covariates and their interactions: GAIN, LOSS, and a dummy variable December (which controls for end-of-the-year effects), where $GAIN_{i,t-1} = \max(NAV_{i,t-1} / NAV_{i,p} - 1, 0)$, and $LOSS_{i,t-1} = \min(NAV_{i,t-1}/NAV_{i,p} - 1, 0)$. $NAV_{i,p}$ denotes the net asset value per share at the time of purchase i and $NAV_{i,t-1}$ denotes the net asset value per share at the end of month t-1 since purchase. All net asset values per share are adjusted for splits. Including GAIN and LOSS in the specification allows for differential effects across funds whose share price has risen and fallen, respectively. We estimate the baseline hazard rate $\lambda_0(t)$ non-parametrically (Han and Hausman (1990), Meyer (1990)). Following Ivković, Poterba, and Weisbenner (2005), we first focus on a fund's capital appreciation, as this is the relevant benchmark for tax considerations. Later, we also consider the fund's total return as well as the composition of that return between capital appreciation and cash distributions.

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:

$$h_i(t) = \lambda_0(t) * e^{X_{i,t} \beta}. \quad (1)$$

The first specification we explore is given in Equation (2):

$$X_{i,t} \beta = \beta_1 * GAIN_{i,\, t-1} + \beta_2 * GAIN_{i,\, t-1} * December_{i,\, t} + \beta_3 * LOSS_{i,\, t-1} +$$

[10] 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. See later sections for related discussion and analyses.

$$\beta_4{*}LOSS_{i,\,t\text{-}1}{*}December_{i,\,t} + \beta_5{*}December_{i,\,t} + \varepsilon_{i,\,t}. \quad (2)$$

If tax-motivated trading or belief in fund performance persistence prevail, investors are more likely not to sell mutual fund shares with accrued gains and to sell mutual fund shares with accrued losses ($\beta_1 < 0$ and $\beta_3 < 0$). On the other hand, the disposition effect predicts that investors are more likely to sell mutual fund shares with accrued gains and not to sell mutual fund shares with accrued losses, which translates into $\beta_1 > 0$ and $\beta_3 > 0$. Such a finding would also be consistent with portfolio rebalancing, but rebalancing is unlikely to play a significant role in the present context.[11] Because, by definition, GAIN is non-negative and LOSS is non-positive, a negative (positive) coefficient on GAIN lowers (raises) the probability of sale, whereas a negative (positive) coefficient on LOSS increases (reduces) it. The end of the tax year in December leads to two tax-induced seasonal predictions: the propensity to postpone the realization of accrued gains until at least the next tax year implies lower probability of sale in December ($\beta_2 < 0$), while the desire to capture tax losses in the current calendar year implies a higher probability of sale in December ($\beta_4 < 0$). In sum, negative coefficients are consistent with the dominance of tax motivations and/or investors' belief in fund performance persistence, whereas positive coefficients on GAIN and LOSS are consistent with the dominance of the disposition effect.

The results of estimating this model across all taxable mutual fund investments in the sample are presented in the first column of Table II, Panel A. Consistent with Figure 1, there is very pronounced evidence in support of a negative relation ($\beta_1 < 0$ and $\beta_3 < 0$) throughout the calendar year. The coefficient on LOSS is –2.11, suggesting that a larger loss leads to a larger probability of sale in all calendar months (not just December). The coefficient for the interaction term LOSS*December is also large and negative (–2.54), indicating that tax-loss selling is the most intense at the end of the year. In months other than December, the monthly hazard rate for a mutual fund investment in which the net asset value per share declined by 25 percent since purchase is 69 percent higher than the hazard rate for a mutual fund share that did not experience a change in net asset value per share since purchase ($e^{-2.11*(-0.25)} - 1 = 0.69$). The monthly hazard rate differential for such investments in December is as large as 220 percent ($e^{(-2.11-2.54)*(-0.25)} - 1 = 2.20$). As for GAIN, in months other than December the monthly hazard rate for a mutual fund investment that increased in price by 25 percent since purchase is 29 percent lower than the hazard rate for a mutual fund investment that did not experience any capital appreciation since purchase ($e^{-1.35*0.25} - 1 = -0.29$),

[11] 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.

consistent with both a strong capital gains lock-in effect and a belief in fund performance persistence (we later examine differences in taxable and tax-deferred accounts to differentiate between the two motivations). According to this baseline specification, investors are even more likely to postpone the realization of gains in December, likely because waiting a month would push the tax consequence of the transaction back a year (the hazard rate of a mutual fund investment with an accrued 25 percent capital gain is 40 percent lower in the month of December relative to an investment with no appreciation). However, the latter finding is not robust to additional controls for investor heterogeneity, as discussed in the next section.

Our results displayed in Figure 1 and Table 2 regarding mutual fund sales (and those we obtain later concerning aggregated outflows) stand in contrast to 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 inflows, 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.[12]

[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 (2005) sample). It is entirely plausible that the characteristics of the investors who choose to invest directly through a small, no-load family may well be different from those of the investors who choose to invest through a large discount broker (we have demonstrated in Section 2 that our sample matches the overall investment population parameters reported by the ICI along several important dimensions, both in terms of the characteristics of the investors as well as how long they hold their mutual funds before sale).

3.2. Controlling for Investor Heterogeneity and the Effects of Holding Period

We next relax the constraint that all investors' trading decisions conform to one general hazard function $\lambda_0(t)$ and instead allow investor-level heterogeneity by enabling each individual i to have a personal, investor-specific baseline hazard function $\lambda_i(t)$. This strategy takes into account that, regardless of past performance, some individuals are more likely to trade than others. Investor-specific baselines help alleviate the concern that investor heterogeneity may be driving the results. For example, suppose that buy-and-hold investors happen to purchase 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. The corresponding regression results with investor-specific baselines, reported in the second column of Table II Panel A, are very similar to those from the first column (with a common baseline), suggesting that investor heterogeneity does not drive the results.

In the third and final column of Table II Panel A, we revisit heterogeneity by using an even more encompassing approach—allowing 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.[13]

Recall that, in the first column, regression results are identified by differences in fund performance since purchase. In the second column, regression results are identified by how the same individual trades funds with different performance since purchase. The regression results obtained from the model in the third column are 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. Even with such controls for heterogeneity, both across individuals and the types of funds into which they invest, the direction, magnitude and significance of regression coefficient estimates obtained from such a generalized model are very similar to those from the first column, estimated from the basic specification. This confirms that adding a considerable level of heterogeneity does not

[13] 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.

alter the key conclusions originating from the basic specification. The one exception is the absence of evidence of postponing the sale of gains in December, where the coefficient is now insignificant.

Coefficients associated with GAIN and LOSS, as reported in Panel A of Table II, are fairly similar in magnitude. Indeed, we cannot reject their equality in the specifications based on multiple baselines, that is, those that control for investor heterogeneity (the second and third columns of Table II, Panel A). Thus, from this point forward we report the results based on the capital appreciation of the fund since purchase $RETURN_{i,\,t}$, defined as $RETURN_{i,\,t}, = NAV_{i,\,t} / NAV_{i,\,t-1} - 1$, that is, without splitting that capital appreciation into capital gains and capital losses. We do so for parsimony and expositional convenience, as the results reported hereinafter for RETURN hold for the respective more detailed specifications featuring GAIN and LOSS. In the reported specifications we model the shifts of the non-parametric baselines in Equation (3) as follows:

$$X_{i,t}\,\beta = \beta_1{*}RETURN_{i,\,t-1} + \beta_2{*}RETURN_{i,\,t-1}{*}December_{i,\,t} + \beta_3{*}\,December_{i,\,t} + \varepsilon_{i,\,t}. \qquad (3)$$

Table II, Panel B reaffirms the negative relation between propensity to sell and capital appreciation since purchase. Across the three specifications, the coefficients associated with RETURN are negative and large in magnitude (–1.56, –1.70, and –1.06, respectively), as well as statistically significant at the 1% level, suggesting that, for example, a mutual fund investment trading at a 20 percent loss is 53 to 97 percent more likely to be sold in a given month than a mutual fund investment that has appreciated 20 percent since purchase.

TABLE II ABOUT HERE

Up to this point, our estimates 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 from Equation (3) by introducing an indicator variable "w/in 12 months since buy" which we interact 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—the coefficient on RETURN is –1.64 for holding periods of less than a year and –1.75 for holding periods of more than a year (this difference is small and statistically insignificant), 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.

3.3. Mutual Fund Trades in Taxable and Tax-Deferred Accounts

The disposition effect predicts a positive relation between the propensity to sell and past returns, whereas both a belief in fund performance persistence and tax considerations predict a negative relation. Although the results we present up to this point establish a very robust negative relation between propensity to sell mutual fund investments and performance since purchase in investors' taxable accounts, considering only taxable accounts does not enable us to disentangle the contributions of tax motivations and belief in fund performance persistence to the negative relation.

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 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.[14]

We introduce a dummy variable TAX_i that denotes whether the mutual fund investment i is held in a taxable account and use it to create interaction terms that enable us to assess the importance of tax-motivations and potentially different impact of psychological biases on the investor behavior in taxable and tax-deferred accounts as follows:

$$\begin{aligned} X_{i,t}\,\beta = \; & \beta_1{*}RETURN_{i,\,t-1} + \beta_2{*}RETURN_{i,\,t-1}{*}December_{i,\,t} + \beta_3{*}\,December_{i,\,t} + \\ & \beta_4{*}RETURN_{i,\,t-1}{*}TAX_i + \beta_5{*}RETURN_{i,\,t-1}{*}December_{i,\,t}{*}TAX_i + \\ & \beta_6{*}December_{i,\,t}{*}TAX_i + \varepsilon_{i,\,t}. \end{aligned} \qquad (4)$$

Panel A of Table III reports the results based on this specification. 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. The fund type is defined by fund objective, degree of active management (index funds versus actively managed funds) and fund family membership. In other words, loosely speaking, we include the analogue of fixed effects for all investor-taxable account-fund objective-index fund-fund family combinations.

[14] 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.

The first column replicates the third column of Table II, Panel B. The key insight featured in this panel is the large and statistically significant differential between the coefficients associated with RETURN in taxable and tax-deferred accounts. Both are negative, but the one associated with taxable accounts is approximately twice as large in magnitude. For example, a 25 percent capital gain is associated with a 13 percent lower monthly hazard rate of sale relative to a mutual fund share with no appreciation in tax-deferred accounts ($e^{-0.54*0.25} - 1 = -0.13$), whereas the decline in hazard rates in taxable accounts amounts to 23 percent decrease ($e^{-1.06*0.25} - 1 = -0.23$). This suggests that a good share (but not all) of the negative relation between past performance and the likelihood of redemption during the non-December months is explained by tax-motivated trading; though somewhat weaker in the absence of tax considerations, there still remains a strong and robust negative relation between performance and subsequent sales of mutual funds in tax-deferred accounts.[15]

Finally, 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 over 17,000 households that have both types of accounts. The results are very similar to those reported in Table III, Panel A, a finding that is not surprising given all of the controls for heterogeneity of investors already included in the model.

3.4. Effects of Relative Performance Rankings

So far we have focused on the absolute performance of a fund (which is germane for tax purposes), but also relevant for an investor may be the performance of that fund relative to similar funds in the same objective. Panel B of Table III augments the specification outlined in Equation (4) with measures of funds' performance rankings. Indeed, investors are routinely supplied 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

[15] A more detailed specification, featuring GAIN and LOSS separately, yields analogous results. Moreover, in that specification, we cannot reject the joint test of equality of the GAIN and LOSS coefficients across the two types of accounts (the *p*-value for the joint test of equality for the coefficients on GAIN and LOSS and the coefficients on GAIN*TAX and LOSS*TAX is 0.139).

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.

In addition, we also include variables that capture costs of investment (front-end loads, the presence of back-end loads, expense ratio, expense ratio increases since purchase, and expense ratio decreases since purchase). To avoid clutter in this table and to streamline the exposition, we postpone the presentation and discussion of those coefficients until Section 4 (Table V).

We highlight two findings. First, all of the previous discussion regarding the magnitude and attribution of the negative relation between propensity to sell and the fund's absolute performance since purchase still holds because the key coefficients of interest on RETURN and RETURN*TAX are essentially unchanged. Second, performance rankings, upon controlling for absolute performance since purchase, have only moderate effects on the propensity to sell. In non-December months, there is a slightly higher propensity in taxable accounts to sell funds with one-year percentile rankings in the bottom quintile (the probability increases by twelve percentage points compared to funds in the middle three quintiles of one-year percentile rankings, $e^{0.11} - 1 = 0.12$), with a similar effect in tax-deferred accounts. Strikingly, the differences between the coefficients on the four relative performance controls among taxable and tax-deferred accounts are jointly insignificant ($p = 0.59$), as well as individually insignificant. This suggests that relative rankings over the previous year do not affect taxable mutual investments differently from tax-deferred ones, whereas absolute performance does have differential effects across the two types of accounts (because tax considerations apply only to taxable accounts).

TABLE III ABOUT HERE

4. The Role of Distributions and Costs of Investment

We next expand our inquiry along two dimensions. First, the analyses presented thus far have focused upon the (unrealized) capital appreciation of mutual fund investments since purchase, a relevant benchmark for tax purposes as well as, perhaps, the disposition effect. Nonetheless, mutual fund distributions are also a significant component of total returns—in the sample, returns from capital appreciation average around 8.5 percentage points per year, whereas returns from distributions average around 5 percentage points per year. Investors' propensity to sell mutual fund investments in tax-deferred accounts should not be related to the *composition* of the total return since purchase because distributions in those accounts are tax-deferred themselves (and are routinely reinvested into the fund). However, a fund that pays higher distributions mechanically reduces an investor's capital gain in the fund (thus reducing the lock-in effect); it also suggests that future total returns may contain a higher level of distributions, which, in turn, will immediately trigger tax payments. Thus, controlling for the *total* return since purchase, the higher the level of distributions the fund has paid, the higher the likelihood of sale, but only in taxable accounts.

Second, 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. By focusing on the sale decision (and later examining aggregated inflows and outflows separately), we are able to provide the insight that, when contemplating changes to the cost parameters, a fund manager should be aware of the countervailing effects induced by the differential responses of the "new" and "old" money to the costs of mutual fund investment.

4.1. Mutual Fund Distributions

The roles of distributions in the domains of mutual fund investments and common-stock investments are somewhat different. Mutual fund distributions include both dividends and realized capital gains and are paid out to investors in most funds on a regular basis.[16] Consequently, distributions are a large component of total mutual fund returns. Their magnitude in the sample, around five percentage

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[16] 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.

points per year, is more than twice the average dividend yield in the domain of common-stock investments during the sample period.

Mutual fund managers have some flexibility in regard to the distribution of capital gains and dividends. Boosting distributions (thereby lowering the fund's capital gains overhang) may attract new investors (see Barclay, Pearson, and Weisbach (1998)). However, decreasing the overhang may result in higher outflows in taxable accounts (Bergstresser and Poterba, 2002) because distributions either reduce the capital gains since purchase or exacerbate the existing losses. In the following analyses, we assess the latter hypothesis by controlling for a fund's total return since purchase and including the share of returns distributed to the investor since purchase into the specifications.

To explore the relation between the propensity to sell mutual fund investments and distributions since purchase, we replicate the analyses from Panel B of Table III with a different representation of performance since purchase. Instead of capital appreciation since purchase (RETURN), the specifications reported in Table IV feature TOTAL RETURN (total fund returns since purchase) and DISTRIBUTION (fund distributions since purchase).

Essentially, all the results presented in Table III carry over. In particular, Table IV suggests that the relation between propensity to sell and total return since purchase is negative and its breakdown into belief in fund performance persistence and tax motivations is very similar to that from Table III (i.e., the relation is significantly more negative in taxable accounts than tax-deferred accounts).

The role of distribution policy is particularly striking. Consistent with the tax considerations discussed above, we find that, controlling for the total return since purchase, the higher the distribution component of the total return, the higher the likelihood of sale of mutual fund investments held in taxable accounts. However, in tax-deferred accounts, where the composition of return has no tax consequences, the amount of the total return in the form of cash distributions has an insignificant effect on sales.

TABLE IV ABOUT HERE

4.2. Costs of Mutual Fund Investment

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, expense ratios charged by the funds at the time of purchase, and changes in expense ratios since the date of purchase (increases and decreases, included into the specification separately).

Table V presents the results for the sample of all mutual fund investments made in taxable accounts and tax-deferred accounts. The full assortment of independent variables includes a number of performance-related variables. They already are presented in Table III, Panel B. In Table V, we focus on the investment costs. All the specifications presented in Table V allow for substantial heterogeneity across investors by featuring investor-mutual fund type non-parametric baselines (as in Tables III and IV), separately for taxable and for tax-deferred accounts.

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 70 percent in taxable accounts and 36 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.[17] 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 (2006): 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, the level of the expense ratio at purchase and any subsequent increases in the expense ratio increase 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

[17] In unreported results, we find a very similar front-end load effect in a specification that allows only one baseline of sale across all investors (focusing on taxable accounts, the coefficient on the front-end load is –17.8 with no heterogeneity controls and –24.0 with heterogeneity controls as displayed in Table V).

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 ($e^{19.8*0.01} - 1 = 0.22$). An increase in the expense ratio since purchase (raising the annuity stream of future costs associated with the investment) dramatically boosts the sale probability: a 50-basis point expense ratio increase is associated with a 70 percent increase in the hazard rate of sale ($e^{105.9*0.005} - 1 = 0.70$) in taxable accounts.

TABLE V ABOUT HERE

5. Contrasting Determinants of Quarterly Fund Inflows and Outflows

The preceding sections reveal 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 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 for small samples of funds (see, e.g., Edelen (1999), Bergstresser and Poterba (2002), Johnson (2004), and Johnson (2006)). The only studies to our knowledge that assessed determinants of fund-level inflows and outflows are Bergstresser and Poterba (2002) and Johnson (2006). Bergstresser and Poterba (2002) relate annual inflows and outflows to one-year fund returns relative to the average return in their sample of 686 fund-year observations, covering the 200 largest mutual funds, and find that inflows are strongly positively related to relative returns, whereas there is no relation between outflows and relative returns (they do not examine the relation with absolute performance). Johnson (2006) finds that outflows are related to neither "absolute" nor "relative" short-term performance and thus posits that mutual fund share sales are merely idiosyncratic and are based on investors' liquidity needs. However, this study of daily fund-level inflows and outflows is based on data from only ten funds from a small, no-load family.

To obtain measures of flows comparable to those employed elsewhere in the literature, 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:

$$\text{Inflow}_{i,q+1} = \text{Buys}_{i,q+1} \,/\, \text{Positions}_{i,q}, \tag{5}$$

$$\text{Outflow}_{i,q+1} = \text{Sells}_{i,q+1} \,/\, \text{Positions}_{i,q}, \quad \text{and}$$

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

where $\text{Positions}_{i,q}$ is the total sum of all households' holdings of fund i at the end of quarter q, $\text{Buys}_{i,q+1}$ and $\text{Sells}_{i,q+1}$ are total sums of all sample households' purchases and sales, respectively, of fund i in quarter q +1. Finally, $\text{NetFlow}_{i,q+1}$, $\text{Inflow}_{i,q+1}$, and $\text{Outflow}_{i,q+1}$ are net flows, inflows, and outflows for fund i in quarter q+1, respectively. For expositional convenience, in all the analyses presented in this section these flow variables, which we will often refer to as normalized flows, are multiplied by 100 and are thus expressed in percentage points.

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.

[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.

Our brokerage-level data provide an estimate of the aggregate inflows and outflows of individual investors (as discussed in Section 2.3, our sample matches the overall mutual fund individual investor population behavior fairly well). 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 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 (based on total net assets and total fund returns) 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.

5.1. 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 (as before, 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 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.[19]

Results are presented in Table VI. The first two columns feature regressions of quarterly net flows, computed from the CRSP data that feature funds' total net assets and returns and from the buys and sells in the brokerage data sample, respectively. The CRSP data flows are calculated for the same group of fund observations contained in the brokerage-based data. The third and fourth columns feature the decomposition of net flows into inflows and outflows (thus, by construction, every regression coefficient in the second column is equal, modulo rounding errors, to the difference of the coefficients from the third and fourth 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. The dependent variables (i.e., normalized

[19] In the course of carrying out 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 equivalent of holding-period returns for purchases. Therefore, we instead focus on the past one-year returns and thereby facilitate direct comparison across net flows, inflows, and outflows.

flow variables) are expressed in percentage points, whereas the independent variables are expressed as raw ratios (i.e., not in percentage points).

Overall, there is a good match between the regression coefficients in the first two columns in terms of their sign, magnitude, and statistical significance. In particular, the sensitivity of net flows to past one-year absolute returns is virtually identical (36.6 vs. 38.0), suggesting that our estimates of the sensitivity of net flows to past absolute performance obtained from the brokerage sample matches the behavior of total net flows (as measured by CRSP) fairly well. These coefficient estimates themselves suggest that a five-percentage point higher absolute return is associated with additional quarterly net flows into the fund of 1.8 to 1.9 percent of fund assets.

The coefficients on other variables included in the regression of net flows generally have their expected sign. Consistent with Barber, Odean, and Zheng (2005), the coefficient associated with the expense ratio is positive and statistically significant for the aggregate net flows based on the CRSP data; it is also positive, but smaller and just below a 10% significance level for the net flows based on the brokerage data (although inflows and outflows each have a statistically significant relation with the expense ratio, as we discuss shortly). The relation between net flow and turnover is positive, consistent with turnover being perceived as a signal of diligent management, with its impact extending over inflows only. Finally, relative performance (as well as absolute performance) predicts net flows into a fund. After controlling for the fund's past one-year return, funds with higher Morningstar ratings have higher net flows into the fund (with the nonlinearity surfacing more strongly in the brokerage data than in the CRSP data).

The decomposition of net flows into inflows and outflows (the last two columns of Table VI) 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 discussed earlier comes from the outflow side (23.2 / 38.0 = 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.

Breaking net flows into its two components yields insights regarding the effect of the expense ratio. Both inflows *and* outflows are positively related with expense ratios; it appears that the effects of marketing are strong when attracting new buys, yet, consistent with the results from Section 4, 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 8.3 percentage points (1376.0 x 0.006 = 8.3).

Finally, both inflows and outflows appear to be negatively related with the front-end load (the aggregate inflow result is consistent with the findings in Section 4 in the context of individual sale decisions), although both estimates narrowly miss statistical significance at the 10 percent level.

TABLE VI ABOUT HERE

5.2. 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 VII), 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 VII presents results of running essentially the same specifications as in Table VI, 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 VI. Augmenting the specification from Table VI 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 VII), it becomes clear that "relative" performance is an important determinant of net flows, a relation spurred primarily 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 VII (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.

Figure 2 plots the results from regressions that are analogous to those displayed in Table VII (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).[20] Precisely, Figure 2 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.

[20] 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. Therefore, the cutoffs are the same for each fund objective and for each quarter.

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 1^{st} to the 10^{th} 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 1^{st} to the 10^{th} 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 1^{st} and the 10^{th} 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)).

TABLE VII ABOUT HERE

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.

6. Conclusion

This paper studies the determinants of 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 in part by tax-motivated trading, with investors' belief in fund performance persistence likely also playing a role. These results are extremely robust to alternative specifications and ample controls for heterogeneity. 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) and the expenses and loads to be charged. Both choices have implications for outflows from the fund. 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, and particularly increases in the expense ratio since purchase, lead to a substantial increase in the probability of redemption. We also find that, controlling for the fund's total return since purchase, the composition of that returns matters for the sale decision; the greater the share of returns distributed to the investor (which mechanically lowers the net asset value per share), the greater the probability of redemption.

The latter results have important implications for the management of a fund's overhang. Whereas potential investors may prefer that the capital gains overhang be kept at low levels and otherwise might be reluctant to invest in the fund, distributing unrealized capital gains lowers the share price, which prompts existing investors to sell. Thus, attracting new investors while, at the same time, keeping the existing investors may be a delicate balancing act for the fund manager. Because our results suggest that the expected holding period for current investors in the fund is substantially lower than that for new investors, catering to existing investors may be a very sensible objective because they are more likely to remain invested in the fund in the future. This consideration is particularly important because outflows represent quite a substantial component of net flows.

Finally, we use our 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.

In closing, we note that we have uncovered several very robust findings regarding individual investors' mutual fund investing, particularly decisions to sell. Still, the brokerage data has its limitations because it simply cannot help us disentangle some of the competing reasons for the results; it cannot tell us the underlying reason *why* the sign of the relation between propensity to sell mutual funds and their past performance is negative—diametrically opposite from that which several studies uncovered for stocks (e.g., Odean (1998), Grinblatt and Keloharju (2001), Ivković, Poterba, and Weisbenner (2005)). One plausible explanation has psychological underpinnings: investors may exhibit differential involvement with their stock investments and mutual fund investments. Although not established empirically, relative to their mutual fund investments, it is likely that individual investors spend more time researching their potential stock investments and, once purchased, follow their performance more frequently. Moreover, the discrepancy between common stock and mutual fund investments may also be governed by the sheer fact that purchasing mutual fund shares entails delegating day-to-day investment decisions to mutual fund managers. Among other issues, this arrangement provides a "scapegoat." That is, investors may be prepared to sell a losing mutual fund investment more easily than a losing stock investment because underperformance of a mutual fund may be blamed on the manager, whereas there is no one but oneself to blame for an underperforming stock pick. A promising avenue to disentangle these potential explanations for trade is collecting and analyzing survey data that would probe investors to provide answers to direct questions regarding their motivations for their financial decisions.

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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

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

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

At Time of Purchase (in percent)		*Change from Purchase to Sale (in percent)*	
5 (top)	41		
4	20	increase	19
3	19	no change	48
2	11	decrease	33
1 (bottom)	9		
Total	100	Total	100

Table II: Relating Sale of Mutual Fund Shares in Taxable Accounts to Capital Appreciation Since Purchase

The Cox proportional hazards model employs a non-parametric estimate of the baseline hazard (i.e., the probability of selling the mutual fund month t after the buy conditional on no prior sale). The first column reports results allowing for a common baseline hazard $\lambda_0(t)$. The second column reports results allowing for household-specific baseline hazards $\lambda_i(t)$. The third column reports results allowing separate non-parametric baseline hazard rates for each investor-mutual fund type combination. The fund type is defined by fund objective, degree of active management (index funds versus actively managed funds), and fund family membership. Panel A focuses on gains and losses since purchase, whereas Panel B focuses on capital appreciation of the mutual fund since purchase. Accordingly, GAIN = max(RETURN, 0) and LOSS = min(RETURN, 0), where RETURN is defined as the capital appreciation (NAV change) of the mutual fund since purchase. Standard errors (shown in parentheses) allow for heteroskedasticity as well as correlation across observations of the same household.

Variable	*Common baseline*	*HH-specific baselines*	*HH-fund type-specific baselines*
Panel A: Gains and Losses Since Purchase			
GAIN	–1.35*** (0.05)	–1.73*** (0.06)	–0.80*** (0.22)
GAIN*December	–0.71*** (0.21)	–0.97*** (0.26)	0.26 (0.69)
LOSS	–2.11*** (0.12)	–1.62*** (0.12)	–1.60*** (0.42)
LOSS*December	–2.54*** (0.39)	–2.48*** (0.38)	–3.61*** (1.21)
December	–0.07** (0.03)	–0.13*** (0.03)	–0.20*** (0.06)
p-value of GAIN = LOSS	0.00***	0.46	0.13
Number of Observations	2,725,732	2,725,732	2,358,091
Panel B: Returns Since Purchase			
RETURN	–1.56*** (0.04)	–1.70*** (0.05)	–1.06*** (0.17)
RETURN*December	–1.52*** (0.18)	–1.49*** (0.19)	–0.78 (0.55)
December	–0.00 (0.02)	–0.08*** (0.02)	–0.10** (0.05)
Number of Observations	2,725,732	2,725,732	2,358,091

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table III: Regression of Sale of Mutual Fund Shares in Taxable vs. Tax-Deferred Accounts

The Cox proportional hazards model employs a non-parametric estimate of the baseline hazard (i.e., the probability of selling the mutual fund month t after the buy conditional on no prior sale). 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. The fund type is defined by fund objective, degree of active management (index funds versus actively managed funds) and fund family membership. RETURN is defined as the capital appreciation (NAV change) of the mutual fund since purchase. Panel A presents a baseline model that relies upon absolute performance since purchase only (the first column replicates the third column of Table II, Panel B), whereas Panel B presents a model that also incorporates measures of funds' ranking of recent one-year total returns within its investment objective. All specifications also include costs of investment, that is, 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, expense ratios charged by the funds at the time of purchase, and changes in expense ratios since the date of purchase (increases and decreases, included into the specification separately). Coefficients associated with costs of investment are presented in Table V. Standard errors (shown in parentheses) allow for heteroskedasticity as well as correlation across observations of the same household.

Table III: Continued

	Panel A: Baseline Model			Panel B: Baseline Model + Relative Performance Rankings		
	Taxable Accounts	All Accounts		Taxable Accounts	All Accounts	
		Tax-Deferred Accounts	Interaction w/taxable		*Tax-Deferred Accounts*	Interaction w/taxable
RETURN	–1.06***	*–0.54****	–0.52**	–1.15***	*–0.49****	*–0.66****
	(0.17)	*(0.16)*	(0.23)	(0.18)	*(0.17)*	*(0.25)*
RETURN*December	–0.78	*–0.14*	–0.64	–0.94	*–0.12*	*–0.82*
	(0.55)	*(0.55)*	(0.78)	(0.56)	*(0.56)*	*(0.79)*
December	–0.10**	*–0.06*	–0.04	–0.18**	*–0.19***	*0.01*
	(0.05)	*(0.06)*	(0.08)	(0.08)	*(0.09)*	*(0.12)*
Previous 1-Year Return in Bottom Quintile of Objective?				0.11***	*0.17****	*–0.06*
				(0.04)	*(0.05)*	*(0.06)*
Prev. 1-Year Return in Bottom Quintile of Obj.? * December				0.05	*0.16*	*–0.11*
				(0.16)	*(0.17)*	*(0.23)*
Previous 1-Year Return in Top Quintile of Objective?				–0.03	*0.01*	*–0.04*
				(0.03)	*(0.04)*	*(0.05)*
Prev. 1-Year Return in Top Quintile of Obj.? * December				0.11	*0.28***	*–0.17*
				(0.11)	*(0.12)*	*(0.16)*
Controls for Costs of Investment (Loads, Expenses)?	No	No		Yes	Yes	
Number of Observations	2,358,091	4,521,648		2,201,308	4,243,002	

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table IV: Consideration of Total Returns and Distributions in Redemption Decision, Taxable vs. Tax-Deferred Accounts

The Cox proportional hazards model employs a non-parametric estimate of the baseline hazard (i.e., the probability of selling the mutual fund month t after the buy conditional on no prior sale). 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. The fund type is defined by fund objective, degree of active management (index funds versus actively managed funds) and fund family membership. TOTAL RETURN is defined as the mutual fund total return since purchase, that is, the sum of capital appreciation (NAV change) of the mutual fund since purchase and all of the distributions since purchase (DISTRIBUTION). The model also incorporates measures of funds' ranking of recent one-year total returns within the investment objective. Standard errors (shown in parentheses) allow for heteroskedasticity as well as correlation across observations of the same household.

	Baseline Model + Relative Performance Rankings		
	Taxable Accounts	All Accounts	
		Tax-Deferred Accounts	Interaction w/taxable
TOTAL RETURN	–1.10***	*–0.59****	*–0.51***
	(0.18)	*(0.18)*	*(0.25)*
TOTAL RETURN*December	–0.91	*–0.23*	*–0.68*
	(0.56)	*(0.56)*	*(0.79)*
DISTRIBUTION	1.86***	*–0.85*	*2.71****
	(0.49)	*(0.53)*	*(0.69)*
DISTRIBUTION*December	0.77	*1.60*	*–0.83*
	(1.60)	*(1.56)*	*(2.23)*
December	–0.15*	*–0.23***	*0.08*
	(0.08)	*(0.09)*	*(0.12)*
Previous 1-Year Return in Bottom Quintile of Objective?	0.12***	*0.16****	*–0.04*
	(0.04)	*(0.05)*	*(0.07)*
Prev. 1-Year Ret. in Bottom Quintile of Obj.? * December	0.04	*0.16*	*–0.12*
	(0.16)	*(0.17)*	*(0.23)*
Previous 1-Year Return in Top Quintile of Objective?	–0.03	*0.01*	*–0.04*
	(0.03)	*(0.04)*	*(0.05)*
Prev. 1-Year Ret. in Top Quintile of Obj.? * December	0.11	*0.29***	*–0.18*
	(0.11)	*(0.12)*	*(0.16)*
Controls for Costs of Investment (Loads, Expenses)?	Yes	Yes	
Number of Observations	2,201,308	4,243,002	

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table V: Role of Costs of Investment in Mutual Fund Sales

The Cox proportional hazards model employs a non-parametric estimate of the baseline hazard (i.e., the probability of selling the mutual fund month t after the buy conditional on no prior sale). 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. The fund type is defined by fund objective, degree of active management (index funds versus actively managed funds) and fund family membership. The specification includes 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, expense ratios charged by the funds at the time of purchase, and changes in expense ratios since the date of purchase (increases and decreases, included into the specification separately). It also includes fund performance since purchase and funds' ranking of recent one-year total returns within its investment objective, already presented in Table III. Standard errors (shown in parentheses) allow for heteroskedasticity as well as correlation across observations of the same household.

	Taxable Accounts	**All Accounts**	
Variable		*Tax-Deferred Accounts*	Interaction w/taxable
Front-end load (fee charged normalized by purchase amount)	–24.0*** (4.0)	–9.1*** (2.6)	–15.0*** (4.8)
Back-end load?	–0.25 (0.15)	0.16 (0.15)	–0.41 (0.27)
Expense Ratio at Time of Purchase	19.8*** (6.6)	19.5*** (7.0)	0.3 (9.6)
Expense Ratio Increased Since Purchase?	105.9*** (29.5)	111.8*** (36.1)	–5.9 (46.7)
Expense Ratio Decreased Since Purchase?	–30.1** (12.6)	–3.6 (12.1)	–26.5 (17.5)
HH-Mutual Fund Type-Specific Baselines?	Yes	Yes	Yes
Performance Controls as in Table III, Panel B?	Yes	Yes	Yes
Number of Observations	2,201,308	4,243,002	

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table VI: 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, 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. CRSP Net Flows are computed from total net assets (TNA) and fund total returns reported by CRSP every quarter, and are normalized by fund assets at the end of the prior quarter. Brokerage sample-based Net Flows, Inflows, and Outflows are computed according to Equation (5) from Section 5—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). Standard errors (shown in parentheses) allow for heteroskedasticity and contemporaneous correlation.

Table VI: Continued

	CRSP Net Flow	Brokerage Sample Net Flow	Brokerage Sample Inflow	Brokerage Sample Outflow
One-Year Total Return	36.6***	38.0***	14.7	–23.3*
	(7.4)	(9.6)	(17.6)	(14.3)
Expense Ratio	5581.6**	1587.4	2963.4**	1376.0*
	(2744.7)	(1073.0)	(1388.3)	(823.8)
Front-end Load	–0.9	56.1	–347.8	–404.0
	(123.6)	(265.0)	(260.4)	(264.4)
Turnover	5.7**	3.7**	5.2**	1.5
	(2.4)	(1.8)	(2.2)	(1.5)
Overhang	–2.3	–0.4	7.0*	7.4**
	(2.6)	(1.5)	(3.7)	(3.7)
Morningstar Rating = 2	1.1	1.7	11.7	10.0
	(3.9)	(6.4)	(9.0)	(6.5)
Morningstar Rating = 3	2.8	8.5	15.3*	6.7
	(4.4)	(6.4)	(8.7)	(6.1)
Morningstar Rating = 4	2.5	13.7**	21.6**	7.9
	(4.8)	(6.7)	(9.1)	(6.3)
Morningstar Rating = 5	6.4**	21.4***	28.5***	7.1
	(3.2)	(7.1)	(9.6)	(6.7)
p-value of test of joint significance of Morningstar ratings	*0.043***	*0.002****	*0.005****	*0.455*
Time (quarter) Fixed Effects	Yes	Yes	Yes	Yes
Objective & Index Fund Fixed Effects	Yes	Yes	Yes	Yes
Mutual Fund-specific Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.084	0.038	0.133	0.187
Number of Observations	8,771	8,771	8,771	8,771

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table VII: 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 (expressed as and other covariates as in Table VI, that is, the expense ratio, front-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. The two measures of fund performance are one-year fund total returns ("Absolute" performance) as in Table VI, 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 "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 (5) from Section 5—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). Panel A focuses on all accounts, whereas Panel B focuses separately on outflows in taxable and tax-deferred accounts. Standard errors (shown in parentheses) allow for heteroskedasticity and contemporaneous correlation.

	Panel A: Net Flow, Inflow, and Outflow in All Accounts			**Panel B: Outflow in Taxable Accounts Only and Tax-Deferred Accounts Only**	
	Net Flow	Inflow	Outflow	Outflow in Taxable Accounts	Outflow in Tax-Deferred Accounts
"Absolute" Performance Only					
One-Year Total Return	38.0***	14.7	–23.3*	–73.4**	14.1***
	(9.6)	(17.6)	(14.3)	(33.7)	(3.9)
Adjusted R^2	0.038	0.133	0.187	0.228	0.214
Number of Observations	8,771	8,771	8,771	7,274	6,745
"Absolute" and "Relative" Performance					
One-Year Total Return	14.6	–8.6	–23.2*	–77.2**	14.5***
	(9.9)	(19.4)	(13.8)	(37.2)	(4.3)
One-Year Rank in Objective	21.0***	20.9***	–0.1	3.6	–0.4
	(4.2)	(5.2)	(3.6)	(5.7)	(1.5)
Adjusted R^2	0.042	0.135	0.187	0.228	0.214
Number of Observations	8,771	8,771	8,771	7,274	6,745

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

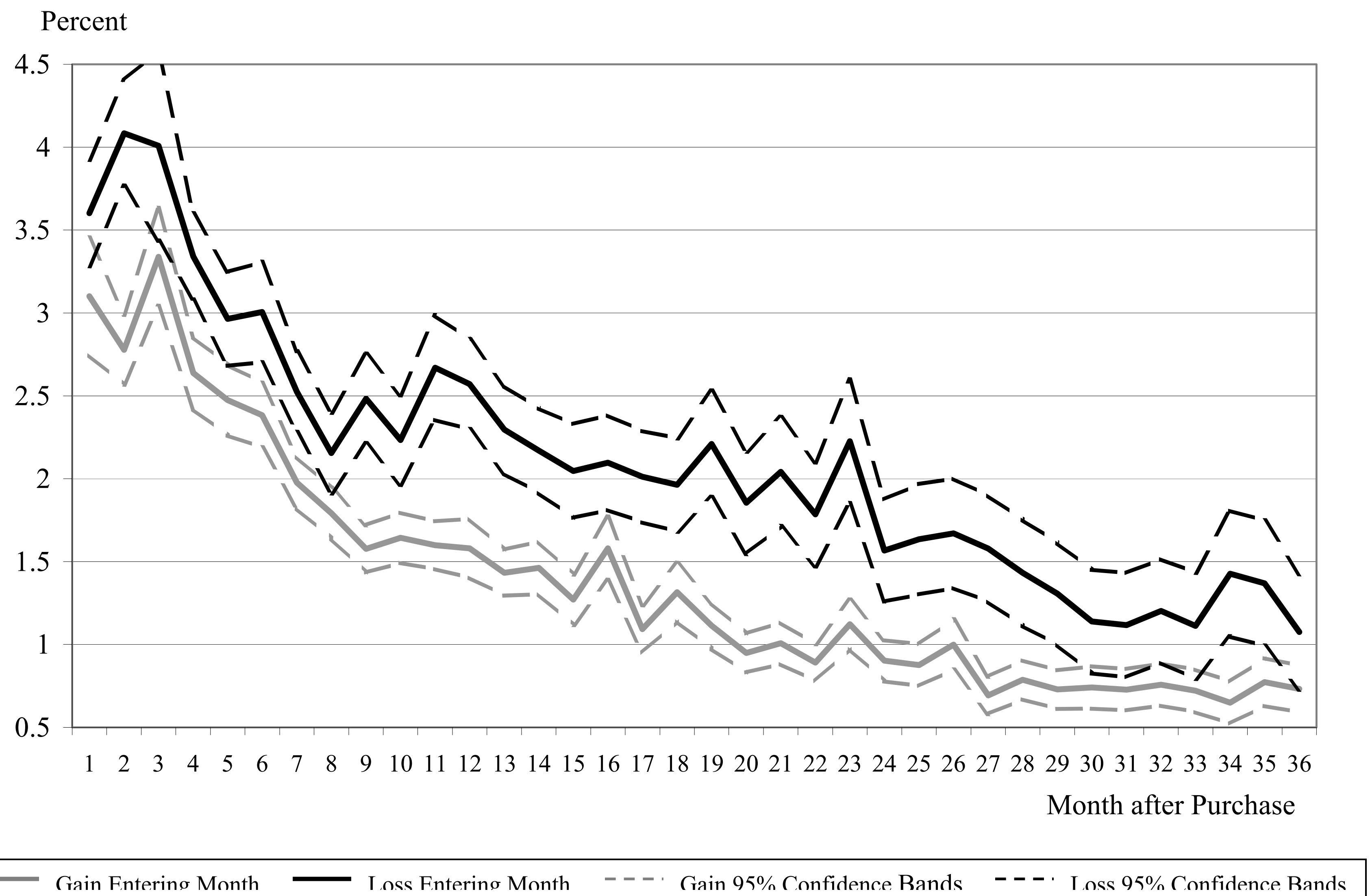

Figure 1: Hazard Rates and the Associated 95% Confidence Intervals of Selling Mutual Funds in Taxable Accounts. The figure displays the hazard rate for mutual fund share purchases conditional on whether the stock has an accrued capital gain (gray line) or loss (black line) entering the month. The figure restricts attention to January fund purchases made in the brokerage sample during the period from 1991 to 1996.

Chart A: Past One-Year Return Coefficients ("Absolute" performance)

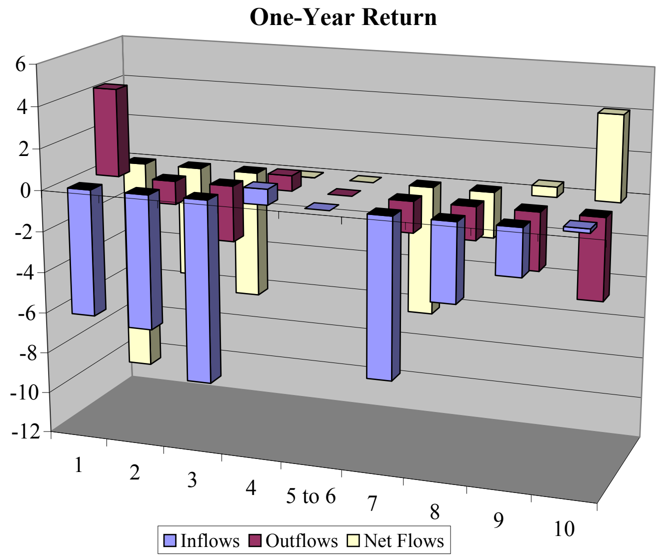

Chart B: Past One-Year Relative Ranking Coefficients ("Relative" performance)

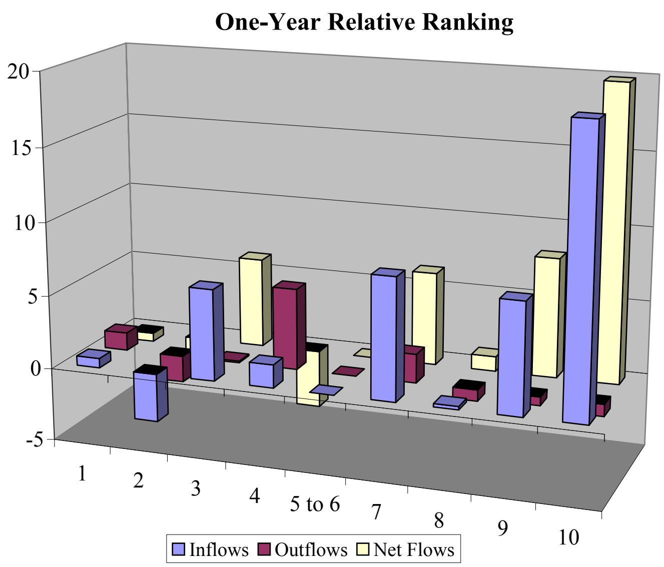

Figure 2: Nonlinear Flow-Performance Relation. The specification, described in detail in Section 5.2, features both measures of "Absolute" performance (Chart A) and measures of "Relative" performance (Chart B). Chart A displays the regression coefficients in the respective regressions for quarterly inflows, outflows, and net flows, each based 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). Chart B displays the regression coefficients in the same respective specification for quarterly inflows, outflows, and net flows, each based 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). The omitted group for each performance measure is the combined 5th and 6th deciles of performance (thus the coefficients reflect the flows in to a certain performance group relative to the 5-6 decile group). Inflows, outflows, and net flows are computed according to Equation (5) from Section 5—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).