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Consumer Interest Rates and Retail Mutual Fund Flows

by Jesus Sierra

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Abstract

This paper documents a link between the real and financial sides of the economy. We find that retail equity mutual fund flows in Canada are negatively related to current and past changes in a component of the prime and 5-year mortgage rates that is uncorrelated with government rates. The effect is present when we control for other determinants of fund flows and is more pronounced for big and old funds. The results suggest that consumers' investments in domestic equity mutual funds take time to respond to changes in interest rates, and that developments in the market for consumer debt may have spillovers into other areas of the financial services industry.

JEL classification: G21, G23
Bank classification: Financial services; Interest rates

Résumé

L'auteur met en évidence un lien entre les sphères réelle et financière de l'économie. Il constate l'existence d'une relation négative entre les flux de placement des particuliers dans les fonds d'actions au Canada et les variations contemporaines et passées d'une composante du taux préférentiel et du taux hypothécaire à cinq ans qui n'est pas corrélée avec les taux des titres d'État. L'effet subsiste lorsqu'on tient compte de l'incidence d'autres déterminants de ces flux et est plus prononcé dans le cas des grands fonds bien établis. Les résultats indiquent que les flux de placement des ménages dans les fonds d'actions canadiennes mettent du temps à réagir aux modifications des taux d'intérêt et que l'évolution du marché du crédit à la consommation peut se répercuter dans d'autres branches du secteur des services financiers.

Classification JEL : G21, G23
Classification de la Banque : Services financiers; Taux d'intérêt

1 Introduction

Mutual funds are one of the most important vehicles through which households invest and save for retirement, either directly as part of their (non-pension) individual registered saving plans, or indirectly, through employer-sponsored pension plans. For example, Statistics Canada reports in its 2005 Survey of Financial Security, that more than half of individual registered saving plan assets were invested in mutual funds and income trusts[1]. In addition, households directly held about 22% of their non-registered financial assets in mutual funds, investment funds and income trusts. Further, households also have exposure to mutual funds through their employer pension plans (EPPs)[2]. In fact, the Investment Funds Institute of Canada estimates that "mutual funds and mutual fund wraps now account for 30% of Canadians' financial wealth"[3]. Therefore, mutual funds are an important component of the asset side in the aggregate household balance sheet.

Given the importance of mutual funds in household's retirement portfolios, as well as the size of the industry and its relative importance as a source of investment capital, the academic literature has devoted significant efforts aimed at understanding the determinants of money flows into mutual funds[4]. In broad terms, academic studies of mutual fund flows can be classified into two groups, depending on whether they analyze flows at the individual fund or aggregate level. The literature that explains individual fund flows has analyzed how fund-specific variables such as age, size, risk, fees and past-performance explain variation in retail flows, controlling for the influence of un-modelled aggregate factors by including category flows; see, for example, [41], [37], [16], [61], [36] and [38]. The literature on aggregate flows, on the other hand, has mainly studied the relation between flows from all investor groups and market returns, often also controlling for the influence of aggregate stock return predictors and business cycle indicators, such as the dividend yield or the benchmark government bond yield ([67], [25], [45], [14]).

Besides fund-specific characteristics, there are other factors that can be expected to influence retail fund flows[5]. Before an investor gets to the stage in which she has to think about her tolerance for risk, learn about different types of funds, gather and evaluate fund specific information or study the past performance of a reduced choice set of prospective funds, she

[1] These include Registered Retirement Savings Plans(RRSPs), Registered Retirement Income Funds (RRIFs), Locked-In Retirement Accounts(LIRAs), and Registered Education Savings Plans (RESPs)

[2] In the first quarter of 2002, 35.2% of total assets in employer pension plans (trusteed pension funds) were invested in bonds, either directly held or via pooled bond funds, while 40.4% of total assets were invested in stocks, either direct or through pooled equity funds (Source: Statistics Canada, Quarterly Estimates of Trusteed Pension Funds, first quarter 2002, pp. 8.). Also, the latest publicly available data, from 1998, shows that the percentage of employer pension plans (EPPs) assets directly invested through pooled vehicles (pooled, mutual and segregated funds) equals 25%. Of this, 30% was in equity funds and 29% was in fixed-income funds (pp. 12)

[3] Source: `https://www.ific.ca/Content/Content.aspx?id=152`

[4] The Investment Funds Institute of Canada estimates that total mutual fund assets under management (AUM) for June 2012 were CAD $796.7 billion (IFIC Industry Overview, June 2012), while the Investment Company Institute estimates the total net assets in the US mutual fund industry at USD 12,171.4 billion (`http://www.ici.org/research/stats/trends/trends_06_12`)

[5] Retail flows represent money coming from households, and excludes flows from institutional investors, such as pension funds, insurance companies and endowments. See [44] for a study of the differences in the response to past-performance between retail and institutional investors.

probably has to have money to invest. In general, only when there are resources in excess of current expenditures, can a person be expected to save for retirement, or speculate for profit, using mutual funds. From this perspective, the overall financial position of a person, both assets and liabilities in her balance sheet, can be expected to influence her willingness or ability to save for retirement. Prominent among the variables that influence household liabilities at the aggregate level are consumer interest rates. In this paper we test whether changes in consumer interest rates affect the flows of money into retail accounts at domestic equity funds in Canada.[6]

We employ data on Canadian domestic equity mutual funds to test whether changes in consumer rates are related to fund flows. We use the prime rate and 5-year mortgage rate, because they can be considered representative of the general cost of funds for mortgage and consumer debt. Given the well known findings in the empirical macro literature that an interest rate shock affects real variables with significant lags, we include several lags of interest rates to allow our empirical model to capture any delayed responses[7]. We regress individual fund flows on fund characteristics, category flows, and changes in orthogonalized consumer rates, defined as the component of changes in consumer rates that is uncorrelated with changes in government rates. We find that, between 1993 and 2007, changes in the orthogonalized prime and 5-year mortgage rate are negatively correlated with the level of future flows, with the effect being stronger for the mortgage rate. The results suggest that developments in the market for consumer debt have spillovers into other areas in the financial services industry.

The present work is most closely related to the study of [59]. Using data on U.S. mutual funds for the period 1973-1985, they find that contemporaneous and 1 lag of the levels of the T-bill and long-term government bond yields have a negative impact on quarterly aggregate-retail flows. Our study differs from theirs along several dimensions. We conduct the analysis at the individual fund level, as in most studies that analyze retail equity flows, which allows comparison of the relative sensitivity of flows to fund-specific or macro factors; we use consumer instead of government rates because we are specifically interested in the effect of changes in the price of consumer debt on household investments; we use the changes in interest rates because we found evidence suggestive of non-stationarity in the levels of the series in our sample period; and we use more lags in the estimation (and find then to be

[6] Interest rates could influence the flow of funds into mutual funds in several ways. For households with variable rate mortgages, decreases in interest rates directly translate into smaller interest payments. For households with fixed rate mortgages close to the reset period, if markets rates are lower now than what they were when the debt was contracted, interest payments will likely be lower from now on, allowing the extra cash to be saved. For households with fixed rate long-maturity debt and free-cash flow, it might be an inefficient use of their personal capital to pre-pay debt when there are alternative investment options that have higher expected returns. Risk-tolerant investors with access to relatively cheap personal lines of credit, perhaps because their home equity increased due to house appreciation, might find it profitable to borrow (home-equity extraction) at low rates and invest in assets that yield higher returns. For example, using data from the Canadian Financial Monitor Survey (CFM) survey, [2] find that between 1999 and 2010, about 34% of home equity extractions were used for financial and non-financial investments. Finally, even if the investor has no debt at all, low real interest rates increase the opportunity cost of keeping money in safe investment alternatives and can induce investors to consider searching for yield in other alternatives.

[7] For example, a delayed response to a decrease in interest rates can come from households that take time to refinance a mortgage. [10] surveys the literature on household finance and presents evidence for the U.S. consistent with the notion that household refinancing of mortgages is sluggish.

significant) since we are interested in exploring whether changes in consumer rates take time to affect household behaviour, much in the same way policy rates have been found to affect real variables with considerable lags ([17], [64], Bank [53]).

Our study is also related to the work of [32]. They extract common factors from the cross-section of individual U.S. fund flows using principal-components, and find that the first factor extracted from the equity fund sector can be explained by the current and lagged values of the rate of inflation, disposable income growth, market volatility, market risk-premium, the BAA-AAA and AAA-T-bill spreads, and the difference between the price-dividend ratio and the yield on the 10-year Treasury bond. The main differences with our paper is that they include both institutional and retail share classes, while we focus on the retail segment as we are interested in consumer debt; they do not use consumer interest rates but benchmark government yields; they use spreads of interest rates with respect to other indicators, while we use changes in the (orthogonalized) rates themselves; and finally, we explore whether more than one lag of interest rates explain flows. Overall, our main contribution is that we present evidence suggestive of an impact of consumer rates on flows over and above changes in government rates, and that part of this impact takes 2 or more quarters to manifest, especially in the case of the mortgage rate.

1.1 Literature review

As mentioned in the introduction, most studies of mutual fund flows can be classified into two groups, depending on whether they analyze flows at an individual fund or aggregate level. Among the papers that study individual fund flows, some of the earlier studies such as [63] and [62] analyzed the relation between performance and growth; subsequent papers, like [68], [41], [37], [16], [61] and [36], have documented the importance of fund-specific characteristics, such as age, size, risk and ranked past-performance in explaining both the level of new money inflows and their sensitivity to past-performance[8] [9]. The present paper complements these studies by documenting that consumer interest rates, which are not fund-specific variables, are important in explaining flows even at the individual-fund level.

In the literature on aggregate flows, researchers study either flows to the whole industry, or to particular categories, such as stock or bond funds. In this area, in general it is found that flows comove with returns and, starting with the seminal work of [67], interest has centered on three possibilities: whether mutual fund investors as a group act like feedback

[8]Some of the other fund-specific variables that have been used to explain the *level* of flows include: volatility and age ([39]); advertising ([43]); components of expense ratios ([3]); "star" performance and affiliation with a family that has produced a "star" fund ([52]); whether the fund is included in a 401k plan ([18]); whether the fund has changed its name to reflect a currently "hot" style ([19]); whether the fund has received a Morningstar rating upgrade or downgrade ([24]); Morningstar star rating, tracking error, the length of manager's track record and whether the fund beat its benchmark ([23]); tax burdens and unrealized capital gains ([5]); holding-period returns and probability of taxable distributions ([42]); level raw returns, 4-factor alphas and tracking error ([44]); whether the flow is a redemption or a purchase ([56], [42]); squared returns ([3], [57]).

[9]Some of the fund-specific variables that have been used to explain the *sensitivity* of flows to past performance include: fees, prior precision and idiosyncratic noise in managerial talent ([6]); strategy changes, proxied by changes in factor loadings or in managers ([51]); size, fees and media-coverage ([61]); investor participation costs ([38]); volatility and age ([39]); illiquidity of fund assets and shareholder composition ([15]); whether the fund is included in a 401k plan ([18]); whether the fund beat its benchmark ([23]).

traders, if there is evidence of price pressure, or whether returns and flows respond to common information ([58], [25], [45]). Newer papers in the area have expanded the list of variables used to explain flows to include indicators such as benchmark interest rates, aggregate savings rates, demographics, or stock return predictors, and have revisited the evidence on the flow-return relationship in the presence of such control variables ([33], [26], [65], [14], [54])[10]. Because the present paper presents evidence that a component of consumer interest rates affects flows, it is also related to the literature that analyzes aggregate flows, since in this area researchers often find that the general level of interest rates affect (aggregate) flows.

One of the most important findings in academic research on mutual fund flows is that, on average, the inflow of new money responds asymmetrically to past performance: while good performance is rewarded with substantial additional inflows, past bad performance seems not to be followed by substantial outflows ([41], [36], [61], [16] and [38]). This means that the flow-performance relationship is convex. Recently, and focusing specifically on the sensitivity of flows to past performance, researchers have documented changes in mutual fund investor behaviour across the business cycle. [30] document that the sensitivity of dollar flows to top performance increased in the post-1998 period. [13] finds that flows respond to past performance in NBER expansions but not in recessions, and in addition, the response of flows to fund risk exposures differs between the two regimes. [66] documents that flows are more responsive to past good performance in periods of positive GDP growth. [55] find that flow sensitivity to past performance depends on the rate of GDP growth, while [48] finds that it is dependent on market volatility and aggregate dispersion in skill and noise in fund performance. [31] find, in a cross-country study, that indicators of economic, financial market and mutual fund industry development affect the sensitivity of flows to past performance. Although the present paper does not study determinants of the sensitivity of flows to past performance, it complements this literature by documenting the influence of consumer interest rates, an aggregate variable, on the level of flows.

Finally, in parallel to the literature focused on U.S. funds, there is a group of papers that analyze Canadian equity mutual funds. For example, [50] finds that survivorship bias affects measured fund performance and persistence; [22] finds that managers on average underperform benchmarks, and that flows respond to contemporaneous and past performance[11]; [21] documents that load funds do not outperform their no-load counterparts; [8] find no evidence of selectivity performance for a sample of 85 equity funds; [60] find that investors do not chase winners and instead actively withdraw money from poorly performing funds; [49] finds evidence of an asymmetric flow-performance relationship. This paper extends previous work on the Canadian fund industry by studying the influence of macroeconomic indicators on retail flows to Canadian equity funds.

The rest of the paper proceeds as follows. In section 2 we present our data sources. In section 3, we explain the construction of the variables used in the study. In section 4 we discuss the main results and present some robustness checks, and section 5 concludes. In the appendix, we provide some additional robustness checks on the main regressions.

[10]Other studies in this area that study flows at different frequencies, for subgroups of funds or investors, using different datasets or different countries include [4], [7], [11], [40]. [29] and [46] study the components of aggregate flows (new sales, redemptions, exchanges-in and exchanges-out).

[11]He also notes that the impact of performance on flows is greater in the 1994-1998 period, compared to 1989-1993.

2 Data

2.1 Mutual fund sample

The main hypothesis we test is that changes in consumer interest rates affect flows, possibly with a lag. To do this, we obtain data on Canadian-domiciled equity mutual funds from Morningstar Inc. The sample covers funds domiciled in Canada for the period 1993-2007. We collect monthly data on returns[12] and assets under management, and qualitative information such as inception date, category affiliation, as well as data on mergers and liquidations. We follow most of the academic literature that studies fund flows, and restrict our sample to actively managed domestic equity funds. Because of this, we exclude index funds and ETF's and only consider funds in the following categories: Canadian Dividend and Income Equity, Canadian Equity, Canadian Focused Equity, Canadian Focused Small/Mid Cap Equity, and Canadian Small/Mid Cap Equity. In addition, as in other studies, we focus on the retail segment of the market and exclude institutional funds and institutional share classes[13]. Also, since their flow data is noisy and as a way to mitigate incubation bias ([27], [28]) we discard small funds, defined as those that never reach CAD 5 million in net assets during their whole lifetime.

2.1.1 Data limitations

In addition to monthly return and net asset data, we obtain information on management expense ratios (MER's) from Fundata Canada Inc., for the period January 2000-April 2012. In our main tests, we do not control for the level of fees because this would have forced us to discard 42% of the available time periods, although in Appendix A.2 we present results that show that this does not change our main findings[14]. Also, our sample is not completely free from survivorship-bias, as we only have data on mergers and liquidations starting in 2006. Survivorship-bias is of special interest in studies that measure average fund risk-adjusted performance or the sensitivity of flows to past-performance, neither of which is the main focus of the present paper. Nevertheless, we re-estimated the main flow-performance model for our Canadian sample for the 2006-2010 period in which we do have information on fund termination, and the conclusions about sensitivity to past performance for different age groups do not change. This analysis is presented in Appendix A.1.

We conduct the analysis at the fund level, value-weighting the returns and adding the net assets across all (non-institutional) share classes.

[12]The return data is net of expenses, but does not account for fees, such as front or back-end loads.

[13]The former are defined as those that either are flagged by Morningstar as institutional or that include in their name the word "institutional" or "inst", etc; the latter are identified by excluding share classes with a minimum initial purchase of 100,000 CAD or more.

[14]Since the main interest of the paper is to study the effect of interest rates on flows over time, and macro variables do not vary across funds but only over time, we need as many quarterly observations as possible to be able to estimate an effect with some precision.

2.1.2 Descriptive statistics

Table 1 presents descriptive statistics. The average fund size increased from CAD 330 million in 1995 to about 540 million in 2000, and then decreased in the following 3 years to a level close to 400 million at the end of 2003; by the end of 2007, the size of the average fund had again increased to CAD 544 million, close to the level it had in 2000. The average fund age has been steadily decreasing since 1995, going from 13.8 years to 10 years in 2007; this reflects new fund offerings in the market. The 12-month standard deviation of returns has been on average 3.5%, or 12.09% in annualized terms, having its highest value around 2000 (4.26%) and lowest in December 2005 (2.58%). Also, between 2000 and 20007, the expense ratios have been on average 2.27% with a standard deviation of 0.59[15]. To get a sense of the coverage, in Panel B we compare the assets under management in our domestic equity fund sample to the total reported by the Investment Funds Institute of Canada (IFIC), at December of each year, for the 1995-2007 period[16]. Our data set covers between 66 and 80% of the total net assets under management reported by IFIC, with an average coverage of 72%. Notice that this comparison includes index funds and ETF's for both sources.

2.2 Risk-factors

To calculate risk-adjusted performance, we use monthly data on market, size, book-to-market and momentum factors from [34]. The data covers the period January 1991-December 2009 and is calculated using information on Canadian companies only[17].

3 Variable definitions

In this section, we explain the construction of the main variables used in the study.

3.1 Individual fund flows

The construction of our measure of individual fund flows follows [61]. Specifically, let tna_t^i denote total net assets of fund i at the end of quarter t, and R_t^i the return of the fund in quarter t[18]. Then, we define the percentage growth rate in new money under management as

$$\mathrm{flow}_t^i = (\mathrm{tna}_t^i/\mathrm{tna}_{t-1}^i) - (1 + \mathrm{R}_t^i). \tag{1}$$

This measure assumes that new money inflows occur at the end of the quarter. To mitigate the effect of outliers, we winsorize flows at the right tail of the distribution at the

[15]Thus, the point estimate of average Total Expense Ratios reported by [47] is contained within a 68% confidence interval of our sample mean MER.

[16]The data is from the 'Overview Reports by Month in New Asset Classes", available at `http://statistics.ific.ca/English/Reports/MonthlyStatistics.asp`. Notice that these figures include index funds and institutional share classes, so the totals reported for our sample include them as well.

[17]The data is available at: `http://expertise.hec.ca/professorship_information_financiere_strategique/`. We thank Profr. Claude Francoeur at HEC Montréal for making the data on Canadian market, size, book-to-market and momentum factors publicly available.

[18]Net of expenses and fees. This is also known as the "investor return".

95% level. There are two reasons why we winsorize only on one tail. The first is that manual inspection of percentage flows showed that there were many more extreme observations of positive growth rates than negative ones. The second is that, since our data set is survivorship biased for most of our sample[19], by allowing for the presence of more extreme negative flows, we attempt to compensate for the missing information. However, we calculated all the results using symmetric cut-off values and the main results do not change if we winsorize on both tails of the distribution[20]. In addition, to further explore whether survivorship-bias induces any changes to our results, in Appendix A.1 we re-estimated the main flow-performance regression for the 2006-2010 period, in which we have data on fund liquidations. As can be seen there, the main results in the text are not altered.

3.2 Category flows

Given our sample selection criteria, we have data on 5 domestic equity fund categories. In analyzing individual fund flows, we control for flows to the category that are not necessarily related to any particular fund. We construct this variable, catflow_t^i, as the growth rate in new money for the category to which fund i belongs, using (1) but replacing tna_t^i with the sum of total net assets across all funds in a given category, and R_t^i with the value-weighted return of all such funds.

Category flows, in principle, could capture the effect of aggregate variables like changes in interest rates, which we are interested in, but will include other factors such as growth in disposable income, popularity of tax-advantaged retirement accounts, availability of personal lines of credit (quantities) or shifts in sentiment to a particular sector (i.e. small stocks)[21], which we are not interested in. Since in this paper we are particularly interested in testing whether changes in interest rates influence fund flows but at the same time would like to control for the influence of other non-interest rate macro factors, we include both category flows and interest rates in the model.

3.3 Relative performance

Performance is measured relative to other funds in the same category, in line with the literature that treats fund competition for new money as a tournament in which what matters is the relative position and not the absolute level of returns[22]. Specifically, every quarter funds are ranked based on a given measure of performance and assigned a ranking, rank_t^i, between 0 (worst performer) and 1(best performer). Then, we estimate the relationship between flows and past ranking. The measures of performance employed are:

[19] We only observe data on mergers and liquidations starting in 2006.

[20] Although the main focus of the paper is not on the sensitivity of flows to past performance, we report that when we re-estimate the main panel regressions using symmetric cut-off values on both tails at the 5 and 95% percent levels, respectively, the sensitivity of flows to performance at the bottom performance quintile decreases, as expected, but it is never the case (across different performance measure) that it becomes zero or statistically significantly smaller than the sensitivity at the medium or higher performance quintiles. Thus, the data does not suggest considerable convexity in the flow-performance relationship in our sample, when data on funds from all age groups are included together.

[21] [35] associate mutual fund flows with investor sentiment for particular stocks.

[22] See, for example, [9] and [61].

1. Category-adjusted excess returns $\mathrm{R}_t^{e,i}$: the fund's return minus the value-weighted return of all funds that belong to the same category.

2. Risk-adjusted returns according to the [12] 4-factor model, estimated as the intercept α^{c4f} in the time-series regression of fund excess-returns on the market, size, book-to-market and momentum factor-mimicking excess returns:

$$\mathrm{R}_t^i - \mathrm{R}_t^f = \alpha_{i,t}^{\mathrm{c4f}} + \beta^{\mathrm{mkt}}(\mathrm{R}_t^m - \mathrm{R}_t^f) + \beta^{\mathrm{smb}} SMB_t + \beta^{\mathrm{hml}} HML_t + \beta^{\mathrm{mom}} MOM_t + \epsilon_t^i. \quad (2)$$

For the 4-factor model alphas, the intercepts are estimated using a rolling-window of 24 months of observations ending in month t. As mentioned before, the factor data is from [34].

3.4 Risk

We measure the riskiness of the fund using the historical standard deviation of returns, as in [16] and [61]. It is calculated as the 12 month standard deviation of returns of the fund, sampled at the last month of each quarter, and denoted stdev_t^i.

3.5 Consumer interest rates

As explained in the introduction, the main goal of the paper is to explore how changes in consumer interest rates might influence a household's ability or willingness to invest or save for retirement using mutual funds. Since the two main sources of household debt are broadly categorized as mortgage and consumer credit ([20], [2]), we use interest rates that can be considered representative of the general cost of both types of debt. To this end, we use the (consumer) prime rate, which will be denoted as prime_t, and the chartered bank conventional mortgage 5-year rate, which will be denoted as $\mathrm{mtg5y}_t$. Both series are obtained from Datastream and are quarter-end values. Also, as mentioned in the introduction, we use changes in the rates instead of the levels, since the tests presented in Table 2 in general do not reject the null hypothesis of a unit-root in the levels of the series for different assumed values of the autoregressive order.

3.5.1 Orthogonolization

Since consumer rates contain a component that depends on the general level of benchmark government rates, it is conceivable that a correlation between rates and flows could be driven by asset-allocation effects or response to new information, instead of disposable income reasons. For example, it is possible that when the yield of fixed-income assets increases, (attentive) consumers substitute stock mutual funds for bond mutual funds, or that when interest rates increase, investors holding bond mutual funds suffer losses that might induce them to buy instead stock mutual funds. Alternatively, a low level of the short-term rate relative to the long rate might predict higher expected stock returns in the future and thus bring about inflows into stock funds today. In order to better capture the effect on mutual fund flows of a change in the price of consumer debt, instead of the quarterly changes in consumer rates, we use the residuals from regressions of changes in consumer rates on changes in benchmark government rates and refer to these as orthogonalized rates. Specifically, the orthogonalized prime rate, Δprime^*_t, is calculated as residual from a regression of the quarterly change in the prime rate on the change in the 3-month Treasury Bill rate Δtb3m_t,

$$\Delta\text{prime}_t = \alpha + \beta\Delta\text{tb3m}_t + \Delta\text{prime}^*_t,$$

while the orthogonalized mortgage rate, Δmtg5y^*_t, is calculated as residual from a regression of the quarterly change in the 5-year mortgage rate on the change in the 5-year benchmark government rate Δtb5yr_t:

$$\Delta\text{mtg5y}_t = \alpha + \beta\Delta\text{tb5yr}_t + \Delta\text{mtg5y}^*_t.$$

Both the T-Bill and 5-year government rates are also obtained from Datastream and are quarter-end values.

Table 2 presents descriptive statistics, unit-root tests and correlations at different lags for the interest rates used in the paper. It shows that the orthogonalized rates are mean zero variables with about half of the standard deviation of the original changes, and with almost no persistence. In Panel B, it can be seen that for most lags up to 4 years (16 quarters), the null hypothesis of a unit-root is not rejected for the level of the prime and mortgage rate. Finally, in Panel C, it can be seen that correlations at different lags of the orthogonalized rates are not high, with the highest being for the orthogonalized prime rate with itself at lags 2 and 3; in particular, none of the cross-correlations between the orthogonalized prime and mortgage rate is higher than 0.39. Therefore, the statistics suggest that multicollinearity of the interest rate variables is not a serious concern in estimation.

4 Empirical results

In this section we present the results of estimating two empirical models that explain the flow of new money to retail accounts at domestic equity mutual funds domiciled in Canada. First, we briefly describe the results of a baseline specification in which percentage flows are explained by fund characteristics. Then, we present the main results of the paper, in which the baseline specification is augmented to include current and past changes in interest rates.

4.1 The relationship between flows, characteristics and past performance

We consider a specification that includes variables used in [61] and [16] to study how fund percentage new money growth rates vary as a function of fund characteristics and relative performance. The independent variable is the net new money, flow^i_t. As fund characteristics, we use: one lag of flows, flow^i_{t-1}, to account for delayed responses to past determinants[23]; the log of fund size, $\log(\text{size}^i_{t-1})$, to control for the fact that an additional dollar of flows has a higher impact on smaller funds; category flow, catflow^i_t, to control for flows related to aggregate shifts to a particular category or in response to common factors; log age (in years), $\log(\text{age})^i_{t-1}$, to account for the fact that older funds are likely bigger, and thus any new

[23]Persistence in flows can arise, for example, from monthly, fixed amount contributions to tax-favored retirement accounts.

money will have a smaller impact on percentage growth; past return volatility, stdev^i_{t-1}, is included to control for risk, as we expect that an increase in it might influence some investors to redeem; the current quarter's fund excess-return, $\text{R}^{e,i}_t$, is included to control for flows that respond to the *current* quarter's return.

As a measure of relative performance, we include the fund's ranking but in a way that allows to capture the asymmetric response of flows to past performance that has been documented in previous studies for the U.S. Specifically, we follow [61] and estimate 5 and 3-segment piecewise-linear functions on measures of the fractional performance rank $q^i_{k,t}$, defined as $q^i_{k,t} = \min(0.2, \text{rank}^i_t - k_j)$, $j \in \{0, 1, 2, 3, 4, 5\}$ and where the knots k_j are the quintile breakpoints $\{0, 0.2, 0.4, 0.6, 0.8\}$; when 3 segments are used, we group together the three middle quintiles and construct its correspondent measure of fractional performance, $q^i_{mid,t}$, as $q^i_{mid,t} = \min(0.6, \text{rank}^i_t - 0.02)$. Thus, the coefficients on the $q^i_{k,t}$ allows us to examine whether flows responds differently to different levels of relative/ranked performance.

Collect the fund characteristics in the $6x1$ vector controls^i_t, and the measures of fractional performance ranking $q^i_{k,t-1}$ in the $5x1$ vector perf^i_{t-1}. Then, the empirical model we estimate is:

$$\text{flow}^i_t = \quad \rho\text{flow}^i_{t-1} + \alpha'\text{controls}^i_t + \beta'\text{perf}^i_{t-1} + (\text{fixed effects}) + \epsilon^i_t. \tag{3}$$

The model is estimated as an unbalanced panel, sampling the observations at a quarterly frequency, and including fund fixed-effects as well as quarter and year dummies. We calculate within-group standard errors following [1].

4.1.1 Results

Table 3 presents results of estimating model (3). The regressions are run for a different measure of performance: in Panel A, we present results when performance is gauged using category-adjusted excess returns, while in Panel B, we use [12] 4-factor model alphas. Also, we divide the sample in two age groups, and estimate the model separately for each, as well as for all funds together. The aggregate results for all funds are included in columns (2), (3), (8) and (9). The results for "young" funds, defined as those having an age of 3 years or less[24] are presented in columns (4), (5), (10) and (11); while those for "old" funds, with more than 3 years since inception, are presented in columns (6), (7), (12) and (13). The analysis by age group is done to explore whether the sensitivity of flows to past performance depends on the age of the fund; [16] find that this is the case for U.S. equity funds. This makes sense since young funds have a much smaller track record from which investors can infer the true skill of the manager, and we might expect that each additional return observation is important in updating investor's prior beliefs about managerial skill. Since the results across performance measures are similar, in our discussion we mainly focus mainly on the results for category-adjusted returns, and note the difference, if any, when the regressions using 4-factor alphas given a different answer.

Among the fund characteristics used to explain flows, we find that for all funds there is persistence in flows, but this is mainly confined to old funds; for young funds, we find that the coefficient on its lagged growth rate is close to 0 and not significant. The log-size of the fund

[24] Age is defined as years since the inception date.

exerts a negative influence on percentage flows, and the effect seems to be more pronounced for small funds. When there is an aggregate shift towards a particular category, the data suggest that young funds seem to benefit proportionately more than old funds, although the effect is not precisely estimated for the case of 4-factor alphas. Age has a negative influence on flows for all funds, although it is not significant for each group individually. The individual volatility of past returns has the expected negative sign, but does not seem to have a significant influence on flows. In addition, consumers seem to strongly react to recent performance $\mathrm{R}^{e,i}$, although the effect is mainly confined to old funds.

A key finding in the literature on fund flows in the U.S. is that the inflow of new money responds asymmetrically to past performance: while good performance is rewarded with substantial additional inflows, past bad performance seems not to be followed by substantial outflows ([41], [16], [61], [36]). In Table 3, we see that the coefficients on fractional performance ranking suggest that flows strongly respond to past performance, but the results are different for specific age groups. When all funds are grouped together, we see considerable sensitivity to bad performance at the first (bottom) quintile, response to middle performance at the third quintile, but no pronounced sensitivity to top performance: this is true whenever we use a 5 or 3 segment specification. However, when we look at the results for young funds in Panel A, we find no sensitivity at the bottom two quintiles, a response to movements in rank in the third performance quintile, and a stronger response to top performance; for 4-factor alphas, flows respond to performance in the bottom and second quintiles, with opposite signs, and there is again a significant response to top performance. Thus, flows respond to top performance but for young funds, which is similar to the findings in [16]. When we group the three middle quintiles, we find the familiar convex shape of the flow-performance relationship for young funds ([16], [61]): the sensitivity of flows to past performance increases with ranking, being strongly convex for the case of 4-factor alphas[25], and slightly less convex for the case of category-adjusted excess returns. On the other hand, for old funds, there is a response to bad and middle performance, with no pronounced reward for being a top performer. Thus, the main takeaway from this exercise is that sensitivity to past top performance is confined to the young fund sample.[26]

We have seen that even in our survivorship-biased sample, there is considerable sensitivity in the worst performance quintile. As mentioned in section 3, we also explored whether the main conclusions with respect to the sensitivity of flows to past performance change when we include data on fund termination. For the period 2006-2012, we have data on mergers and liquidations, and can test whether the conclusions about such sensitivity across groups is in fact explained by not having observations on fund termination. In the Appendix, we re-estimate the main flow-performance regressions for the above mentioned sub-period and, as can be seen in Table A.1, the main finding that sensitivity to top performance is more pronounced in the young fund subgroup is not changed.

Overall, the results suggest that fund characteristics explain important *differences* in

[25]Although the absence of sensitivity to middle performance is an artifact of grouping quintiles with different coefficients: -0.169 at quintile 2, 0.115 at quintile 3, and -0.004 at quintile 4.

[26][16] find that the flow-performance relationship for young funds is more convex than that for old funds. One caveat to the findings in the present paper is that if our fund size filter does not completely eliminate incubation bias ([27]), then the flows that we observe could be driven by families pouring more money into young funds that do well, and not necessarily by consumer's chasing past returns.

flows across funds. In the next section, we turn to regressions that explain the level flows with characteristics and interest rates. Since our goal is not to study the response of flows to different levels of past-performance, we will employ a parsimonious specification similar to equation (3) but in which instead of the fractional performance ranking quintile variables $q^i_{k,t-1}$, we include the ranking rank^i_{t-1} as additional control variable. In this way, we control for the influence of past-performance but estimate less parameters.

4.2 Individual fund percentage flows and interest rates

In this section, we study how retail flows react to changes in consumer interest rates. Since in empirical studies of the dynamic relationship between short-term policy interest rates and the real economy it is generally found that interest rates affect real variables with a lag, we explore whether a similar logic applies here. As we are interested in a possible delayed response in which current and possibly past values of interest rate changes affect flows, we include contemporaneous and lagged terms of changes in interest rates. The model we estimate is:

$$\text{flow}^i_t = \rho\text{flow}^i_{t-1} + \alpha'\text{controls}^i_t + \gamma\text{rank}^i_{t-1} + \sum_{k=0}^{4} \beta'_k x_{t-k} + (\text{fixed effects}) + \epsilon^i_t, \quad (4)$$

In (4), the vector x_t includes the category flow catflow^i_t, the orthogonalized change in the prime rate Δprime^*_t and the orthogonalized change in the 5-year mortgage rate Δmtg5y^*_t: $\text{x}_t = (\text{catflow}^i_t, \Delta\text{prime}^*_t, \Delta\text{mtg5y}^*_t)'$. We include 4 lags of x_t.[27] Notice that category flows are included for every lag in which interest rates appear. Thus, any estimated effect of the orthogonalized rates is independent of other macroeconomic forces that might in addition influence flows and that are in principle included in catflow^i_t.

4.2.1 Results

Table 4 presents the results of relating interest rates to fund flows. We first regress flows on interest rates alone to see of there is an unconditional association between the two, and then we augment the panel regressions in the last section with interest rates to see if there is an association after controlling for other known drivers of flows.

Columns (2) to (4) of Table 4 present regressions in which contemporaneous flows are explained by lagged flows and interest rates with no additional control variables. In column (2), the coefficient estimates show that contemporaneous and lagged changes in the orthogonalized prime rate are negatively related to individual fund percentage flows: the estimates imply that a one standard deviation increase in the orthogonalized prime rate (roughly 33 bps) brings about an accumulated outflow of about 1.52% from the average equity fund after 1 year.[28] In column (3), instead of the prime rate, the change in the orthogonalized 5-year mortgage rate is used to explain flows and in this case, coefficient estimates are again negative and significant, but bigger in magnitude and significant at all lags. The estimates

[27] In unreported results available upon request, we also estimated a model including 8 lags (2 years) of x_{t-k}. We found that only lag 7 of category flows was significant, and that as in the results presented in the paper, only terms up to lag 4 were significant for the 5-year mortgage rate.

[28] (-0.020-0.017-0.017+0+0.008)*(0.33) = -0.0152. We assume that non-significant coefficients are equal to zero.

imply that a one standard deviation increase in the orthogonalized mortgage rate (roughly 29 bps) brings about an accumulated outflow of about 4.35% after a year. Then, in column (4), when both rates are included in the regression, we see that all lags of the prime lose statistical significance, while those of the mortgage rate remain negative and significant, although with somewhat smaller magnitudes. The estimates indicate that the prime rate affects flows contemporaneously, while the mortgage rate affects them with a lag. Therefore, the evidence discussed so far suggests that the bivariate, unconditional association between orthogonalized rates and flows is negative, and stronger for the mortgage rate.

In columns (5) to (7) we examine whether the negative association between interest rates and flows remains after we control for other determinants in addition to interest rates, e.g. the control variables from the regressions in Table 3. In column (5), when only contemporaneous and lagged changes in the prime rate are used, the results suggest that flows are still negatively correlated with changes in the orthogonalized prime rate that occurred up to 6 months in the past. In column (6), we again find that all terms on the orthogonalized mortgage rate are highly significant and negative. Finally, in column (7) when the regression includes both the prime and mortgage rates together with the control variables, we obtain a similar conclusion as in the case of column (4): the orthogonalized prime rate is negatively correlated with contemporaneous flows, while the orthogonalized mortgage rate seems to negatively affect flows with at least a 3-month lag. And, as in columns (4) and (6), the negative correlation between the past changes in the mortgage rate and flows seems to be present for all lags up to 12 months. Overall, the results from the panel regressions, both when rates are included alone or in the presence of other control variables, suggest that increases in consumer rates predict outflows from domestic equity funds in the retail segment of the market.

4.2.2 Additional robustness checks

As explained in the introduction, we do not have data on fees for our whole sample. As in the case of fund liquidations, we also explored whether the main conclusions with respect to the impact of rates on flows change when we include data on fund fees. For the period 2000-2007, we have data on manager and operational expense ratios (MER), and can test whether the conclusions about the correlation between rates and flows is altered by the inclusion of fees. In the Appendix, we re-estimate model (4) including data on fees and as can be seen in Table A.2, the main conclusions are not changed.

We also estimated the main regressions dividing the sample of funds by age and size. With respect to age, it is of interest to see if the results are mainly driven by small fund's flows being more sensitive to disposable income changes, much in the same way they seem to be more sensitive to past good performance than old funds. In Table 5 we present the results of estimating several empirical models for young and old funds separately. As before, young funds are those with less than 3 years since inception, while old funds are those that have been alive for more than 3 years. The results suggest that the negative effect of the prime rate on flows is confined mainly to the old fund subsample, and as before, is stronger contemporaneously. On the other hand, the impact of the mortgage rate is stronger for old funds, although is negative and significant in some cases for young funds. Therefore, we find that the sensitivity of flows to interest rates is stronger for the old fund sub-sample.

A related robustness check on our main results is to estimate the panel regressions for different size groups. The rationale for this is that since our category flows variable is constructed using the value-weighted return for all funds in the category, it is possible that it mainly captures the flows to big funds, and hence that the impact of interest rates on flows that we measure is confined to the small fund subgroup. In Table 6 we present the results of estimating several empirical models for small and big funds separately. Small funds are defined as those with assets under management in $t-1$ of less than CAD 118 million, which is the median size in our sample; big funds are defined as those with total net assets greater than 118 million. As can be seen in the table, the results suggest that while the impact of the prime rate seems to be roughly the same for both size groups, the negative influence of the orthogonalized mortgage rate on flows is stronger in the big fund sample. As before, the prime rate seems to affect flows contemporaneously, while the mortgage rate takes several quarters to affect flows; in particular, flows to big funds are the most sensitive to past changes in the orthogonalized mortgage rate. Hence, we conclude that small and young funds are not the ones most sensitive to consumer interest rate changes.

4.2.3 Managerial risk-taking incentives

A related hypothesis which is also of interest, is whether interest rates affect the *sensitivity* of flows to past performance. The importance of this possibility lies in the well known finding that on average the flow-performance relationship is convex and thus, together with the fact that managerial compensation is a function of the level of assets under management, gives managers an incentive to alter the risk of their portfolio in order to gain more assets and increase compensation. In unreported results which are available upon request, we tested whether the sensitivity of flows to past performance changes with interest rates and did not find strong evidence. Thus, our results suggest that interest rates lead to changes in the level of flows irrespective of past performance. This is consistent with the evidence presented so far that it is flows to old, big funds the ones most responsive to consumer rate changes.

5 Conclusions

This paper has presented evidence that suggests that interest rates related to consumers and households, such as the prime rate or the 5-year mortgage rate, negatively affect the flow of funds to retail equity mutual funds in Canada. We find that contemporaneous and lagged changes in these rates predict outflows from equity funds, with the prime rate exerting mainly a contemporaneous negative effect while the influence of the mortgage rate takes several months to affect flows. The results suggest that consumer's investments in domestic equity mutual funds take time to respond to changes in interest rates, and that developments in the market for consumer debt may have spillovers into other areas of the financial services industry.

References

[1] Arellano, M. (1987). Computing robust standard errors for within-group estimators. *Oxford Bulletin of Economics and Statistics*, (49):431–434.

[2] Bailliu, J., Kartashova, K., and Meh, C. (2011). Household borrowing and spending in canada. *Bank of Canada Review*, Winter 2011-2012.

[3] Barber, B. M., Odean, T., and Zheng, L. (2005). Out of sight, out of mind: The effects of expenses on mutual fund flows. *The Journal of Business*, 78(6):2095–2120.

[4] Ben-Rephael, A., Kandel, S., and Wohl, A. (2011). The price pressure of aggregate mutual fund flows. *Journal of Financial and Quantitative Analysis*, 46(2):585–603.

[5] Bergstresser, D. and Poterba, J. (2002). Do after-tax returns affect mutualfund inflows? *Journal of Financial Economics*, 63(3).

[6] Berk, J. B. and Green, R. C. (2004). Mutual fund flows and performance in rational markets. *Journal of Political Economy*, 112(6):1269–1295.

[7] Boyer, B. and Zheng, L. (2009). Investor flows and stock market returns. *Journal of Empirical Finance*, 16(1):87–100.

[8] Bridger, J. and Cyr, D. (2006). Selectivity performance of canadian equity mutual fund managers conditional on sector and asset class holdings. Working paper, Faculty of Business, Brock University.

[9] Brown, K. C., Harlow, W., and Starks, L. T. (1996). Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry. *The Journal of Finance*, LI(1):85–110.

[10] Campbell, J. Y. (2006). Household finance. *The Journal of Finance*, 61(4):1553–1604.

[11] Cao, C., Chang, E., and Wang, Y. (2008). An empirical analysis of the dynamic relationship between mutual fund flow and market return volatility. *Journal of Banking and Finance*, 32(10):2111–2123.

[12] Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance*, 52(1):57–82.

[13] Cederburg, S. (2008). Mutual fund investor behavior across the business cycle mutual fund investor behavior across the business cycle mutual fund investor behavior across the business cycle. Working Paper.

[14] Chalmers, J., Kaul, A., and Phillips, B. (2009). Aggregate mutual fund flows: The role of economic conditions and flight-to-quality. *Working paper*, pages 1–43.

[15] Chen, Q., Goldstein, I., and Jiang, W. (20120). Payoff complementarities and financial fragility: Evidence from mutual fund flows. *Journal of Financial Economics*, 97(2):239–262.

[16] Chevalier, J. and Ellison, G. (1997). Risk taking by mutual funds as a response to incentives. *Journal of Political Economy*, 105(6):1167–1200.

[17] Christiano, L., Eichembaum, M., and Evans, C. (1999). *Monetary Policy shocks: what have we learned and to what end ?* Handbook of Macroeconomics. North Holland.

[18] Cohen, L. and Schmidt, B. (2009). Attracting flows by attracting big clients. *The Journal of Finance*, 64(5):2125–2151.

[19] Cooper, M. J., Gulen, H., and Rau, P. R. (2005). Changing names with style: Mutual fund name changes and their effects on fund flows. *The Journal of Finance*, 60(6):2825–2858.

[20] Crawford, A. and Faruqui, U. (2011). What explains trends in household debt in canada? *Bank of Canada Review*, Winter 2011-2012.

[21] Deaves, R. (2003). The comparative performance of load and no-load funds in canada. Working paper, DeGroote School of Business, McMaster University.

[22] Deaves, R. (2004). Data-conditioning biases, performance, persistence and flows: The case of canadian equity funds. *Journal of Banking and Finance*, 28(3):673 – 694.

[23] DelGuercio, D. and Tkac, P. A. (2002). The determinants of the flow of funds of managed portfolios: Mutual funds vs. pension funds. *The Journal of Financial and Quantitative Analysis*, 37(4):523–557.

[24] DelGuercio, D. and Tkac, P. A. (2008). Star power: The effect of monrningstar ratings on mutual fund flow. *The Journal of Financial and Quantitative Analysis*, 43(4):907–936.

[25] Edelen, R. M. and Warner, J. B. (2001). Aggregate price effects of institutional trading: a study of mutual fund flow and market returns. *Journal of Financial Economics*, 59(2):195–220.

[26] Edwards, F. R. and Zhang, X. (1998). Mutual funds and stock and bond market stability. *Journal of Financial Services Research*, 13(3):257–282.

[27] Evans, R. B. (2010). Mutual fund incubation. *The Journal of Finance*, 65(4):170–180.

[28] Fama, E. and French, K. (2010). Luck versus skill in the cross-section of mutual fund returns. *The Journal of Finance*, LXV(5):1915–1947.

[29] Fant, L. (1999). Investment behavior of mutual fund shareholders: the evidence from aggregate fund flows. *Journal of Financial Markets*, 2(4):391–402.

[30] Fant, L. and O'neal, E. (2000). Temporal changes in the determinants of mutual fund flows. *Journal of Financial Research*, 23(3):353–371.

[31] Ferreira, M. A., Keswani, A., Miguel, A. F., and Ramos, S. B. (2012). The flow-performance relationship around the world. *Journal of Banking and Finance*, 36(6):1759–1780.

[32] Ferson, W. and Kim, M. S. (2011). The factor structure of mutual fund flows. Technical report, USC and University of New South Wales.

[33] Ferson, W. and Warther, V. A. (1996). Evaluating fund performance in a dynamic market. *Financial Analysts Journal*, 52(6):20–28.

[34] Francoeur, C. (2012). Cga professorship in strategic financial information, hec montreal.

[35] Frazzini, A. and Lamont, O. A. (2008). Dumb money: Mutual fund flows and the cross-section of stock returns. *Journal of Financial Economics*, 88(2):299–322.

[36] Goetzmann, W. N. and Peles, N. (1997). Cognitive dissonance and mutual fund investors. *The Journal of Financial Research*, 20(2):145–158.

[37] Gruber, M. J. (1996). Another puzzle: The growth in actively managed mutual funds. *The Journal of Finance*, 51(3):783–810.

[38] Huang, J., Wei, K., and Yan, H. (2007). Participation costs and the sensitivity of fund flows to past performance. *The Journal of Finance*, 62(3):1273–1311.

[39] Huang, J., Wei, K., and Yan, H. (2012). Investor learning and mutual fund flows. *Working paper*, pages 1–26.

[40] Humphrey, J. E., Benson, K. L., and Brailsford, T. J. (2008). Determinants of aggregate flow in the retail funds market. University of Queensland Business School Working Paper.

[41] Ippolito, R. A. (1992). Consumer reaction to measures of poor quality: evidence from the mutual fund industry. *Journal of Law and Economics*, 35:45–70.

[42] Ivković, Z. and Weisbenner, S. (2009). Individual investor mutual fund flows. *Journal of Financial Economics*, 92(2):223–237.

[43] Jain, P. C. and Wu, J. S. (2000). Truth in mutual fund advertising: Evidence on future performance and fund flows. *The Journal of Finance*, 55(2):937–958.

[44] James, C. and Karceski, J. (2006). Investor monitoring and differences in mutual fund performance. *Journal of Banking and Finance*, 30(10):2787 – 2808.

[45] Jank, S. (2012). Mutual fund flows, expected returns and the real economy. *Journal of Banking and Finance*.

[46] Karceski, J. (2002). Returns-chasing behavior, mutual funds, and beta's death. *Journal of Financial and Quantitative Analysis*, 37(4):559–594.

[47] Khorana, A., Servaes, H., and Tufano, P. (2009). Mutual fund fees around the world. *The Review of Financial Studies*, 22(3):1279–1310.

[48] Kim, M. S. (2010). Changes in mutual fund flows and managerial incentives. Working Paper.

[49] LaBerge, J. M. (2007). Canadian mutual fund flows and performance : non-linearity, frictions and diminishing returns to scale. Thesis, m.sc.admin., John Molson School of Business, Concordia University.

[50] Liang, X. (2000). Survivorship bias in mutual fund performance : evidence in canadian mutual funds. Thesis, m.sc.admin., John Molson School of Business, Concordia University.

[51] Lynch, A. W. and Musto, D. K. (2003). How investors interpret past fund returns. *The Journal of Finance*, 53(5):2033–2058.

[52] Nanda, V., Wang, Z. J., and Zheng, L. (2004). Family values and the star phenomenon: Strategies of mutual fund families. *The Review of Financial Studies*, 17(3):667–698.

[53] of Canada, B. (2012). How monetary policy works: The transmission of monetary policy.

[54] Oh, N. and Parwada, J. (2007). Relations between mutual fund flows and stock market returns in korea. *Journal of International Financial Markets, Institutions and Money*, 17(2):140–151.

[55] Olivier, J. and Tay, A. (2009). Time-varying incentives in the mutual fund industry. Working Paper.

[56] O'Neal, E. S. (2004). Purchase and redemption patterns of us equity mutual funds. *Financial Management*, 33(1):63–90.

[57] Rakowski, D. and Wang, X. (2009). The dynamics of short-term mutual fund flows and returns: a time-series and cross-sectional investigation. *Journal of Banking and Finance*, 33(11):2102–2109.

[58] Remolona, E. M., Kleinman, P., and Gruenstein, D. (1997). Market returns and mutual fund flows. *Federal Reserve Bank of New York Economic Policy Review*, 3(2):33–51.

[59] Santini, D. L. and Aber, J. W. (1998). Determinants of net new money flows to the equity mutual fund industry. *Journal of Economics and Business*, 50(5):419–429.

[60] Sinha, R. and Jog, V. (2007). Fund flows and performance: a study of canadian equity mutual funds. *Canadian Investment Review*, pages 28–34.

[61] Sirri, E. R. and Tufano, P. (1998). Costly search and mutual fund flows. *The Journal of Finance*, LIII(5):1589–1622.

[62] Smith, K. V. (1978). Is fund growth related to fund performance? *Journal of Portfolio Management*, 4(3):49–54.

[63] Spitz, A. E. (1970). Mutual fund performance and cash inflows. *Applied Economics*, 2(2):141–145.

[64] Uhlig, H. (2005). What are the effects of monetary policy on output? results from an agnostic identification procedure. *Journal of Monetary Economics*, 52(2):381–419.

[65] VanCampenhout, G. (2004). Aggregate equity fund flows and the stock market. University of Antwerp working paper.

[66] Wang, X. (2009). On time varying mutual fund performance. Technical report, University of Toronto.

[67] Warther, V. A. (1995). Aggregate mutual fund flows and security returns. *Journal of Financial Economics*, 39(39):209–235.

[68] Zeckhauser, R., Patel, J., and Hendricks, D. (1991). Nonrational actors and financial market behavior. *Theory and Decision*, 31(2-3):257–287.

Table 1: Descriptive statistics for panel regressions

This table presents descriptive statistics for the variables used in the panel regression analysis, and information about the coverage of the sample employed. In Panel A, the means and standard deviations of the regressors are presented for different years. The description of the variables is as follows: flow_t^i is the percentage growth rate in new money under management for fund i, excluding internal growth and distributions and is expresses in natural units, so 0.0150 means a 1.5% quarterly growth rate; catflow_t^i is the percentage growth rate in new money for the aggregate category to which fund i belongs; size_t^i is the level of total net assets of the fund, in millions of CAD; age_t^i is the age of the fund, in years; stdev_t^i is the 12 month standard deviation of returns of the fund (monthly return standard deviation), sampled at the last month of each quarter; $\text{R}_t^{e,i}$ is the quarterly return of the fund in excess of its category return; mer_t^i is the management expense ratio, which comprises both the management fee and operating expenses; gdp_t is quarterly log-growth rate in real GDP; mktvol_t is the rolling 20-day volatility of the S&P/TSX index sampled at month-end; skill_t is the cross-sectional standard deviation across all available funds in month t of intercepts of [12] 4-factor model regressions; and noise_t is the cross-sectional standard deviation across all available funds in month t of the residual excess return (for month t) from [12] 4-factor model regressions. In Panel B, we compare the level of assets under management covered in our initial sample, with the universe reported by the Investment Funds Institute of Canada (IFIC) in their 'Overview Reports by Month in New Asset Classes" (1995-2007), available at: `http://statistics.ific.ca/English/Reports/MonthlyStatistics.asp`, for different year-ends.

Panel A: descriptive statistics of variables used in panel regressions

		1995	1997	2000	2003	2005	2007	1994-2007
flow_t^i	mean	0.0079	0.0513	0.0093	0.0151	0.0224	0.0039	0.0150
	sd	0.0770	0.1013	0.0899	0.0804	0.0911	0.0777	0.0848
catflow_t^i	mean	0.0151	0.0855	0.0075	-0.0233	0.0056	0.0018	0.0121
	sd	0.0342	0.0539	0.0382	0.0709	0.0404	0.0192	0.0688
size_t^i	mean	330.20	533.00	539.80	398.50	495.10	544.80	490.00
	sd	550.40	965.70	858.30	665.70	885.60	1,140.00	900.00
age_t^i	mean	13.85	13.19	11.83	10.21	9.82	10.06	10.99
	sd	14.38	13.80	12.81	11.71	11.12	10.87	12.11
stdev_t^i	mean	3.14	3.55	4.26	3.49	2.58	2.59	3.49
	sd	0.76	0.59	1.73	1.04	0.94	0.90	1.45
$\text{R}_t^{e,i}$	mean	-0.0003	0.0061	-0.0022	0.0036	0.0014	0.0003	0.0015
	sd	0.0267	0.0386	0.0567	0.0300	0.0265	0.0254	0.0356
mer_t^i	mean	-	-	2.12	2.32	2.35	2.22	2.27
	sd	-	-	0.61	0.63	0.56	0.55	0.59

Panel B: Sample coverage at December of each year, in CAD million.

	1995	1997	2000	2003	2005	2007
TNA, IFIC	35,656	91,392	115,987	136,323	197,022	182,492
TNA, Sample	25,837	68,920	88,082	89,766	131,467	145,739
% coverage	0.72	0.75	0.76	0.66	0.67	0.80

Table 2: Descriptive statistics, unit-root tests and correlations

This table presents descriptive statistics, unit-root tests and correlations at different lags for the interest rate series used in the paper. The series are: the levels of the prime (prime_t) and 5-year mortgage (mtg5y_t) rates; the levels of the 3-month T-Bill (tb3m_t) and 5-year government bond (tb5yr_t) rates; the first difference of the prime (Δprime_t) and 5-year mortgage (Δmtg5y_t) rates; and the orthogonalized changes in the prime (Δprime^*_t) and 5-year mortgage (Δmtg5y^*_t) rates. Δprime^*_t is calculated as the residual from a regression of Δprime_t on Δtb3m_t, and Δmtg5y^*_t is the residual from a regression of Δmtg5y_t on Δtb5yr_t. Panel A presents descriptive statistics. Panel B presents MacKinnon approximate p-values in Augmented Dickey-Fuller unit-root tests for different assumed autorregressive orders. Panel C presents correlations at different lags. The data is sampled at a quarterly frequency, and runs from 1993Q1-2007Q4.

Panel A: descriptive statistics

	nobs	mean	std	ρ_1	ρ_2	ρ_3	ρ_4
prime_t	60	5.87	1.34	0.88	0.74	0.58	0.36
mtg5y_t	60	7.42	1.11	0.88	0.77	0.68	0.60
tb3m_t	60	4.11	1.36	0.88	0.75	0.63	0.45
tb5yr_t	60	5.32	1.44	0.90	0.83	0.77	0.71
Δprime_t	60	-0.02	0.67	0.09	0.09	0.23	-0.22
Δmtg5y_t	60	-0.04	0.51	-0.05	-0.09	0.12	-0.34
Δprime^*_t	60	0.00	0.33	-0.39	0.11	0.05	-0.14
Δmtg5y^*_t	60	0.00	0.29	-0.19	-0.02	-0.23	0.13

Panel B: MacKinnon approximate p-value for H0: series has unit-root, for different assumed autorregressive orders

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
prime_t	0.245	0.184	0.089	0.009 ***	0.043 **	0.138	0.123	0.143	0.15	0.159	0.157	0.168	0.184	0.143	0.193	0.154	0.126
mtg5y_t	0.183	0.225	0.25	0.214	0.337	0.346	0.324	0.335	0.326	0.364	0.241	0.243	0.245	0.176	0.079 *	0.028 **	0.064 *

Panel C: Correlation at different lags

	$\Delta\text{prime}^*_{t-k}$					$\Delta\text{mtg5y}^*_{t-k}$				
	$k=0$	$k=1$	$k=2$	$k=3$	$k=4$	$k=0$	$k=1$	$k=2$	$k=3$	$k=4$
Δprime^*_t	1.00									
$\Delta\text{prime}^*_{t-1}$	-0.41	1.00								
$\Delta\text{prime}^*_{t-2}$	0.11	-0.42	1.00							
$\Delta\text{prime}^*_{t-3}$	0.03	0.13	-0.43	1.00						
$\Delta\text{prime}^*_{t-4}$	-0.15	0.06	0.12	-0.39	1.00					
Δmtg5y^*_t	0.39	-0.23	0.24	-0.26	-0.06	1.00				
$\Delta\text{mtg5y}^*_{t-1}$	-0.07	0.36	-0.25	0.21	-0.29	-0.19	1.00			
$\Delta\text{mtg5y}^*_{t-2}$	0.01	-0.06	0.34	-0.24	0.21	-0.01	-0.22	1.00		
$\Delta\text{mtg5y}^*_{t-3}$	-0.03	0.02	-0.09	0.35	-0.23	-0.26	-0.04	-0.23	1.00	
$\Delta\text{mtg5y}^*_{t-4}$	0.06	-0.04	0.04	-0.10	0.33	0.14	-0.24	-0.04	-0.24	1.00

Table 3: Individual fund percentage retail flows, characteristics and past performance

This table presents results of regressions explaining individual fund flows with fund characteristics and past performance. The dependent variable is flow^i_t, the percentage growth rate in new money. Performance is measured relative to other funds in the same category. Every quarter funds are ranked based on a given measure of performance and assigned a ranking, rank^i_t, between 0 (worst performer) and 1(best performer). Then, a 5-segment piecewise-linear function is estimated on measures of the fractional performance rank $q^i_{k,t}$, defined as $q^i_{k,t} = \min(0.2, \text{rank}^i_t - k_j)$, $j \in \{1,2,3,4,5\}$ and where the knots k_j are the quintile breakpoints $\{0, 0.2, 0.4, 0.6, 0.8\}$. When 3 segments of fractional performance are used, $q^i_{mid,t}$ is defined as $q^i_{mid,t} = \min(0.6, \text{rank}^i_t - 0.02)$. Panel A presents results when the measure of performance used is the fund 12-month category-adjusted excess return. In Panel B, the measure of performance is the [12] 4-factor model alpha. The fund-specific ($\log(\text{size})^i_{t-1}$, catflow_t, $\log(\text{age})^i_t$, stdev^i_t, $\text{R}^{e,i}_t$, flow^i_{t-1}) control variables are described in Table 1. The panel regressions are run using quarterly observations for the period 1993Q1-2007Q4 (53 quarters), and include quarter and year dummies, as well as fund-fixed effects, and an intercept. t-statistics in parentheses are obtained using cluster-robust standard errors. The asterisks denote significance at the 90%(*), 95%(**) and 99%(***) levels, respectively.

	Panel A: category-adjusted excess returns $\text{R}^{e,i}_{t-1}$						Panel B: Carhart 4-factor alpha α^{c4f}_{t-1}					
	all funds		young funds ($\leq$ 3 yrs)		old funds ($>$ 3 yrs)		all funds		young funds ($\leq$ 3 yrs)		old funds ($>$ 3 yrs)	
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
flow^i_{t-1}	0.302	0.303	0.032	0.031	0.289	0.289	0.321	0.321	0.037	0.041	0.307	0.306
	(7.70)***	(7.73)***	(0.43)	(0.41)	(6.77)***	(6.81)***	(8.01)***	(7.98)***	(0.47)	(0.52)	(6.97)***	(6.95)***
$\log(\text{size})^i_{t-1}$	-0.011	-0.011	-0.057	-0.057	-0.011	-0.011	-0.013	-0.013	-0.063	-0.065	-0.012	-0.012
	(3.97)***	(3.96)***	(3.86)***	(3.76)***	(3.40)***	(3.40)***	(4.91)***	(4.84)***	(4.22)***	(4.18)***	(4.18)***	(4.13)***
catflow^i_t	0.098	0.098	0.227	0.220	0.087	0.087	0.098	0.097	0.216	0.206	0.086	0.086
	(2.10)**	(2.09)**	(1.82)*	(1.75)*	(1.85)*	(1.85)*	(2.08)**	(2.06)**	(1.66)*	(1.60)	(1.82)*	(1.81)*
stdev^i_{t-1}	-0.001	-0.001	-0.001	-0.002	-0.001	-0.001	0.000	0.000	-0.002	-0.002	0.001	0.001
	(0.83)	(0.83)	(0.23)	(0.27)	(0.52)	(0.51)	(0.21)	(0.23)	(0.29)	(0.28)	(0.38)	(0.40)
$\log(\text{age})^i_{t-1}$	-0.017	-0.017	-0.050	-0.059	-0.024	-0.024	-0.012	-0.012	-0.089	-0.069	-0.021	-0.021
	(1.63)	(1.63)	(0.72)	(0.85)	(1.37)	(1.36)	(1.13)	(1.14)	(1.18)	(0.91)	(1.19)	(1.19)
$\text{R}^{e,i}_t$	0.199	0.199	0.112	0.111	0.184	0.184	0.225	0.227	0.064	0.058	0.212	0.213
	(6.13)***	(6.14)***	(1.20)	(1.20)	(5.00)***	(4.99)***	(6.84)***	(6.88)***	(0.64)	(0.59)	(5.65)***	(5.66)***
$q^i_{1,t-1}$	0.115		-0.035		0.114		0.097		0.157		0.079	
	(3.63)***		(0.27)		(3.29)***		(3.31)***		(1.67)*		(2.48)**	
$q^i_{2,t-1}$	0.019		0.046		0.022		-0.011		-0.169		0.004	
	(0.85)		(0.57)		(0.97)		(0.51)		(1.79)*		(0.18)	
$q^i_{3,t-1}$	0.065		0.204		0.056		0.078		0.115		0.066	
	(2.84)***		(2.55)**		(2.42)**		(2.95)***		(1.53)		(2.34)**	
$q^i_{4,t-1}$	0.032		-0.049		0.041		0.045		-0.004		0.056	
	(1.35)		(0.58)		(1.69)*		(1.86)*		(0.06)		(2.23)**	
$q^i_{5,t-1}$	0.070		0.245		0.049		0.004		0.167		-0.021	
	(1.93)*		(2.75)***		(1.25)		(0.12)		(2.09)**		(0.64)	
$q^i_{1,t-1}$		0.101		-0.033		0.101		0.062		0.054		0.051
		(3.77)***		(0.29)		(3.40)***		(2.21)**		(0.57)		(1.64)
$q^i_{mid,t-1}$		0.043		0.085		0.042		0.043		0.004		0.046
		(6.40)***		(3.17)***		(5.90)***		(5.81)***		(0.15)		(5.51)***
$q^i_{5,t-1}$		0.067		0.176		0.052		0.014		0.182		-0.008
		(2.27)**		(2.05)**		(1.64)		(0.48)		(2.58)**		(0.24)
year/quarter dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.24	0.24	0.22	0.21	0.22	0.22	0.22	0.22	0.19	0.18	0.21	0.21
nobs	5,362	5,362	763	763	4,599	4,599	5,362	5,362	763	763	4,599	4,599

Table 4: Individual fund percentage retail flows and consumer interest rates

This table presents results of panel regressions explaining individual fund flows with fund characteristics and current and lagged changes in consumer interest rates. The dependent variable is flow_t^i, the percentage growth rate in new money. The explanatory interest rate variables are as follows: Δprime_t^* is the orthogonalized change in the prime rate, obtained as the residual in a time-series regression of quarterly changes in the prime rate on changes in the 3-month Tbill rate; $\Delta\text{mortg5y}_t^*$ is the orthogonalized change in the 5-year mortgage rate, obtained as the residual in a time-series regression of quarterly changes in the mortgage rate on changes in the 5-year government benchmark bond yield. The additional fund-specific ($\log(\text{size})_{t-1}^i$, catflow_{t-k}, $\log(\text{age})_t^i$, stdev_t^i, $\text{R}_t^{e,i}$, flow_{t-1}^i) control variables are described in Table 1. rank_{t-1}^i is ranked performance for fund i, using estimated alphas from the [12] 4-factor model. The regressions in columns (2), (3) and (4) do not include any additional explanatory variables except for the lags of individual flow, flow_{t-1}^i and year and quarter dummies; the regressions in columns (5), (6) and (7) are run including the additional explanatory variables. The panel regressions are run using quarterly observations for the period 1993Q1-2007Q4, and include quarter and year dummies, as well as fund-fixed effects and an intercept (not reported). t-statistics in parentheses are obtained using cluster-robust standard errors. The asterisks denote significance at the 90%(*), 95%(**) and 99%(***) levels, respectively.

	(2)	(3)	(4)	(5)	(6)	(7)
flow_{t-1}^i	0.337	0.336	0.336	0.315	0.315	0.315
	(7.63)***	(7.63)***	(7.60)***	(7.31)***	(7.34)***	(7.28)***
$\text{R}_t^{e,i}$				0.210	0.210	0.211
				(5.96)***	(5.83)***	(5.93)***
$\log(\text{size})_{t-1}^i$				-0.013	-0.013	-0.013
				(4.64)***	(4.64)***	(4.59)***
$\log(\text{age})_{t-1}^i$				-0.010	-0.010	-0.009
				(0.75)	(0.74)	(0.73)
stdev_t^i				0.000	0.000	0.000
				(0.10)	(0.26)	(0.11)
rank_{t-1}^i				0.040	0.040	0.040
				(7.06)***	(7.07)***	(7.06)***
catflow_t				0.079	0.091	0.081
				(1.68)*	(1.86)*	(1.69)*
catflow_{t-1}				-0.015	-0.025	-0.018
				(0.86)	(1.39)	(1.06)
catflow_{t-2}				-0.046	-0.041	-0.041
				(2.78)***	(2.49)**	(2.47)**
catflow_{t-3}				-0.012	-0.019	-0.015
				(0.86)	(1.27)	(1.03)
catflow_{t-4}				-0.003	-0.004	-0.003
				(0.18)	(0.26)	(0.21)
Δprime_t^*	-0.020		-0.016	-0.018		-0.014
	(4.07)***		(2.90)***	(3.93)***		(2.56)**
$\Delta\text{prime}_{t-1}^*$	-0.017		-0.008	-0.018		-0.008
	(3.02)***		(1.21)	(3.10)***		(1.19)
$\Delta\text{prime}_{t-2}^*$	-0.017		-0.010	-0.018		-0.012
	(2.67)***		(1.32)	(2.90)***		(1.55)
$\Delta\text{prime}_{t-3}^*$	0.006		0.005	0.001		0.001
	(0.75)		(0.69)	(0.14)		(0.10)
$\Delta\text{prime}_{t-4}^*$	0.008		0.008	0.004		0.003
	(2.01)**		(1.64)	(0.81)		(0.67)
Δmtg5y_t^*		-0.020	-0.010		-0.017	-0.009
		(3.37)***	(1.45)		(2.81)***	(1.34)
$\Delta\text{mtg5y}_{t-1}^*$		-0.031	-0.022		-0.030	-0.024
		(3.88)***	(2.47)**		(4.06)***	(2.71)***
$\Delta\text{mtg5y}_{t-2}^*$		-0.037	-0.026		-0.035	-0.025
		(4.89)***	(2.44)**		(4.92)***	(2.42)**
$\Delta\text{mtg5y}_{t-3}^*$		-0.036	-0.029		-0.030	-0.024
		(4.38)***	(2.90)***		(3.73)***	(2.49)**
$\Delta\text{mtg5y}_{t-4}^*$		-0.026	-0.020		-0.023	-0.018
		(4.06)***	(2.92)***		(3.74)***	(2.57)**
nobs	4,687	4,687	4,687	4,687	4,687	4,687
adj R2	0.158	0.157	0.159	0.205	0.205	0.206
year/quarter dummies	yes	yes	yes	yes	yes	yes

Table 5: Individual fund percentage retail flows and consumer interest rates, by age group

This table presents panel regressions explaining individual fund flows with fund characteristics and consumer interest rates, for different age groups. The dependent variable is flow_t^i, the percentage growth rate in new money. The explanatory interest rate variables are as follows: Δprime_t^* is the orthogonalized change in the prime rate, obtained as the residual in a time-series regression of quarterly changes in the prime rate on changes in the 3-month Tbill rate; $\Delta\text{mortg5y}_t^*$ is the orthogonalized change in the 5-year mortgage rate, obtained as the residual in a time-series regression of quarterly changes in the mortgage rate on changes in the 5-year government benchmark bond yield. The additional fund-specific ($\log(\text{size})_{t-1}^i$, catflow_{t-k}, $\log(\text{age})_t^i$, stdev_t^i, $\text{R}_t^{e,i}$, flow_{t-1}^i) control variables are described in Table 1. rank_{t-1}^i is ranked performance for fund i, using estimated alphas from the [12] 4-factor model. Age is measured by the number of years since inception. The columns labeled 'young" use data on flows only for funds with 3 years of age, or less; the columns labeled 'old" use data on flows for funds with more than 3 years since inception. The regressions in columns (2) to (5) do not include any additional explanatory variables except for the lags of individual flow, flow_{t-1}^i and year and quarter dummies; the regressions in columns (6) and (7) are run including the additional explanatory variables. The panel regressions are run using quarterly observations for the period 1993Q1-2007Q4, and include quarter and year dummies, as well as fund-fixed effects and an intercept (not reported). t-statistics in parentheses are obtained using cluster-robust standard errors. The asterisks denote significance at the 90%(*), 95%(**) and 99%(***) levels, respectively.

	young (2)	old (3)	young (4)	old (5)	young (6)	old (7)
flow_{t-1}^i	0.118	0.329	0.118	0.329	0.123	0.305
	(0.68)	(7.24)***	(0.61)	(7.23)***	(0.73)	(6.85)***
$\text{R}_t^{e,i}$					0.055	0.215
					(0.47)	(5.82)***
$\log(\text{size})_{t-1}^i$					-0.079	-0.012
					(2.80)***	(4.27)***
$\log(\text{age})_{t-1}^i$					0.300	-0.021
					(1.42)	(1.29)
stdev_{t-1}^i					-0.008	0.000
					(0.74)	(0.18)
rank_{t-1}^i					0.040	0.041
					(1.70)*	(6.76)***
catflow_t					0.045	0.080
					(0.40)	(1.64)
catflow_{t-1}					0.136	-0.020
					(1.02)	(1.23)
catflow_{t-2}					-0.085	-0.039
					(0.51)	(2.38)**
catflow_{t-3}					-0.064	-0.015
					(0.50)	(1.03)
catflow_{t-4}					0.143	-0.004
					(0.97)	(0.22)
Δprime_t^*	-0.010	-0.020			0.035	-0.015
	(0.55)	(4.12)***			(1.28)	(2.68)***
$\Delta\text{prime}_{t-1}^*$	-0.008	-0.018			0.008	-0.010
	(0.34)	(3.09)***			(0.17)	(1.46)
$\Delta\text{prime}_{t-2}^*$	-0.021	-0.017			0.023	-0.013
	(0.56)	(2.71)***			(0.37)	(1.73)*
$\Delta\text{prime}_{t-3}^*$	-0.004	0.005			-0.000	0.000
	(0.11)	(0.71)			(0.00)	(0.04)
$\Delta\text{prime}_{t-4}^*$	0.020	0.008			0.012	0.002
	(0.96)	(1.84)*			(0.39)	(0.52)
Δmtg5y_t^*			0.008	-0.021	0.014	-0.009
			(0.30)	(3.39)***	(0.45)	(1.29)
$\Delta\text{mtg5y}_{t-1}^*$			-0.045	-0.030	-0.058	-0.022
			(0.97)	(3.65)***	(1.25)	(2.43)**
$\Delta\text{mtg5y}_{t-2}^*$			-0.076	-0.036	-0.123	-0.022
			(1.85)*	(4.52)***	(1.95)*	(2.12)**
$\Delta\text{mtg5y}_{t-3}^*$			-0.033	-0.036	-0.067	-0.023
			(1.11)	(4.17)***	(1.39)	(2.27)**
$\Delta\text{mtg5y}_{t-4}^*$			-0.024	-0.026	-0.068	-0.017
			(1.60)	(3.85)***	(2.38)**	(2.32)**
q/y dummy	yes	yes	yes	yes	yes	yes
N	266	4,421	266	4,421	266	4,421
adj R2	0.072	0.154	0.091	0.152	0.182	0.203

Table 6: Individual fund percentage retail flows and consumer interest rates, by size group

This table presents results of panel regressions explaining individual fund flows with fund characteristics and current and lagged changes in consumer interest rates, for different size groups. The dependent variable is flow_t^i, the percentage growth rate in new money. The explanatory interest rate variables are as follows: Δprime_t^* is the orthogonalized change in the prime rate, obtained as the residual in a time-series regression of quarterly changes in the prime rate on changes in the 3-month Tbill rate; $\Delta\text{mortg5y}_t^*$ is the orthogonalized change in the 5-year mortgage rate, obtained as the residual in a time-series regression of quarterly changes in the mortgage rate on changes in the 5-year government benchmark bond yield. The additional fund-specific ($\log(\text{size})_{t-1}^i$, catflow_{t-k}, $\log(\text{age})_t^i$, stdev_t^i, $\text{R}_t^{e,i}$, flow_{t-1}^i) control variables are described in Table 1. rank_{t-1}^i is ranked performance for fund i, using estimated alphas from the [12] 4-factor model. Size is measured by the level of assets under management(AUM). The columns labeled 'small" use data on flows only for funds that have AUMs less than or equal to CAD 118 million, which is the median size in our sample; the columns labeled 'big" use data on flows only for funds that have AUMs greater than CAD 118 million. The regressions in columns (2) to (5) do not include any additional explanatory variables except for the lags of individual flow, flow_{t-1}^i and year and quarter dummies; the regressions in columns (6) and (7) are run including the additional explanatory variables. The panel regressions are run using quarterly observations for the period 1993Q1-2007Q4, and include quarter and year dummies, as well as fund-fixed effects and an intercept (not reported). t-statistics in parentheses are obtained using cluster-robust standard errors. The asterisks denote significance at the 90%(*), 95%(**) and 99%(***) levels, respectively.

	small (2)	big (3)	small (4)	big (5)	small (6)	big (7)
flow_{t-1}^i	0.262	0.391	0.262	0.391	0.247	0.320
	(5.62)***	(6.13)***	(5.61)***	(6.13)***	(5.31)***	(4.90)***
$\text{R}_t^{e,i}$					0.219	0.180
					(3.78)***	(4.25)***
$\log(\text{size})_{t-1}^i$					-0.009	-0.026
					(1.17)	(4.29)***
$\log(\text{age})_{t-1}^i$					0.020	-0.020
					(0.84)	(1.35)
stdev_{t-1}^i					-0.003	0.005
					(1.25)	(2.12)**
rank_{t-1}^i					0.038	0.036
					(3.88)***	(5.05)***
catflow_t					0.019	0.298
					(0.57)	(8.49)***
catflow_{t-1}					0.001	0.028
					(0.05)	(0.72)
catflow_{t-2}					-0.038	-0.037
					(1.77)*	(1.54)
catflow_{t-3}					-0.028	0.035
					(2.09)**	(1.53)
catflow_{t-4}					-0.014	0.035
					(0.61)	(0.96)
Δprime_t^*	-0.014	-0.024			-0.013	-0.013
	(2.16)**	(3.70)***			(1.78)*	(1.74)*
$\Delta\text{prime}_{t-1}^*$	-0.016	-0.018			-0.007	-0.006
	(2.14)**	(2.07)**			(0.66)	(0.63)
$\Delta\text{prime}_{t-2}^*$	-0.024	-0.009			-0.020	-0.004
	(2.49)**	(1.12)			(1.67)*	(0.38)
$\Delta\text{prime}_{t-3}^*$	-0.000	0.009			0.001	-0.004
	(0.01)	(0.89)			(0.13)	(0.42)
$\Delta\text{prime}_{t-4}^*$	0.017	-0.001			0.014	-0.004
	(2.39)**	(0.18)			(1.92)*	(0.58)
Δmtg5y_t^*			-0.013	-0.023	-0.002	-0.009
			(1.57)	(3.16)***	(0.24)	(1.14)
$\Delta\text{mtg5y}_{t-1}^*$			-0.026	-0.033	-0.019	-0.026
			(2.97)***	(3.14)***	(1.66)*	(2.27)**
$\Delta\text{mtg5y}_{t-2}^*$			-0.028	-0.043	-0.018	-0.036
			(2.83)***	(4.18)***	(1.22)	(3.00)***
$\Delta\text{mtg5y}_{t-3}^*$			-0.026	-0.043	-0.016	-0.035
			(2.28)**	(3.73)***	(1.12)	(2.92)***
$\Delta\text{mtg5y}_{t-4}^*$			-0.014	-0.034	-0.006	-0.028
			(1.36)	(3.85)***	(0.49)	(3.37)***
N	2,108	2,579	2,108	2,579	2,108	2,579
adj R2	0.113	0.205	0.109	0.206	0.148	0.280

A Appendix

In this appendix, we present three additional robustness checks to our main results. In the first section, we estimate the flow-performance relationship (without interest rates) for the 2006-2010 period in which we have data on liquidations and mergers and hence our database is survivorship-bias free. In the second section, we re-estimate the baseline specification with interest rates, equation (4), for the 2000-2007 period in which we have data on management expense ratios (mer's).

A.1 Survivorship bias-free sample: 2006-2010

When information on liquidations and mergers is available, we modify or exclude the percentage flow figure depending on whether the fund[29] was liquidated, merged into another fund, or if the fund itself was the acquiror. Specifically, we modify the flow data as follows:

1. If the whole fund is merged into another fund outside the sample (i.e. a balanced fund), we apply a -100% flow to the merged fund in the quarter of the event.
2. If all the share classes of a fund are merged into another (the same) fund, we apply a -100% flow to the merged fund and exclude the observation of the acquiror fund from the regressions for the event quarter only.
3. When all share classes of the fund are merged, but into two o more different funds, we apply a -100% flow to the terminated fund and exclude the observation of the acquiror fund(s), except in the case in which the "merger" is an absorption at an earlier date (before the final termination date) into another share class of the same fund; in this case, we exclude the observation of the "merged" fund for the event quarter.
4. When on the same date, some share classes are liquidated while others are merged into a different fund, we apply a -100% flow to the fund that is being terminated, and exclude the observation of the acquiror for the event quarter only.
5. When a share class "partially absorbs' (merges) another share class from the same fund, we don't modify the flow figure, since the fund was not terminated.
6. When a share class of fund A is merged into fund B (but fund A continues), we exclude the flow figure for both funds at the quarter of the event.
7. When a share class is merged into a different fund or absorbed into another share class of the same fund, and at the same time a (third) share class is terminated, but the fund is still alive, we exclude the observation for both acquiror and acquired for the event quarter.
8. We one out of many share classes is either merged into the same fund ("absorbed") or liquidated, we exclude the observation for the event quarter.
9. When one share class is merged into another fund and other share class is liquidated (but the fund remains in operation), we exclude the observation for both the acquired and acquiror fund(s) on the quarter of the event.

[29] Or some or all of its share classes.

10. When all the share classes of a fund are liquidated on the same date, we apply a -100% flow to the terminated fund.
11. When all the share classes were liquidated, but on different dates, we apply a -100% flow to the terminated fund on each event date. This actually imparts a bias *against* finding low sensitivity to bad performance, since we will have 2 or more observations of -100% flow.
12. When one or more share classes are liquidated, but the fund continues operation, we do not modify the flow figure.

A.1.1 Results

Table A.1 presents regression results when the flow data is adjusted to account for mergers and liquidations. We also include data on expense ratios. In general, we find that sensitivity to bad performance does not increase, neither for young or old funds, when compared to the full-sample results on Table 3. On the other hand, for young funds, sensitivity to top performance increases sharply, and as a result, the overall convexity of the flow-performance relationship increases, especially in the 3-segment specification. Therefore, when we control for the effect of fund liquidation on flows, we find that the main conclusions with respect to the flow-performance relationship on Table 3 do not change.

A.2 Sample with complete data on expense ratios: 2000-20007

In this section, we test if the effect of interest rates on flows are robust to the inclusion of fees as additional control variable.

A.2.1 Results

As explained in section 2, we have data on fund expense ratios for the post-2000 period. When we re-estimate the main panel regression (4) controlling for fund characteristics and interest rates, the results in Table A.2 suggest that the main conclusions with respect to the effect of interest rates on flows do not change. The changes in the prime rate, which previously had negative signs but no statistical significance, now show some significantly positive coefficients al lags 1 and 2, but the accumulated positive impact is again small compared to that of the mortgage rate. On the other hand, the changes in the mortgage rate rate are again negative and statistically significant for all lags, with an accumulated impact after 1 year of approximately -0.197. Thus, these robustness tests show that the main conclusions regarding the effect of orthogonalized consumer interest rates on flows are robust to the inclusion of fees and, in addition, provide sub-sample evidence on the impact of rates on flows.

Table A.1: Flow-performance relationship, survivorship-unbiased sample, 2006-2010

This table presents results of regressions explaining individual fund flows with fund characteristics, aggregate control variables, and fund performance for the years 2006-2010. In this period we have data on mergers and liquidations, so the sample is survivorship-bias free and the flow data is adjusted accordingly, as explained in section 2. Independent and explanatory variables are described in Tables 1 and 3. The panel regressions are run using quarterly observations for the period 2006Q1-2010Q1 (17 quarters), and include quarter and year dummies, as well as fund-fixed effects. t-statistics in parentheses are obtained using cluster-robust standard errors. The asterisks denote significance at the 90%(*), 95%(**) and 99%(***) levels, respectively.

	Measure of performance: category-adjusted excess-returns $R_t^{e,i}$					
	all funds		young funds ($\leq$ 3 yrs)		old funds ($>$ 3 yrs)	
	(2)	(3)	(4)	(5)	(6)	(7)
flow_{t-1}^i	0.089	0.090	0.061	0.062	0.070	0.070
	(2.56)**	(2.60)***	(0.95)	(0.97)	(1.84)*	(1.87)*
$\log(\text{size})_{t-1}^i$	-0.043	-0.043	-0.067	-0.067	-0.036	-0.036
	(3.89)***	(3.89)***	(2.54)**	(2.53)**	(3.88)***	(3.90)***
catflow_t^i	0.102	0.103	0.142	0.144	0.093	0.093
	(2.24)**	(2.24)**	(1.43)	(1.43)	(1.77)*	(1.77)*
stdev_{t-1}^i	-0.005	-0.005	-0.009	-0.008	-0.005	-0.005
	(2.68)***	(2.68)***	(1.57)	(1.53)	(2.61)***	(2.60)***
$\log(\text{age})_{t-1}^i$	-0.004	-0.004	-0.101	-0.101	-0.076	-0.076
	(0.18)	(0.18)	(0.82)	(0.84)	(2.12)**	(2.12)**
$R_t^{e,i}$	0.014	0.013	0.138	0.137	0.002	0.002
	(0.30)	(0.29)	(1.33)	(1.30)	(0.05)	(0.05)
mer_{t-1}^i	0.001	0.001	0.029	0.029	0.001	0.001
	(0.19)	(0.19)	(1.96)*	(1.93)*	(0.13)	(0.12)
Bottom performance quintile $q_{1,t-1}^i$	0.022		-0.145		0.044	
	(0.49)		(0.95)		(0.87)	
$q_{2,t-1}^i$	0.061		0.085		0.051	
	(1.94)*		(1.10)		(1.42)	
$q_{3,t-1}^i$	0.002		-0.081		0.024	
	(0.06)		(1.09)		(0.73)	
$q_{4,t-1}^i$	0.010		-0.056		0.014	
	(0.29)		(0.54)		(0.38)	
Top performance quintile $q_{5,t-1}^i$	0.119		0.453		0.069	
	(1.87)*		(2.04)**		(1.09)	
Bottom performance quintile $q_{1,t-1}^i$		0.050		-0.061		0.061
		(1.33)		(0.46)		(1.49)
Middle performance quintiles $q_{mid,t-1}^i$		0.021		-0.026		0.029
		(1.96)*		(0.61)		(2.66)***
Top performance quintile $q_{5,t-1}^i$		0.105		0.417		0.055
		(1.90)*		(2.20)**		(0.97)
R^2	0.08	0.07	0.25	0.25	0.06	0.06
N	3,313	3,313	541	541	2,772	2,772
nfunds	278	278	122	122	216	216

Table A.2: Interest rates and fund flows controlling for fees: 2000-2007

This table presents results of regressions explaining individual fund flows with fund characteristics, aggregate control variables, and fund performance for the years 2000-2007. In this period we include management expense ratios (mer) as an additional control variable. The regressions are run with all the non-performance, fund-specific control variables (flow^i_{t-1}, $\log(\text{size})^i_{t-1}$, catflow^i_t, $\log(\text{age})^i_{t-1}$, stdev^i_{t-1}, $\text{R}^{e,i}_t$,) included in Table 3, but their estimated coefficients are not presented to save space. Independent and explanatory variables are described in Tables 1, 3 and 4. The panel regressions are run using quarterly observations for the period 2000Q1-2007Q4, and include quarter and year dummies, as well as fund-fixed effects. t-statistics in parentheses are obtained using cluster-robust standard errors. The asterisks denote significance at the 90%(*), 95%(**) and 99%(***) levels, respectively.

	rank^i_{t-1} calculated using:	
	Category-adjusted excess-returns	4-factor alpha
flow^i_{t-1}	0.187	0.201
	(4.19)***	(4.36)***
$\text{R}^{e,i}_t$	0.092	0.109
	(1.92)*	(2.22)**
$\log(\text{size})^i_{t-1}$	-0.026	-0.029
	(5.21)***	(5.67)***
catflow^i_t	0.236	0.233
	(6.87)***	(6.65)***
catflow^i_{t-1}	0.103	0.102
	(2.77)***	(2.77)***
catflow^i_{t-2}	-0.026	-0.028
	(0.95)	(1.04)
catflow^i_{t-3}	0.029	0.022
	(0.86)	(0.66)
catflow^i_{t-4}	0.053	0.052
	(1.03)	(1.03)
$\log(\text{age})^i_{t-1}$	-0.003	0.000
	(0.18)	(0.00)
stdev^i_{t-1}	0.004	0.006
	(1.93)*	(2.56)**
mer^i_{t-1}	0.009	0.010
	(1.14)	(1.20)
rank^i_{t-1}	0.047	0.036
	(9.51)***	(5.90)***
Δprime^*_t	-0.007	-0.008
	(0.82)	(0.98)
$\Delta\text{prime}^*_{t-1}$	0.024	0.024
	(2.52)**	(2.44)**
$\Delta\text{prime}^*_{t-2}$	0.021	0.020
	(1.90)*	(1.79)*
$\Delta\text{prime}^*_{t-3}$	0.010	0.007
	(0.80)	(0.51)
$\Delta\text{prime}^*_{t-4}$	0.007	0.007
	(0.81)	(0.82)
Δmtg5y^*_t	0.002	0.001
	(0.22)	(0.11)
$\Delta\text{mtg5y}^*_{t-1}$	-0.033	-0.034
	(2.32)**	(2.34)**
$\Delta\text{mtg5y}^*_{t-2}$	-0.073	-0.076
	(4.36)***	(4.44)***
$\Delta\text{mtg5y}^*_{t-3}$	-0.063	-0.066
	(3.72)***	(3.87)***
$\Delta\text{mtg5y}^*_{t-4}$	-0.022	-0.022
	(1.92)*	(1.97)*
year/quarter dummies	yes	yes
n	3,377	3,377
adj R2	0.170	0.155