Cheaper Is Not Better:
On the Superior Performance of High-Fee Mutual Funds*

Jinfei Sheng† Mikhail Simutin‡ Terry Zhang§

March 2019

Abstract

The well-established negative relation between expense ratios and future net-of-fees performance of actively managed equity mutual funds guides portfolio decisions of institutional and retail investors. We show that this relation is an artifact of the failure to adjust performance for exposure to the profitability and investment factors. High-fee funds exhibit a strong preference for stocks with low operating profitability and high investment rates, characteristics recently found to associate with low expected returns. We show that after controlling for exposures to profitability and investment factors, high-fee funds significantly outperform low-fee funds before expenses and perform equally well net of fees. Our results have important implications for asset allocation decisions and support the theoretical prediction that skilled managers extract rents by charging high fees.

JEL Classification: G23, G11, J24
Keywords: Mutual fund performance, fee-performance relation, factor models, valuation cost

* We thank Vikas Agarwal, Jan Bena, Janis Berzins (discussant), Jonathan Berk, Oliver Boguth, Murray Carlson, Stephen Dimmock (discussant), Richard Evans, Jack Favilukis, Adlai Fisher, Lorenzo Garlappi, Ron Giammarino, Will Gornall, Leonard Kostovetsky (discussant), Kai Li, Juhani Linnainmaa, Russell Lundholm, Elena Pikulina, Elena Simintzi, Juan Sotes-Paladino (discussant), Yuehua Tang, and seminar and conference participants at 2017 Finance Down Under Conference, 2017 China International Conference in Finance, 2017 European Finance Association Conference, 2017 Northern Finance Association Conference, and University of British Columbia for helpful comments. We also thank Lu Zhang for sharing with us data about q-factors. Wanyi Wang provided excellent research assistant.
† Paul Merage School of Business, University of California-Irvine. 4291 Pereira Drive, Irvine, CA 92697. Email: jinfei.sheng@uci.edu.
‡ Rotman School of Business, University of Toronto. 105 St. George Street, Toronto ON, M5S 3E6, Canada. Email: mikhail.simutin@rotman.utoronto.ca.
§ Sauder School of Business, University of British Columbia. 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada. Email: terry.zhang@sauder.ubc.ca.

1. Introduction

At the end of 2017, domestic U.S. equity mutual funds were responsible for managing $7.5 trillion in assets. These funds continue to be the primary investment vehicle for households, with over ninety million people in the U.S. holding their shares. The average fund charges over 1% in fees, and each year investors spend billions of dollars on fund expenses, which supposedly compensate managers for their ability to generate value. [1]

Economic principles and theoretical arguments suggest that fees of a fund should be commensurate with the value it creates for investors. Skilled managers should generate better before-fee performance but capture all rents by charging higher expenses, leading to a flat relation between fund expenses and net-of-fees performance (Berk and Green, 2004). In stark contrast with the theory, empirical studies do not find a positive relation between fund expense ratios and before-fee performance. The literature concludes that net of expenses, investors in high-fee funds earn significantly worse factor-adjusted returns than do investors in low-fee funds.[2]

The seemingly poor factor-adjusted performance of high-fee funds has shaped asset allocation decisions of both retail and institutional investors. For example, in his best-selling book aimed at individual investors, Malkiel (2016) writes, "The best-performing actively managed funds have moderate expense ratios… I suggest that investors never buy actively managed funds with expense ratios above 50 basis points." More sophisticated investors also avoid high-fee funds. For instance, in a study of asset flows of defined contribution pension plans, Sialm, Starks, and Zhang (2015, p. 832) show that "plan sponsors and participants invest more in funds with lower expense ratios."

[1] Statistics for the mutual fund industry are from Investment Company Fact Book 2018.
[2] See, for example, Jensen (1968), Malkiel (1995), Gruber (1996), Wermers (2000), Gil-Bazo and Ruiz-Verdú (2009), Fama and French (2010).

In addition to offering these billion-dollar practical implications, the inverse relation between fees and net performance raises important unanswered questions. Specifically, how should the literature square this link with the theory, which predicts a flat relation? And, why do high-fee funds continue to exist if their managers extract more economic rents than the value they add? In this paper we offer an explanation, which reconciles theory with empirics, and calls for revisiting the oft-offered practical advice to prefer low-fee funds over high-fee counterparts.

In our first set of analyses, we establish that funds with different expense ratios invest in fundamentally different stocks. In particular, relative to firms held by funds in the lowest fee decile, firms held by funds in the high-fee group grow their assets at a significantly faster rate (19% vs 12% annually) and have lower gross profit ratios (28% vs 34%). Importantly, these firms are precisely the types that conventional factor models misprice: firms with high asset growth and low profitability have significantly negative three- and four-factor alphas (Cooper, Gulen, and Schill, 2008; Novy-Marx, 2013). As a result of high-fee funds tilting their portfolios to such stocks, analyses based on conventional models lead to the premature conclusion of poor performance of these funds and the practical guidance to avoid investing in them. We re-examine the fee-performance relation through the lens of a recently proposed Fama-French (2015) five-factor model, which is designed to capture differences in average returns of stocks with different profitability and investment patterns and is hence well-suited to study factor-adjusted performance of funds with different fees.

In striking contrast with the conclusions of the prior literature, we find that high-fee funds generate significantly better factor-adjusted gross-of-expenses performance than do low-fee funds. Results of panel regressions of funds' five-factor alphas on expense ratios suggest that funds that charge 1% higher fee deliver 1% more alpha. We show that after deducting expenses, high-fee funds do not underperform low-fee funds. In other words, the seemingly

poor performance of these funds documented in prior literature is but an artifact of the failure to adjust performance for the exposure to priced factors. Importantly, our results strongly support the theoretical predictions of Berk and Green (2004) that high-fee mutual funds generate higher alphas before fees, and that fees are unrelated to net-of-expenses performance because skilled managers extract rents by charging higher fees.

To better understand why high-fee funds invest more in high-investment low-profitability stocks, we consider two hypotheses. Under the *naïve investor hypothesis*, we conjecture that these companies appeal to unsophisticated investors who are also less price-sensitive, which allows high-fee funds to charge higher expenses. We find this is not the case: high-fee funds with more sophisticated investors exhibit similar propensities to invest in high-investment low-profitability stocks.

Alternatively, under the *valuation cost hypothesis*, we conjecture that fees of funds that tilt their portfolios to high-investment low-profitability companies are high because estimating intrinsic value of these stocks is more difficult. Funds that choose to specialize in investing in hard-to-value companies must spend more resources on valuation per unit of capital, for example by hiring more talented managers, which justifies the higher fees on a percentage basis. Because companies that are difficult-to-value are more likely to be the ones with fast growth rates and low profits, traditional factor models, being unable to correctly price such companies, lead to biased inferences in evaluating performance of high-fee funds. To test this hypothesis, we use several proxies for the difficulty of valuing a company. Consistent with the valuation cost hypothesis, we find that high-fee funds invest significantly more in companies with high valuation uncertainty: those that have high idiosyncratic volatility, high financial uncertainty, low asset tangibility, and low coverage from sell-side analysts. When we decompose a fund's expense ratio into distribution cost and asset management cost, we find that the relationship between a fund's expense ratio and proxies of the valuation cost of its underlying companies

is entirely driven by the part of the expense ratio that reflects the asset management cost – that is, management fees and expenses – rather than the distribution costs such as 12b-1 fees. In other words, in line with the valuation cost hypothesis, funds investing in hard-to-value companies compensate their managers more richly by charging higher management fees.

Our results contribute to the large literature on mutual fund performance.[3] An important long-standing debate in this research is whether fund managers deliver performance that justifies the fees they charge (e.g., Daniel et al., 1997; Carhart, 1997; Berk and Green, 2004; Fama and French, 2010; Berk and van Binsbergen, 2015). Our key contribution is to show that – consistent with the theory of Berk and Green (2004) – skilled managers indeed extract rents by charging high fees.

We also extend the growing literature that investigates how anomalies associated with investment and profitability rates impact mutual funds. Several recent papers advance this research by addressing questions distinct from ours. For example, Busse et al. (2016) argue that mutual fund performance measures should control for portfolio characteristics, such as investment and profitability. Jordan and Riley (2015) show that idiosyncratic volatility can predict mutual fund performance measured with three- and four-factor models, but cannot predict five-factor alpha. Jordan and Riley (2016) find that five-factor mutual fund alphas exhibit more persistence than alphas from other models, highlighting the apparent superiority of the five-factor model over its predecessors. Our paper adds to this strand of literature by documenting the implications of exposures to the investment and profitability factors for the fee-performance relation, a central topic in the mutual fund literature.

[3] The literature has grown tremendously since Jensen (1968). See Ferson (2010), Musto (2011), and Wermers (2011) for recent comprehensive reviews.

2. Data

We obtain mutual fund data by linking the CRSP Survivor-Bias-Free U.S. Mutual Fund Database with the Thomson Reuters Mutual Fund Holdings Database using the MFLINKS table (Wermers, 2000). Following the literature, we apply several filters to form our sample (e.g., Kacperczyk, Sialm, and Zheng, 2008). We remove passive index funds by searching through fund name and index fund indicator. We then exclude mutual funds that are not U.S. domestic equity funds based on the CRSP style code, Thomson Reuters style code, and Lipper objective name. We eliminate mixed funds or highly levered funds, which hold less than 70% or more than 130% of their assets in equity. For the analysis of holdings, we require a fund to have at least 10 stock holdings. We remove extremely small funds, i.e. funds with less than $20 million in asset in real 2017 terms, which is approximately $6 million in 1980. To estimate factor-adjusted performance for each fund, we require at least five years of return history. Our final sample contains 2,828 funds and spans the period from 1980 to 2017.[4]

If a fund has multiple share classes, we aggregate information of the different classes. Fund-level returns and expense ratios are the class size-weighted averages. We winsorize expense ratios, to which we refer interchangeably as fees, at the 99th percentile to remove extreme outliers. Fund size is the aggregate of all share classes. We drop observations where any of the fund size, return, or expense ratios is missing. We define fund age as the age of its oldest share class in our sample. To proxy for the investor sophistication of a fund, we use the fund's distribution channel and variable capturing whether it is a retail or institutional fund. Following Sun (2014), we classify a share class as broker-sold (as opposed to directly sold), if its 12b-1 fee is higher than 25 basis points or if it charges front- or back-end load fees. We define a fund's broker share as the fraction of assets in broker-sold share classes. We label a

[4] In Section 6, we show that the results remain similar if we use only three-year windows to estimate risk loadings, leaving us with 3,261 unique funds.

share class as institutional if its name contains words beginning with "inst", if it is of class Y or I, or if its institutional flag is Y in CRSP. Similarly, we measure a fund's institutional share as the fraction of its assets in institutional share classes. Finally, we identify funds that are in the same fund family based on their management company name and calculate fund family size as the sum of total assets of its affiliated funds. Panel A of Table 1 reports fund-level summary statistics. The average fund is 10.6 years old and charges a 1.22% fee. The average broker share is 49% and the average institutional share is 29%.

Our analysis of mutual fund holdings requires stock-level data, which we obtain from the CRSP, COMPUSTAT, and IBES files, restricting the sample to common stocks (share code 10 and 11). For each stock, we measure characteristics such as the CAPM beta, market capitalization, book-to-market ratio, and momentum. We also compute investment- and profitability-related characteristics such as asset growth, equity issuance, operating profitability, and stock age. To gauge whether a company is difficult to value, we construct proxies such as asset tangibility, idiosyncratic volatility, readability of financial statements, and analyst coverage. The appendix provides details on variable definitions. We winsorize firm-level variables at the top and bottom 0.5%. We take natural logarithms of growth rates and market capitalizations. To study portfolio-level attributes of the funds, we take position-weighted averages of characteristics of stocks they hold at the beginning of each year. Panel B of Table 1 shows summary statistics of these stock characteristics.

3. Mutual funds fees and investment styles

In this section we uncover systematic differences in the investment strategies of high-fee and low-fee funds.

3.1 Textual analysis of the differences in fund prospectuses

Fund prospectuses provide valuable information on fund's investment strategies (Abis, 2017). To get a first sense of whether high- and low-fee funds follow distinct investment approaches, we examine the differences in the "Principal Investment Strategies" (PIS) section of prospectus forms 497K available from EDGAR. To the extent that high- and low-fee funds differ in their investment styles, we expect to observe differences in the language in that section.

We find that high-fee funds tend to describe their investment strategies differently from low-fee funds. A typical PIS section of high-fee funds reads:

> *[The fund] utilizes a growth approach to choosing securities based upon fundamental research which attempts to identify companies whose earnings growth rate exceeds that of their peer group, exhibit a competitive advantage in niche markets, or do not receive significant coverage from other institutional investors.* (Emerald Mutual Fund)

By contrast, a typical low-fee fund describes its investment strategy as follows:

> *The Fund invests, under normal circumstances, primarily in U.S. common stocks that are considered by the Fund's subadvisers to have above-average potential for growth. The subadvisers emphasize stocks of well-established medium- and large-capitalization firms.* (The Vantagepoint Funds)

To systematically investigate the differences in fund prospectuses, we conduct a textual analysis of the PIS sections. Specifically, we construct a "*research index*" to capture a fund's research activities by calculating the fraction of words that are related to research. Motivated by reading through a random set of 50 fund prospectus, we include the following words in list: analysis, analyze, analyzes, analyzed, bottom-up, fundamentally-based, fundamentals-based, and research. The text data is then merged with fund variables using the links in SEC's Investment Company Series and Class information. The final data for the textual analysis is from 2010 to 2016 due to availability of the text data.

To test whether high- and low-fee funds differ significantly in describing research activities central to their trading strategies, we regress the *research index* on the expense ratio and control variables. Table 2 shows that the coefficients on the expense ratio are positive and significant in all specifications. This first set of results provides an early indication that high-fee funds appear to be more focused on research in formulating their investment strategies. We thus expect that high- and low-fee funds may analyze different stocks for inclusion into their portfolios. To analyze whether this is the case, we next study characteristics of holdings of funds with different expense ratios.

3.2 Differences in portfolio holdings

We compute average characteristics of stock holdings of funds with different expense ratios. In addition to the commonly considered stock characteristics such as size, book-to-market ratio, and momentum, we also investigate asset growth rate, operating profitability, equity issuance rate, and stock age. For every fund at the first observation of each year, we take position-weighted averages across all stocks in its portfolio to calculate average characteristics of stockholdings. We then run the following panel regression:

$$Avg\ char_{j,t} = b_0 + b_1 Expense\ ratio_{j,t-1} + \boldsymbol{c}' Controls_{jt-1} + \epsilon_{j,t-1} \quad (1)$$

where $Avg\ char_{j,t}$ is one of the above-mentioned stock characteristics for fund j in year t,

$Expense\ ratio_{j,t-1}$ is the fund's expense ratio in year $t-1$, and $Controls_{j,t-1}$ include the natural logarithm of fund size, fund age (in months), and the size of other affiliated funds in the same family. Since our focus is on the cross-sectional comparison between high-fee and low-fee funds, we include year fixed effects to control for time series trends in the mutual fund industry. We cluster standard errors at the fund level and scale all variables by their standard deviations annually to better facilitate the interpretation of the magnitudes of the coefficients.

Our main focus in this test is on the coefficient on the expense ratio. For example, for asset growth rate, a positive coefficient indicates that high-fee funds tilt their holdings to companies with high asset growth rates. Table 3 shows that the coefficients on the expense ratio are significant for seven out of eight characteristics we study. With respect to commonly considered characteristics, regressions (1)-(4) establish high-fee funds invest more in high-beta stocks, small stocks, and high momentum stocks. Specifications (5) and (6) show that high-fee funds also invest more in stocks with high asset growth rates and high equity issuance rates. Finally, regressions (7) and (8) shows that high-fee funds invest more in young stocks and stocks with low profitability. Overall, the results of this analysis suggest that funds charging different fees have systematically different investment preferences. Broadly speaking, high-fee funds prefer younger firms in a stage of rapid expansion that have not yet achieved high profitability.

In terms of the economic significance, we observe that the absolute magnitude of the coefficient in regressions (5)-(8) is often greater than that in specification (1)-(4), indicating that growth- and profitability-related characteristics are economically more important in capturing portfolio differences among funds charging different fees. To better gauge the economic magnitude of tilts by high-fee funds, we plot average asset growth rates, equity issuance rates, operating profitability and stock age against fund fee deciles in Figure 1. The benefit of this plot is that it does not impose a linear structure between fee and stock characteristics, which better demonstrates the reliability of fee as an indicator of tilt towards certain characteristics. The figure shows that stock characteristics change strikingly and monotonically with fees. The average asset growth rate of companies invested by funds in the bottom decile is about 12% a year, while in the highest decile is about 19%. The difference of 7% represents a half of the average asset growth rate of all companies. The plot also reveals

that companies held by bottom decile funds on average achieve operating profitability that is 6 percentage points higher than that of companies held by top decile funds.

The landscape of the mutual fund industry and academic understanding of the determinants of asset returns have both changed significantly since the 1990s. It is possible that the preference of high-fee funds for different types of stocks has changes over time. To test this conjecture, we run regression (1) annually and plot the time series of the coefficients on the expense ratio in Figure 2. The coefficients are more volatile during the early part of the sample, potentially because of the smaller number of observations. Importantly, the preference of funds with higher fees for low-profitability high-growth firms is persistent over time.

4. Mutual fund fee-performance relation

The persistent preference of high-fee funds for fast-growing, low-profitability stocks has important implications for the relation between expenses and performance of mutual funds. To the extent that these stock characteristics are associated with lower expected returns, as recent literature has shown (Fama and French, 2015; Hou, Xue, and Zhang, 2015), failure to account for these characteristics can lead to erroneous conclusions on the relation between fees and fund performance. Such failure would be analogous to using CAPM to evaluate performance of a large-cap growth fund: without explicitly accounting for loadings on size and value factors, the performance of this fund would appear poor on average. In our context, accounting for exposures to asset growth and profitability factors of funds with different fees is necessary to get a clearer picture of the relation between expenses and performance of mutual funds.

To control for exposures to asset growth and profitability factors, we use the five-factor model of Fama and French (2015). To contrast our results with those of prior literature, we also use commonly considered models such as the CAPM as well as the three- and four-factor

models and evaluate robustness to other models in section 6. For each performance model and in each month *t*, we regress a fund's monthly return in the previous five years on factors to obtain loadings $\boldsymbol{\beta}_{jt}^{Model}$. We compute monthly alphas as

$$\alpha_{jt}^{Model} = r_{jt}^{e} - \boldsymbol{\beta}_{jt}^{Model\prime}\boldsymbol{r}_{\boldsymbol{t}}^{\boldsymbol{Factor}},$$

where r_{jt}^{e} is fund *j*'s excess return before fee or after fee, and $\boldsymbol{r}_{\boldsymbol{t}}^{\boldsymbol{Factor}}$ is a vector of realized factor returns in each model. We measure a fund's gross monthly alpha using its gross return, which is net return plus the annual expense ratio divided by 12.

4.1 Empirical evidence

Figure 3 summarizes future performance of funds grouped into deciles on the basis of fees disclosed in the most recent fiscal year end. Panel A plots before-fee alphas from different models. The results from the CAPM, three- and four-factor models confirm the findings of the prior literature: gross fund performance is unrelated to fees. By contrast, alphas from the five-factor model display a very different pattern: they increase significantly with fees.

Panel B shows that irrespective for the model, actively managed mutual funds with both high and low expense ratios achieve poor net-of-fees factor-adjusted performance. In addition, consistent with the previously established results, net-of-expenses fund performance as measured by the CAPM, three-, and four-factor models, deteriorates with fees. Strikingly, this negative relation is absent when we use five-factor alphas. The difference in five-factor performance of funds with high and low expense ratios is economically small and statistically indistinguishable from zero. Taken together, the evidence in Figure 1 provides the missing support of the prediction of Berk and Green (2004) that skilled managers extract rents by charging higher fees, and consequently actively managed funds deliver similar net-of-fees performance.

The sort-based results in Figure 1 are informative, but to evaluate the fee-performance relation more formally, we run the following panel regression:

$$\alpha_{jt}^{Model} = d_0 + d_1 Expense\ ratio_{jt-1} + \boldsymbol{h}' Control_{jt-1} + F_t + \varepsilon_{jt-1}, \quad (2)$$

where $Expense\ ratio_{jt-1}$ is the fund j's expense ratio measured at the most recent fiscal year end, and $Control_{jt-1}$ is a vector controls measured at the same time as fees, including the logarithm of fund size, fund age (in months), and the total size of other affiliated funds in the family. To facilitate presentation, we divide the control variables by 10. We include month fixed effects and cluster standard errors by month.

Panel A of Table 4 reports the results of regression (2) with before-fee alphas. Specifications (1)-(3) show funds that charge higher fees do not provide better performance as measured by conventional factor models. However, in regression (4), which controls for fund exposure to the investment and profitability factors, the coefficient on the *Expense ratio* is significantly positive, suggesting that high-fee funds deliver better performance.

Panel B of Table 4 repeats the analysis using after-fee alphas. Consistent with prior literature, regressions (1)-(3) show that the coefficients on the *Expense ratio* are large and negative, suggesting that performance – measures using conventional models – declines with fees. Crucially, and consistent with the theoretical arguments that skilled managers extract rents by charging higher fees (Berk and Green, 2004), specification (4) shows that the coefficient on *Expense ratio* is statistically insignificant from zero. In other words, expenses are not related to future after-fee performance when investment and profitability factors are controlled for.

Why does the performance of high-fee funds improve after controlling for investment and profitability factors? The reason is that the stocks in which high-fee funds invest most heavily have high asset growth rates and low profitability. Thus, high-fee funds should have low loadings on the investment and profitability risk factors, both of which carry positive factor

premia. Table 5 reports this result in a formal test. Columns (1) and (2) show the coefficients on Expense ratio are negative and significant after controlling for fund characteristics. Columns (3) and (4) shows that the coefficients are significantly negative after controlling for fund characteristics and loadings on the other risk factors, such as the market, size, and value factors. This finding suggests that high-fee funds tend to load less on the investment and profitability factors. The realized risk premium of the investment factor and the profitability factor are 0.25% and 0.36% per month in the 1985 to 2017 period. Based on the magnitude of the coefficients in columns (1) and (2), a 1 percentage point increase in fee would reduce the required rate of return by 0.86 percentage point (i.e. $1.15\times0.25\%+1.6\times0.36\%=0.86$) in the five-factor model. These differences in risk loadings explain why high-fee funds appear to have poor performance in the traditional models.

4.2 Sub-sample analysis of the fee-performance relationship

We next investigate whether the relation between expense ratios the performance varies across different sub-sample of funds. To this end, we separate funds into two groups based on each of their size, age, family size, turnover ratio, institutional indicator, or broker sold indicator. Specifically, for each of these fund level characteristics, we define a dummy variable equal to one if the variable is greater than the sample median in each year. We then regress the five-factor alpha on the expense ratio, a characteristic dummy, and an interaction term of the dummy variable and expense ratio, controlling for other fund attributes. The coefficient of the expense ratio measures the fee-alpha relationship for the baseline group of funds with their dummy variable equal to 0. Its sum with the coefficient on the interaction term indicates the fee-alpha relationship for the second half of funds.

Table 6 reports the results of this test with before-fee alpha.[5] Across all columns, irrespective of the particular fund type used to define the dummy variable, the coefficients on *Expense ratio* remain statistically and economically significant. The performance of high-fee funds as measured by the five-factor alpha thus appears consistent across different types of funds. Especially in Columns (1) to (3) and Column (6), the fee-alpha relationship exceeds 1 for smaller funds, younger funds, funds offered by smaller families and funds sold directly to investors. A coefficient greater than 1 means, for any additional fee that investors pay for these funds, investors are obtaining positive net benefit after fee, which suggests for some types of funds, managers are not extracting all the rents generated from their skill. The coefficients on the interaction terms in columns (1) and (2) are also significantly negative, indicating that smaller and younger funds have steeper fee-alpha relationship than larger and older funds. The higher fee-alpha relationship could be due to several reasons. For example, smaller and younger funds are less well-known, investors might need to incur positive search cost to find these funds. Theoretically, as predicted by Garleanu and Pedersen (2018), investors should be compensated by higher alpha for their search effort. Alternatively, Chevalier and Ellison (1997) have shown that the response of flow to performance is more sensitive for younger and smaller funds. Therefore, skilled managers of these funds might be willing to charge a lower fee to build a track record.

4.3 After-fee performance conditional on holdings and fees

The prior sections have shown that controlling for the investment and profitability factors, high-fee mutual funds perform better before fees and perform equally well after fees comparing to low-fee funds. In this section, we ask what the fund's performance would be, if it does not invest in companies with high asset growth rate and low profitability and, especially, if the fund charges high fees. To answer this question, we group mutual funds into portfolios

[5] Results obtained using after-fee alphas are similar and are omitted for brevity.

according to their holding characteristics and expense ratio. Specifically, in each year, we sort mutual funds into quintiles independently based on their expense ratio as of the most recent fiscal year-end and the characteristics of the prior year's holdings, such as asset growth rate and operating profitability. For each portfolio of mutual funds, we compute their monthly value-weight after-fee return using the prior month's fund size as weights. Then, we compute the Fama-French five factor alpha for each portfolio of mutual funds. Table 7 presents the results.

Table 7 shows that high-fee funds do perform significantly worse after fees, if they do not invest in companies with high asset growth rate and low profitability. In Table 7 Panel A, the group of mutual funds with the lowest after-fee alpha is in lowest asset growth quintile and the second highest fee quintile. The next worst group is in the lowest asset growth quintile and highest fee quintile. Similarly, in Panel B, the group of funds with the lowest after-fee alpha is in the highest profitability quintile and highest fee quintile. This table shows that households that invest in high-fee mutual funds do not always obtain a fair reward after fees. Households should indeed avoid certain groups of high-fee mutual funds, especially ones that invest in companies with low asset growth rate and high profitability.

5. Explanations

We now consider two hypotheses to understand why mutual fund expense ratios relate systematically to funds' propensities to invest in firms with certain asset growth and profitability profiles.

5.1 Naïve investor hypothesis

The behavioral finance literature has postulated that naïve investors overinvest in fast-growing companies due to cognitive biases. For example, Lakonishok, Shleifer, and Vishny (1994) and La Porta et al. (1997) argue that unsophisticated investors over-extrapolate high

growth rate of a company into its future, causing it to be overpriced. In a related study, Frazzini and Lamont (2008) document a dumb money effect in retail investor flows. They find retail investors display positive sentiment towards growth stocks and allocate more capital to funds that hold more such stocks.

Motivated by this literature, we propose the *naïve investor hypothesis*, which conjectures that fast-growing companies are more appealing to naïve investors, who are also less likely to be price sensitive about mutual fund fees. These companies can be expected to have a high rate of asset growth, low profitability, and high equity issuance to finance the growth. If such companies attract unsophisticated investors, we would expect that some fund managers invest more in high-growth and low-profitability stocks to attract more unsophisticated investors. Since unsophisticated investors tend to be less price sensitive, the fund manager can charge higher fees than what is justified by the performance.[6]

To test the *naïve investor hypothesis*, we construct two measures of a fund's investor sophistication. The first proxy is the fraction of a fund's asset that belongs to institutional share classes. It is well recognized that institutional investors are more sophisticated than retail investors. The second proxy is broker share, defined as the fraction of a fund's asset that is sold through broker channels instead of being sold directly to investors. Funds sold through brokers charge investors higher sales loads, which do not contribute to the management of the fund. Prior literature has shown that investors who purchase mutual fund through brokers are less performance-sensitive than investors who purchase mutual funds directly and, in addition, brokers' incentives are more aligned with fund families (Del Guercio and Reuter, 2014; Sun, 2014). Therefore, the higher the broker share of a fund, the less sophisticated the fund's

[6] Indeed, the literature has explored how fund managers set fees strategically to exploit investors who are less sensitive to price. Christoffersen and Musto (2002) find that retail money funds tend to increase fees after a large amount of outflow. They propose that outflows are an indication of performance-sensitive investors leaving the fund, which also signals a decrease in the average price sensitivity among investors remaining in the fund, causing the managers to subsequently raise fees.

investors are. We re-run regression (1) of average portfolio characteristics on the expense ratio, either investor sophistication proxy, and their interaction.

Table 8 summarizes regression results for each of the investor sophistication proxy in four separate panels. Under the naïve investor hypothesis, we expect to see that sophisticated high-fee funds have weaker tilt towards stock characteristics appealing to naïve investors, which implies that the coefficient on the interaction term of expense ratio and institutional share should be of the opposite sign to that on the expense ratio. With broker share, the coefficients on the interaction term should have the same sign as the coefficient on the expense. We find that it is not the case. In Panel A, the coefficients on the interaction term between expense ratio and institutional share all have the same sign as the coefficient on the expense ratio. In Panel B, the coefficients on the interaction term between expense ratio and broker share all have the opposite sign as the coefficient on the expense ratio and are all statistically significant.

In contrast to the predictions of the hypothesis, we find that high-fee institutional funds have a stronger tilt towards high-growth and low-profitability companies, while high-fee broker-sold funds have a weaker tilt towards such companies. In other words, among funds with more sophisticated investors, the association between expense ratio and growth-related characteristics is the same, if not stronger. Overall, the results summarized in Table 8 suggest that the *naïve investor hypothesis* does not explain the link between expense ratios and portfolio stock characteristics of mutual funds.

5.2 Valuation cost hypothesis

We now consider the hypothesis that funds investing in high-growth and low-profitability stocks charge high fees because their valuation is considerably more difficulty and demands more time and effort from fund managers per unit of capital. The high valuation cost, in turn, necessitates higher fees on a percentage basis. In other words, funds charge high fees

because they invest in difficult-to-value stocks characterized by high growth and low profitability. We label this alternative explanation the *valuation cost hypothesis*. Under this hypothesis, we would expect to observe that high-fee funds invest more in companies that are more difficult to value.

To test the valuation cost hypothesis, we use four measures to identify whether a company is hard to value. Our first measure is idiosyncratic volatility (Ang et al., 2006), which has been linked to valuation difficulty (e.g., Kumar, 2009). Our second measure is based on the textual analysis of a company's annual reports. Following Loughran and McDonald (2011), we construct an uncertainty index by counting the uncertainty words such as 'almost' and 'appears', and dividing it by the total number of words in each annual report.[7] The index is higher if the annual report contains more uncertain words. We deem a company as opaque if its uncertainty index is high. The third measure we consider is tangibility: valuing a firm whose intangible assets represent a large portion of its asset base can be difficult (e.g., Baker and Wurgler, 2006). Our last measure is the number of analysts that have earning forecasts for a firm from the IBES database. Stocks with more analyst coverage likely have better information available and are thus less challenging to price. We aggregate each company-level measure of valuation cost to the fund level using portfolio weights of a fund.

Panel A of Table 9 shows our results from regressions of valuation cost proxies of funds' stockholdings on their expense ratios. Lending support to the valuation cost hypothesis, the results suggest that fund fees relate positively to each of the valuation difficulty proxies we consider. To further test the hypothesis, we split a fund's reported expense ratio into the part that represents its asset management cost and the part that represents marketing and distribution cost. A typical fund's expense ratio consists of three main components, including 12b-1 fee,

[7] The word list is available from Bill McDonald's website: http://www3.nd.edu/~mcdonald/.

management fee, and other operating expenses. Management fee and other operating expenses cover the cost of fund managers and daily operations, while 12b-1 fee is mainly used for the fund's marketing and distribution, e.g., compensation to brokers who sell the fund to investors. Under the valuation cost hypothesis, funds investing in harder-to-value stocks should charge higher management fees to compensate managers for their efforts, but we do not expect marketing and distribution fees to relate to valuation difficulty of the stockholdings. We find this to be the case. In Panel B of Table 9, the coefficient on the asset management cost is positively related with the valuation cost of the underlying companies, while 12b-1 fee is negatively related or unrelated to the valuation cost of stocks, lending further support for the *valuation cost hypothesis*.

6. Robustness and additional results

To evaluate robustness of our results, in this section we conduct several tests modifying various aspects of our empirical methods. In Panel A of Table 10, we assess whether the propensity of high-fee funds to hold high-growth low-profitability stocks, as established in Table 3, is driven by the omission of other stock characteristics as controls. Specifically, we re-run the regression of average portfolio characteristics on expense ratios and other variables after adding averages of CAPM beta, market capitalization, momentum, and B/M ratio of the stockholdings as regressors. Our results remain similar to those in the base-case analysis summarized in Table 3.

We also perform several robustness tests for the fee-alpha relationship. In Panel A of Table 11, we perform Fama-MacBeth regressions by regressing monthly alpha measured with different models on the most recent expense ratio. We find that the relationship between the expense ratio and the before-fee alpha measured with the Fama-French five factor model, the six-factor model that adds the momentum factor, and Hou, Xue and Zhang four-factor model

are significantly positive. In Panel B of Table 11, we perform the same regression as in Table 4 for the sample period of 1998 to 2017. The results are quantitatively the same as Table 4. In Panel C of Table 10, we use a shorter three-year rolling window to calculate factor loadings of the funds. The results are the same as Table 4. Overall, we show that after controlling for exposures to profitability and investment factors, high-fee funds significantly outperform low-fee funds before deducting expenses, and perform equally well net of fees.

7. Conclusion

Previous literature uncovers a robust inverse relation between fees charged by actively managed mutual funds and future after-fee fund performance. Before deducting expenses, high-fee funds have been found to perform just as well as do low-fee funds. Theoretically, this result is puzzling as it suggests that managers of high-fee funds extract more rents than the value they add. Empirically, the apparent negative relation between expenses and net-of-fees performance has helped to guide allocations of billions of dollars of retail and institutional investors, who shun high-fee funds. The relation is also puzzling as it calls into question the continued existence of high-fee funds.

This paper resolves the puzzle by showing that factor models used to establish the prior fee-performance results are inadequate to control for differences in performance of funds with different fees. High-fee funds exhibit a strong preference for stocks with high investment rates and low profitability, characteristics that have been recently shown to associate with low expected returns. The commonly used three- and four-factor models produce large negative alphas for these types of stocks, leading to a premature conclusion that high-fee funds underperform net of expenses.

We evaluate the fee-performance relation using the recently proposed five-factor model that controls for exposures to the investment and profitability factors. The results we obtain

stand in stark contrast with those in the prior literature. We find that high-fee funds significantly outperform low-fee funds before deducting expenses, and do equally well net of fees. Our findings support the theoretical prediction that skilled managers extract rents by charging high fees, and call into question the widely offered advice to avoid high-fee funds.

References

Abis, S., 2017. Man vs. machine: Quantitative and discretionary equity management, Working paper.

Ang, A., Hodrick, R.J., Xing, Y. and Zhang, X., 2006. The cross-section of volatility and expected returns, *Journal of Finance, 61*(1), 259-299.

Baker, M. and Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns, *Journal of Finance, 61*(4), 1645-1680.

Berk J, and Green R. 2004, Mutual fund flows and performance in rational markets, *Journal of Political Economics* 12(6), 1269–1295.

Berk, J.B. and Van Binsbergen, J.H., 2015, Measuring skill in the mutual fund industry, *Journal of Financial Economics* 118(1), 1-20.

Busse, J.A., Jiang, L. and Tang, Y., 2016, Double adjusted mutual fund performance, Working paper, *Available at SSRN 2516792*.

Carhart, M.M., 1997, On persistence in mutual fund performance, *Journal of Finance 52*(1), 57-82.

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

Christoffersen, S.E. and Musto, D.K., 2002, Demand curves and the pricing of money management, *Review of Financial Studies 15*(5), 1499-1524.

Cooper, M.J., Gulen, H. and Schill, M.J., 2008, Asset growth and the cross-section of stock returns, *Journal of Finance 63*(4), 1609-1651.

Daniel, K., Grinblatt, M., Titman, S. and Wermers, R., 1997, Measuring mutual fund performance with characteristic-based benchmarks, *Journal of Finance 52*(3), 1035-1058.

Del Guercio, D. and Reuter, J., 2014, Mutual fund performance and the incentive to generate alpha, *Journal of Finance 69*(4), 1673-1704.

Fama, E.F. and French, K.R., 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics 33*(1), 3-56.

Fama, E.F. and French, K.R., 2010, Luck versus skill in the cross-section of mutual fund returns, *Journal of Finance 65*(5), 1915-1947.

Fama, E.F. and French, K.R., 2015, A five-factor asset pricing model, *Journal of Financial Economics 16*(1), 1-22.

Ferson, W.E., 2010, Investment performance evaluation, *Annual Review of Financial Economics 2*(1), 207-234.

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.

French, K.R., 2008, Presidential address: The cost of active investing, *Journal of Finance 63*(4), 1537-1573.

Hou, K., Xue, C. and Zhang, L., 2015. Digesting anomalies: An investment approach, *Review of Financial Studies 28*(3), 650-705.

Gârleanu, N. and Pedersen, L.H., 2018. Efficiently inefficient markets for assets and asset management, *Journal of Finance 73(4),* 1663-1712.

Gil-Bazo, J. and Ruiz-Verdú, P, 2009, The relation between price and performance in the mutual fund industry, *Journal of Finance 64*(5), 2153-2183.

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

Jordan, B.D. and Riley, T.B., 2015, Volatility and mutual fund manager skill, *Journal of Financial Economics 118*(2), 289-298.

Jordan, B.D. and Riley, T.B., 2016, Skill and Persistence in Mutual Fund Returns: Evidence from a Six-Factor Model, Working paper, *Available at SSRN 2717091*.

Jensen, M.C., 1968, The performance of mutual funds in the period 1945–1964, *Journal of Finance 23*(2), 389-416.

Kacperczyk, M., Sialm, C. and Zheng, L., 2008, Unobserved actions of mutual funds, *Review of Financial Studies 21*(6), 2379-2416.

Kumar, A., 2009. Hard-to-value stocks, behavioral biases, and informed trading, *Journal of Financial and Quantitative Analysis 44*(06), 1375-1401.

La Porta, R., Lakonishok, J., Shleifer, A. and Vishny, R., 1997, Good news for value stocks: Further evidence on market efficiency, *Journal of Finance 52*(2), 859-874.

Lakonishok, J., Shleifer, A. and Vishny, R.W., 1994, Contrarian investment, extrapolation, and risk, *Journal of Finance 49*(5), 1541-1578.

Lewellen, J. and Nagel, S., 2006. The conditional CAPM does not explain asset-pricing anomalies, *Journal of Financial Economics*, *82*(2), 289-314.

Loughran, T. and McDonald, B., 2011, When is a liability not a liability? textual analysis, dictionaries, and 10-ks, *Journal of Finance* 66, 35–65.

Malkiel, B.G., 1995. Returns from investing in equity mutual funds 1971 to 1991, *Journal of Finance* 50(2), 549-572.

Malkiel, B.G., 2016. *A random walk down Wall Street: the time-tested strategy for successful investing*. WW Norton & Company.

Musto, D.K., 2011, The economics of mutual funds, *Annual Review of Financial Economics 3*(1), 159-172.

Novy-Marx, R., 2013, The other side of value: The gross profitability premium, *Journal of Financial Economics 108*(1), 1-28.

Sialm, C., Starks, L.T. and Zhang, H., 2015. Defined contribution pension plans: Sticky or discerning money?, *Journal of Finance 70*(2), 805-838.

Sun, Y., 2014, The effect of index fund competition on money management fees, Working paper, *Available at SSRN 2432361*.

Wermers, R., 2000, Mutual fund performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses, *Journal of Finance 55*(4), 1655-1703.

Wermers, R., 2011, Performance measurement of mutual funds, hedge funds, and institutional accounts, *Annual Review of Financial Economics 3*(1), 537-574.

Appendix: Variable definition

Variable	Definition
CAPM beta	Following Lewellen and Nagel (2006), we measure a stock's daily CAPM beta as the sum of the slope coefficients from a regression of the stock excess return in day *t* on the market excess returns in *t*, *t-1*, and average market excess return during *t-4* through *t-2*. We estimate the betas annually using one calendar year of data.
Market capitalization	The natural logarithm of stock i's market capitalization, measured in the end of December of each year.
B/M ratio	The ratio of stock i's book equity at the end of its fiscal year to its December end market capitalization. We adjust market capitalization for any share issuance between the fiscal and calendar year end. Following Fama and French (2008), book equity is common equity plus deferred taxes (if available). If common equity is not available, we replace it with total asset minus liability minus preferred equity (if available). The formula for B/M ratio is $B/M_{i,t} = \frac{BE_{it}}{ME_{it}}$.
Momentum	The cumulative return of a stock from January to November of each year.
Asset growth	The asset growth rate of company i in year t is defined as the natural logarithm of the ratio of its total asset in year t to total asset in year $t-1$. Total asset is measured as of the fiscal year end: $AG_{i,t} = \ln\frac{Asset_{i,t}}{Asset_{i,t-1}}$.
Equity issuance	Equity issuance: equity issuance for company i in year t is defined as the natural logarithm of the ratio of number of shares outstanding in year t to the number of shares outstanding in year $t-1$. Number of shares outstanding is measured as of December of each year. We adjust for stock splits between two year ends. The formula is $EI_{i,t} = \ln\frac{Adjusted\ Shares\ Outstanding_{i,t}}{Adjusted\ Shares\ Outstanding_{i,t-1}}$.
Operating profitability	For company i year t, we measure its operating profitability following Fama and French (2015). Specifically, profitability is measured as of the end of fiscal year as revenue minus cost of goods sold, minus selling, general, and administrative expenses, minus interest expense, all divided by the book equity. The formula is $OP_{i,t}^{stock} = \frac{(REV-COGS-SG\&A-INT\ EXP)_{i,t}}{Book\ Equity_{i,t}}$.
Stock age	Number of years a stock is publicly listed
Sales growth	The sales growth rate of company i in year t is defined as the natural logarithm of the ratio of its total sales in year t to total sales in year $t-1$.
Uncertain words	Loughran and MacDonald (2011) firm level uncertainty index.
Tangibility	For company i in year t, its tangibility is measured as the ratio of the amount of property, plant and equipment to its total asset.
Number of analysts	Number of analysts that provides earnings forecasts for a stock.
Idiosyncratic volatility	For company i in year t, $IVOL$ is measured as the standard deviation of the residual of daily Fama-French three-factor regression as in Ang et al. (2006).

Figure 1: Characteristics of stock portfolios of funds charging different fees

This figure plots average characteristics of stocks held by mutual funds grouped into deciles on the basis of expense ratio. For each fund, we calculate its stock characteristics as the position-weighted averages across companies held by the fund. The characteristics, defined in detail in the Appendix, are the asset growth rate, operating profitability, equity issuance rate, and stock age. The sample period is 1980-2015.

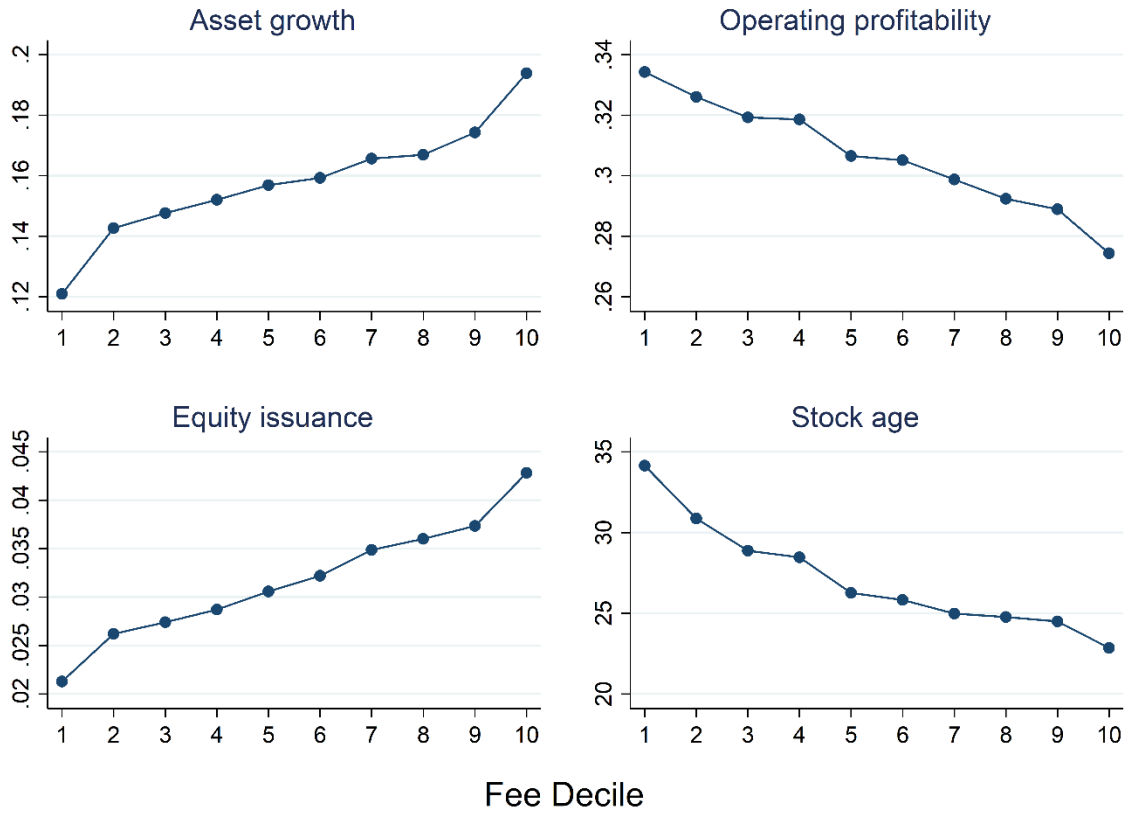

Figure 2: Fund fees and time series dynamics of fund portfolio characteristics

This figure presents the time series dynamics of the relation between fund fees and portfolio characteristics. For each characteristic, we plot the time series of coefficients on the *fee* variable from annual cross-sectional regressions

$$Average\ characteristic_{j,t} = b_0 + b_1 fee_{j,t-1} + \boldsymbol{b}' Controls_{j,t-1} + \epsilon_{j,t-1},$$

where $Average\ characteristic_{j,t}$ is one of the measures of stock characteristics (asset growth rate and operating profitability) for fund j in year t; $fee_{j,t-1}$ is the fund j's expense ratio in year $t-1$; $Controls_{j,t-1}$ are fund level control variables, including the natural log of fund age (in months), fund size, and fund family size. For each fund, we calculate its stock characteristics as the position-weighted averages across companies held by the fund. Detailed variable definitions are provided in the Appendix. All variables are scaled by their standard deviation and demeaned in each year. The sample period if from 1980 to 2015.

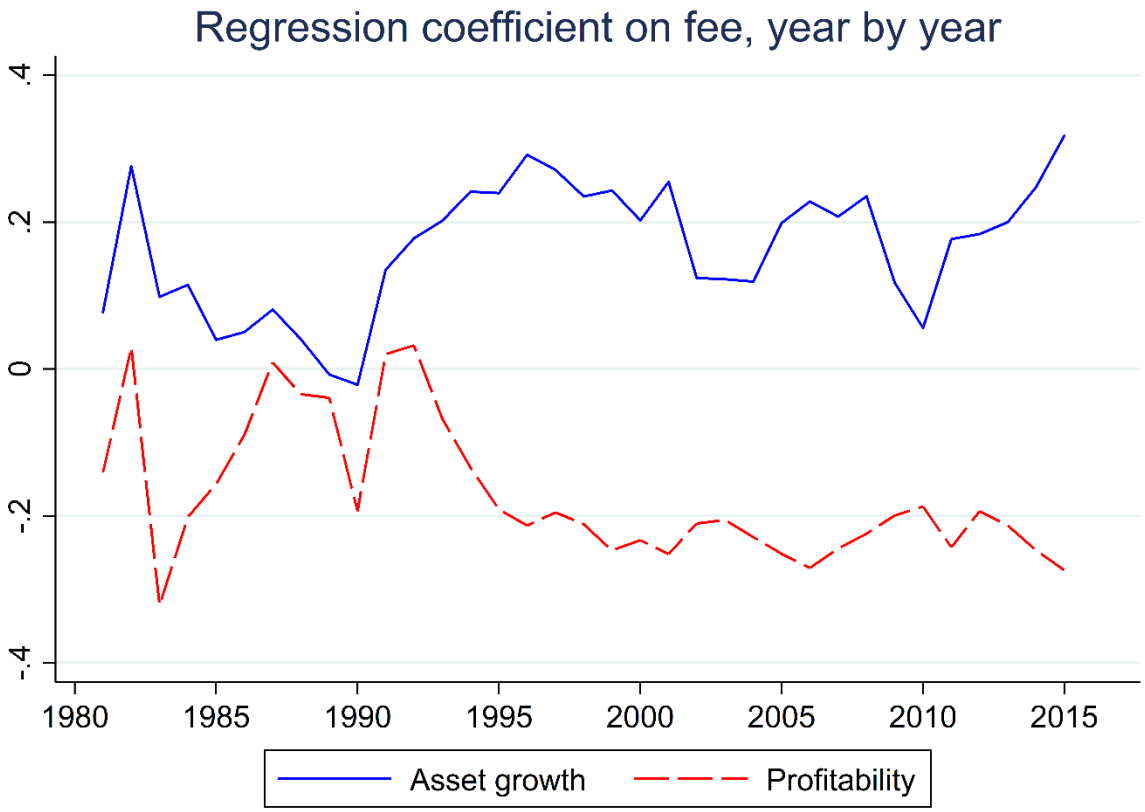

Figure 3: Mutual fund fee-performance relationship

This figure plots expected alphas, in percent per year, of funds grouped into deciles on the basis of expense ratio reported in the most recent fiscal year. We measure alpha with four benchmark models: the CAPM, the Fama-French three-factor, the Fama-French-Carhart four-factor, and the Fama-French five-factor. A fund's alpha in month *t* is the difference between the fund's excess return in month *t* and its expected return, calculated as the sum of the products of factor returns in *t* and factor loadings estimated from rolling regressions on five years of monthly data. Panel A plots the average before-fee alphas against the fee decile, and Panel B shows the corresponding plot for after-fee alphas. The sample period for alphas is from 1980-2017.

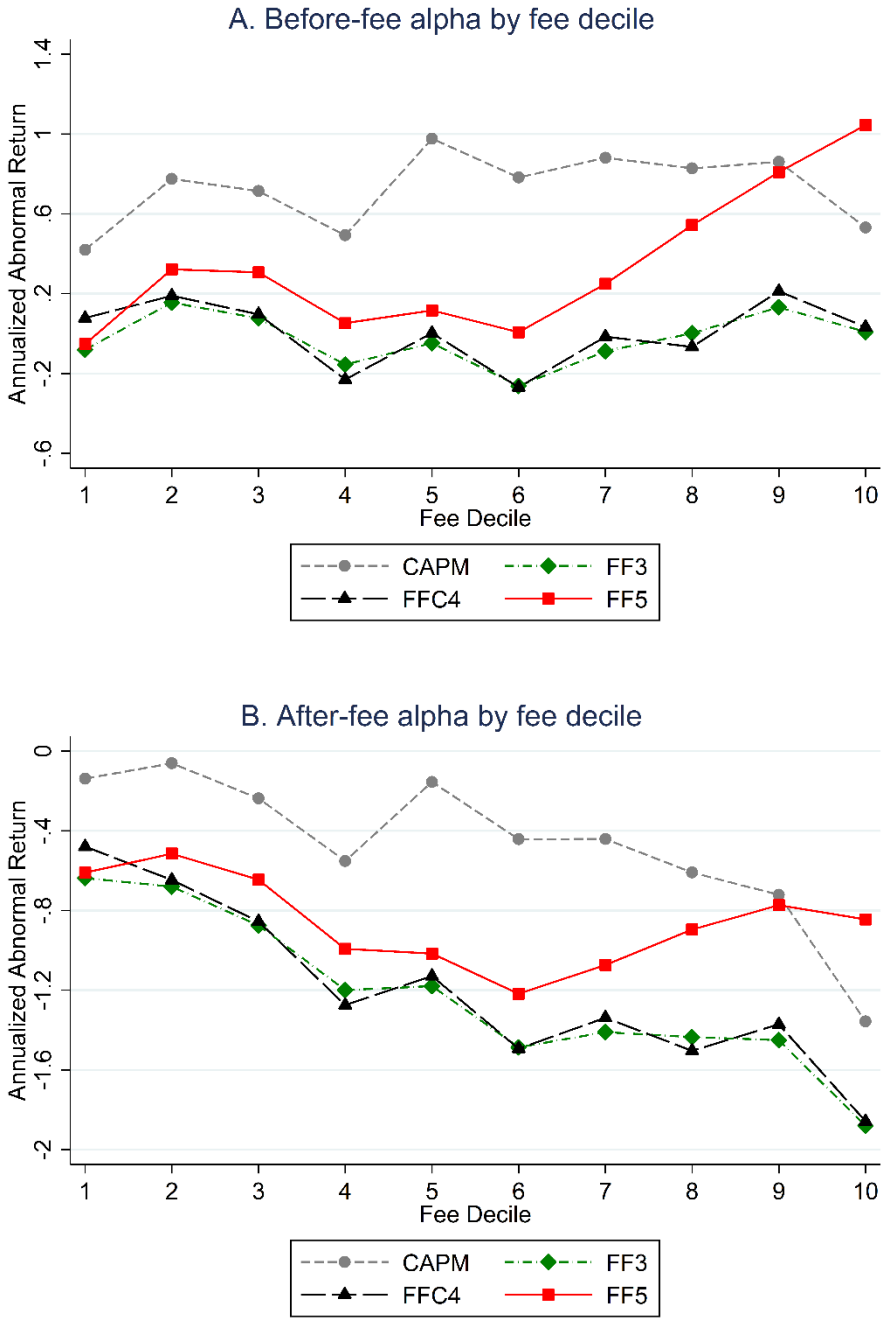

Table 1: Summary statistics for fund and portfolio characteristics

This table reports the summary statistics for fund characteristics (Panel A) and portfolio characteristics (Panel B). Fund size and fund family size are measured in nominal terms in millions. Broker-sold share is the estimated percentage of a fund's assets in share classes sold through brokers. Institutional share is the estimated percentage of a fund's assets in share classes sold to institutional investors. Detailed definitions are in the Appendix. The sample period is from 1980 to 2017.

	Mean	Median	SD	Min	p25	p75	Max
Panel A. Fund characteristics							
Expense ratio	1.22%	1.18%	0.44%	0.24%	0.95%	1.47%	2.92%
Fund size (million)	1,304	234	5,034	0	73	851	202,306
Fund age, years	10.3	8.7	7.7	0.1	4.2	14.9	38.0
Family size (million)	32,931	4,660	87,043	0	693	21,139	535,314
Turnover ratio	84%	63%	80%	3%	33%	107%	514%
Broker-sold share	49%	45%	45%	0%	0%	100%	100%
Institutional share	29%	5%	38%	0%	0%	61%	100%
12b-1 fee	0.18%	0.07%	0.23%	0.00%	0.00%	0.29%	1.25%
Panel B. Portfolios characteristics							
Stock age	12.9	8.6	13.9	0.1	3.3	17.3	89.1
CAPM beta	0.94	0.86	0.92	-1.55	0.37	1.41	4.06
Market cap	1,795	115	11,179	0	26	585	647,507
Book-to-market	0.80	0.61	0.73	0.04	0.33	1.01	4.46
Momentum	11%	5%	59%	-90%	-25%	35%	267%
Asset growth rate	13%	7%	38%	-83%	-3%	21%	182%
Operating probability	8%	19%	55%	-320%	4%	30%	120%
Equity issuance rate	5%	0%	14%	-18%	0%	3%	79%
Idiosyncratic volatility	4%	3%	3%	1%	2%	5%	15%
Tangibility	26%	18%	24%	0%	6%	39%	90%
Financial uncertainty	1.36%	1.37%	0.35%	0.62%	1.11%	1.62%	2.13%
Number of analysts	3	0	5	0	0	3	55

Table 2: Textual analysis of mutual fund prospectus

This table reports a textual analysis of fund prospectus. We extract the text of "Principal Investment Strategies" from 497K filings from EDGAR database and construct a "research index" by calculating the fraction of words that are research-related. The control variables used in Column (3) include fund size, fund age, and family size. Standard errors are clustered at the fund level. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) Research Index	(2) Research Index	(3) Research Index
Expense ratio$_t$	0.16***	0.13***	0.15***
	(4.91)	(3.41)	(3.87)
Constant	0.01***	-0.01***	-0.01***
	(23.90)	(-5.30)	(-6.14)
Observations	6,036	6,036	6,036
Adj. R^2	0.004	0.030	0.036
Controls	No	Yes	Yes
Year FEs	No	No	Yes

Table 3: Fund fees and characteristics of stock holdings

This table reports the results of panel regressions of the characteristics of a fund's stockholdings (shown in the column heading) on the fund's attributes lagged by one year. Characteristics of stockholdings are position-weighted averages across all stocks in a fund's portfolio. All variables are scaled by their cross-sectional standard deviations in each year. Regressions include year fixed effects. The sample period is from 1980 to 2015. Standard errors are clustered at the fund level. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) Beta	(2) B/M	(3) Size	(4) Momentum	(5) Asset growth	(6) Equity Issuance	(7) Profitability	(8) Stock age
Expense ratio$_{t-1}$	0.20***	-0.03	-0.20***	0.09***	0.19***	0.21***	-0.21***	-0.27***
	(14.43)	(-1.52)	(-11.25)	(7.33)	(13.68)	(17.01)	(-14.05)	(-16.05)
Log fund size$_{t-1}$	0.04***	0.00	0.09***	-0.02*	-0.01	0.01	0.01	0.01
	(2.68)	(0.21)	(4.79)	(-1.79)	(-0.83)	(1.18)	(0.34)	(0.69)
Log fund age$_{t-1}$	-0.03**	-0.06***	0.01	0.00	0.03**	-0.01	0.02	-0.00
	(-2.47)	(-3.73)	(0.90)	(0.13)	(2.48)	(-0.89)	(1.31)	(-0.18)
Log fund family size$_{t-1}$	0.06***	-0.03	-0.00	0.05***	0.07***	0.08***	-0.06***	-0.05***
	(3.88)	(-1.54)	(-0.12)	(3.57)	(4.77)	(6.37)	(-3.93)	(-3.06)
Observations	35,134	35,131	35,134	35,132	35,132	35,132	35,131	35,134
Adj. R^2	0.833	0.189	0.387	0.664	0.134	0.284	0.430	0.130
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Mutual fund fee-performance relation: Panel regressions

This table presents the results of panel regressions of fund alphas on expense ratios, both in percent per month, and other fund characteristics. Alphas are computed using the CAPM, the Fama-French three-factor model (FF3), the Fama-French-Carhart four-factor model (FFC4), and the Fama-French five-factor model (FF5). Alphas are calculated using factor loadings estimated from a five-year rolling window regression. In Panel A (B), alpha is computed using before-fee (after-fee) returns. Independent variables are measured as of the most recent fiscal year of the fund. All regressions include month fixed effects and cluster standard errors by month. The sample period is from 1980 to 2017. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) α_t^{CAPM}	(2) α_t^{FF3}	(3) α_t^{FFC4}	(4) α_t^{FF5}
Panel A. Before-fee alpha				
Expense ratio$_{t-1}$	-0.15	0.11	-0.07	1.08***
	(-0.26)	(0.31)	(-0.19)	(3.62)
Log fund size$_{t-1}$	-0.23***	-0.08	-0.11*	0.02
	(-3.38)	(-1.35)	(-1.91)	(0.29)
Log fund age$_{t-1}$	0.27*	0.21*	0.28**	0.13
	(1.81)	(1.72)	(2.35)	(1.11)
Log fund family size$_{t-1}$	0.06*	0.06**	0.05*	0.09***
	(1.88)	(2.31)	(1.70)	(3.13)
Observations	321,414	321,414	321,414	321,414
Adj. R^2	0.110	0.074	0.083	0.075
Month FE	Yes	Yes	Yes	Yes
Panel B. After-fee alpha				
Expense ratio$_{t-1}$	-1.09*	-0.83**	-1.01***	0.14
	(-1.93)	(-2.43)	(-2.78)	(0.46)
Log fund size$_{t-1}$	-0.23***	-0.07	-0.11*	0.02
	(-3.33)	(-1.29)	(-1.85)	(0.35)
Log fund age$_{t-1}$	0.27*	0.20*	0.27**	0.12
	(1.77)	(1.67)	(2.30)	(1.06)
Log fund family size$_{t-1}$	0.06*	0.06**	0.05*	0.09***
	(1.91)	(2.35)	(1.73)	(3.16)
Observations	321,414	321,414	321,414	321,414
Adj. R^2	0.110	0.074	0.083	0.074
Month FEs	Yes	Yes	Yes	Yes

Table 5: Fund fees and loadings on the investment and profitability factors

This table reports the results of panel regressions of funds' investment or profitability factors loadings in the beginning of each year on annual expense ratios and other fund characteristics. To obtain the loadings, we regress a fund's monthly before-fee return in the previous five years on Fama-French five-factor portfolios and use the coefficients as risk loadings. Control variables include the log of fund size, fund age (in months), and fund family size, measured from the most recent fiscal year, as well as contemporaneous loadings on market, size, and value factors. Regressions include year fixed effects. Standard errors are clustered at the fund level. The sample period is from 1980 to 2017. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) FF5 CMA factor loading	(2) FF5 RMW factor loading	(3) FF5 CMA factor loading	(4) FF5 RMW factor loading
Expense ratio$_{t-1}$	-1.15***	-1.60***	-0.78***	-1.32***
	(-7.68)	(-11.61)	(-5.37)	(-11.15)
Log fund size$_{t-1}$	-0.05	-0.03	-0.07**	-0.03
	(-1.63)	(-0.99)	(-2.44)	(-1.08)
Log fund age$_{t-1}$	-0.13	-0.08	-0.16**	-0.01
	(-1.63)	(-1.14)	(-2.08)	(-0.23)
Log fund family size$_{t-1}$	0.00	-0.08***	0.01	-0.06***
	(0.02)	(-6.39)	(0.47)	(-4.58)
FF5 market factor loading$_t$			-0.22***	-0.02
			(-7.22)	(-0.60)
FF5 HML factor loading$_t$			-0.03*	0.31***
			(-1.74)	(19.65)
FF5 SMB factor loading$_t$			-0.14***	-0.02**
			(-13.19)	(-2.06)
Observations	25,636	25,636	25,636	25,636
Adj. R^2	0.091	0.050	0.135	0.183
Year FEs	Yes	Yes	Yes	Yes

Table 6: Fee-performance relation and different fund characteristics

This table presents results of regressions of the monthly before-fee gross Fama-French Five-Factor alpha on the fund's monthly expense ratio and its interactions with fund characteristic dummies. For each of characteristics, i.e. fund size, age, family size, turnover ratio, institutional share, and broker share, we create a dummy variable to be 1 or 0 if the characteristic value is above or below the cross-sectional median. We also include other fund level control variables, which are the log of fund size, fund age (in months), and fund family size. All independent variables are measured as of the most recent fiscal year end of the fund. Regressions include month fixed effects and cluster standard errors by month. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
			α_t^{FF5}			
Expense ratio $_{t-1}$	1.39***	1.23***	1.24***	0.82***	0.94***	1.24**
	(4.58)	(4.07)	(3.36)	(3.28)	(2.84)	(2.55)
Size dummy$_{t-1}$	0.07**					
	(2.57)					
Expense ratio$_{t-1}$ × Size dummy$_{t-1}$	-0.76***					
	(-2.83)					
Age dummy$_{t-1}$		0.03				
		(1.13)				
Expense ratio$_{t-1}$ × Age dummy$_{t-1}$		-0.41*				
		(-1.68)				
Family size dummy$_{t-1}$			0.03			
			(1.28)			
Expense ratio$_{t-1}$ × Family size dummy$_{t-1}$			-0.33			
			(-1.16)			
Turnover dummy$_{t-1}$				-0.02		
				(-0.73)		
Expense ratio$_{t-1}$× Turnover dummy$_{t-1}$				0.42		
				(1.14)		
Institution dummy$_{t-1}$					-0.03	
					(-1.03)	
Expense ratio$_{t-1}$× Institution dummy$_{t-1}$					0.03	
					(0.10)	
Broker dummy$_{t-1}$						-0.00
						(-0.09)
Expense ratio$_{t-1}$× Broker dummy$_{t-1}$						-0.13
						(-0.36)
Observations	321,414	321,414	321,414	315,411	284,212	306,522
Adj. R^2	0.075	0.075	0.075	0.075	0.071	0.074
Fund level controls	Yes	Yes	Yes	Yes	Yes	Yes
Month FEs	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: after-fee performance of mutual funds conditional on holdings and fees

This table reports the Fama-French 5 factor alpha for portfolios of mutual funds sorted according to their holding characteristics and fees. In each year, we sort mutual funds into quintiles independently based on their expense ratio as of the most recent fiscal year-end and the characteristics of the prior year's holdings. For each portfolio, we compute the value-weighted average after-fee return using the prior month's fund size as weights. We then regress each portfolio's return on the five Fama-French factors to obtain its constant as abnormal return, i.e. alpha. We remove funds that are younger than 3 years. In Panel A, the holding characteristic is the average asset growth rate of stocks each fund holds. In Panel B, the holding characteristic is the average operating profitability of stocks each fund holds. Standard errors are (heteroskedasticity) robust standard errors. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: mutual funds sorted by stock asset growth rate and fees

		Fee					
		Low	2	3	4	High	**High-Low**
Asset growth	Low	-0.20***	-0.25***	-0.23***	-0.30***	-0.29***	-0.09
		(-3.71)	(-3.95)	(-3.55)	(-4.38)	(-4.36)	(-1.37)
	2	-0.16***	-0.10**	-0.21***	-0.20***	-0.22***	-0.06
		(-3.26)	(-2.16)	(-5.01)	(-4.11)	(-3.35)	(-0.96)
	3	-0.07*	-0.04	-0.13***	-0.17***	-0.09	-0.01
		(-1.86)	(-0.83)	(-2.91)	(-3.46)	(-1.19)	(-0.19)
	4	0.05	0.04	-0.03	-0.11*	-0.11*	-0.16***
		(1.11)	(0.76)	(-0.60)	(-1.85)	(-1.96)	(-2.82)
	High	0.08	0.08	-0.04	-0.01	0.01	-0.07
		(1.06)	(0.96)	(-0.51)	(-0.15)	(0.10)	(-1.12)
	High-Low	0.28***	0.32***	0.19*	0.28**	0.30***	
		(2.79)	(3.17)	(1.74)	(2.37)	(2.68)	

Panel B: mutual funds sorted by stock profitability and fees

		Fee					
		Low				High	**High-Low**
Profitability	Low	0.01	-0.10	-0.13*	-0.11	0.05	0.03
		(0.23)	(-1.07)	(-1.77)	(-1.54)	(0.65)	(0.43)
		-0.00	-0.06	0.00	-0.10	-0.01	-0.01
		(-0.02)	(-0.94)	(0.01)	(-1.44)	(-0.14)	(-0.10)
		-0.11**	-0.07	-0.12**	-0.12*	-0.15*	-0.04
		(-2.59)	(-1.23)	(-2.57)	(-1.86)	(-1.69)	(-0.46)
		-0.15***	-0.04	-0.08*	-0.13**	-0.16**	-0.01
		(-3.20)	(-0.80)	(-1.73)	(-2.30)	(-2.26)	(-0.11)
	High	-0.11**	-0.19***	-0.24***	-0.22***	-0.24***	-0.13**
		(-2.22)	(-3.40)	(-4.22)	(-4.13)	(-3.72)	(-2.19)
	High-Low	-0.13	-0.09	-0.11	-0.11	-0.28***	
		(-1.63)	(-0.78)	(-1.08)	(-1.25)	(-3.10)	

Table 8: Fund fees and characteristics of stock holdings: Investor sophistication

This table reports the results of panel regressions of the characteristics of a fund's stockholdings (shown in column heading) on the fund's expense ratio, a proxy of investor sophistication, and the interaction of the two, controlling for other fund level characteristics. All independent variables are measured at the most recent fiscal year. Characteristics of stockholdings are position-weighted averages across all stocks in a fund's portfolio. In Panel A, the proxy for investor sophistication is institutional share, which measures the fraction of a fund's asset from institutional share classes. In Panel B, the proxy for investor sophistication is broker share, which measures the fraction of a fund's asset from share classes that are sold through brokers. All independent variables are scaled by the cross-sectional standard deviation and de-meaned in each year. Regressions include year fixed effects and cluster standard errors at the fund level. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A. Institution share

	(1)	(2)	(3)	(4)
	Asset growth	Equity issuance	Profitability	Stock age
Expense ratio$_{t-1}$	0.23***	0.24***	-0.25***	-0.35***
	(13.76)	(16.39)	(-13.57)	(-17.28)
Institution share$_{t-1}$	0.08***	0.07***	-0.06***	-0.15***
	(4.56)	(4.72)	(-3.43)	(-7.24)
Expense ratio$_{t-1}$× Institution share$_{t-1}$	0.03	0.02	-0.01	-0.09***
	(1.57)	(1.53)	(-0.34)	(-4.68)
Log fund size$_{t-1}$	-0.01	0.02	-0.02	-0.01
	(-0.91)	(1.12)	(-1.15)	(-0.49)
Log fund age$_{t-1}$	0.05***	-0.00	0.01	-0.00
	(3.30)	(-0.02)	(0.87)	(-0.07)
Log fund family size$_{t-1}$	0.07***	0.08***	-0.06***	-0.05***
	(4.42)	(5.44)	(-3.62)	(-2.71)
Observations	26,730	26,731	26,729	26,732
Adj. R^2	0.140	0.294	0.358	0.134
Year FEs	Yes	Yes	Yes	Yes

Panel B. Broker share

	(1) Asset growth	(2) Equity issuance	(3) Profitability	(4) Stock age
Expense ratio$_{t-1}$	0.24***	0.24***	-0.26***	-0.35***
	(14.91)	(16.86)	(-14.07)	(-18.99)
Broker share$_{t-1}$	-0.06***	-0.03**	0.05***	0.11***
	(-3.88)	(-2.43)	(3.21)	(6.35)
Expense ratio$_{t-1}$× Broker share$_{t-1}$	-0.03**	-0.04***	0.06***	0.09***
	(-2.36)	(-3.71)	(3.95)	(5.53)
Log fund size$_{t-1}$	-0.01	0.02*	-0.00	-0.01
	(-0.39)	(1.67)	(-0.14)	(-0.27)
Log fund age$_{t-1}$	0.04***	-0.01	0.01	-0.01
	(2.64)	(-0.81)	(0.93)	(-0.40)
Log fund family size$_{t-1}$	0.07***	0.08***	-0.07***	-0.07***
	(5.13)	(6.31)	(-4.48)	(-3.72)
Observations	32,410	32,410	32,409	32,412
Adj. R^2	0.138	0.294	0.408	0.151
Year FEs	Yes	Yes	Yes	Yes

Table 9: Fund fees and characteristics of stock holdings: Valuation cost

This table reports the results of panel regressions of the characteristics of a fund's stockholdings (shown in the column heading) on the fund's attributes measured at the most recent fiscal year. Characteristics of stockholdings are position-weighted averages across all stocks in a fund's portfolio. All variables are scaled by their cross-sectional standard deviations and de-meaned in each year. Regressions include year fixed effects. Standard errors are clustered at the fund level. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

A. Expense ratio and valuation cost

	(1) Idiosyncratic volatility	(2) Financial uncertainty	(3) Asset tangibility	(4) Number of analysts
Expense ratio$_{t-1}$	0.28***	0.22***	-0.11***	-0.16***
	(16.99)	(13.66)	(-6.23)	(-8.82)
Log fund size$_{t-1}$	-0.02	0.00	-0.02	0.04**
	(-1.49)	(0.28)	(-1.08)	(2.22)
Log fund age$_{t-1}$	-0.02	-0.00	0.00	0.04**
	(-1.32)	(-0.06)	(0.18)	(2.39)
Log family size$_{t-1}$	0.05***	0.07***	0.02	0.03
	(3.13)	(4.52)	(0.94)	(1.64)
Observations	35,134	29,794	35,131	33,239
Adj. R^2	0.293	0.952	0.078	0.097
Year FEs	Yes	Yes	Yes	Yes

B. Asset management fee and valuation cost

	(1) Idiosyncratic volatility	(2) Financial uncertainty	(3) Asset tangibility	(4) Number of analysts
Expenses excluding 12b-1 fee$_{t-1}$	0.45***	0.32***	-0.17***	-0.30***
	(25.06)	(18.30)	(-9.09)	(-15.30)
12b-1 fee$_{t-1}$	-0.06***	-0.02	0.02	0.09***
	(-3.66)	(-1.43)	(0.77)	(5.31)
Log fund size$_{t-1}$	0.06***	0.05***	-0.05***	-0.02
	(3.45)	(3.07)	(-2.76)	(-1.35)
Log fund age$_{t-1}$	-0.03**	-0.00	0.01	0.05***
	(-2.02)	(-0.13)	(0.61)	(2.98)
Log family size$_{t-1}$	0.11***	0.12***	-0.01	-0.02
	(6.97)	(7.48)	(-0.24)	(-1.46)
Observations	32,412	29,794	32,409	32,412
Adj. R^2	0.317	0.953	0.039	0.133
Year FEs	Yes	Yes	Yes	Yes

Table 10: Robustness check about fund fees and characteristics of stock holdings

This table reports the results of panel regressions of the characteristics of a fund's stockholdings (shown in column heading) on the fund's attributes lagged fund expense ratio. Additional control variables include log of fund size, fund age (in months), and fund family size, all measured at the same time as the expense ratio. All variables are scaled by their cross-sectional standard deviations in each year. Control variables also include contemporaneous portfolio characteristics. Regressions include year fixed effects. Standard errors are clustered at the fund level. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) Asset growth	(2) Equity issuance	(3) Profitability	(4) Stock age
Expense ratio$_{t-1}$	0.07***	0.08***	-0.08***	-0.06***
	(10.01)	(8.86)	(-7.65)	(-7.49)
Avg. CAPM beta$_t$	0.07***	0.08***	-0.08***	-0.06***
	(10.01)	(8.86)	(-7.65)	(-7.49)
Avg. B/M ratio$_t$	(15.84)	(17.24)	(-20.81)	(-30.12)
	-0.52***	-0.03**	-0.21***	0.29***
Avg. market cap$_t$	(-41.90)	(-2.10)	(-13.21)	(24.13)
	-0.28***	-0.24***	0.39***	0.74***
Avg. momentum$_t$	(-29.37)	(-18.04)	(31.62)	(84.29)
	0.18***	0.20***	0.02	-0.05***
Observations	35,129	35,129	35,129	35,129
Adj. R^2	0.552	0.483	0.643	0.754
Fund level controls	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes

Table 11: Robustness of the mutual fund fee-performance relation

This table presents the results of regressions of fund alphas on lagged expense ratios, both in percent per month. Alphas are computed using the CAPM, the Fama-French three-factor model (FF3), the Fama-French-Carhart four-factor model (FFC4), the Fama-French five-factor model (FF5), Fama-French five-factor augmented with Carhart momentum factor model (FFC6), and Hou, Xue, and Zhang four-factor model (HXZ4). In Panel A, regressions are Fama-MacBeth regressions with expense ratio as the only independent variable and standard errors are adjusted for 4 lags of auto-correlation. In Panel B, the results are based on the 1998-2017 sample with fund level control variables and month fixed effects. Factor loadings for each fund in each month in both Panel A and B are based on five-year rolling regression windows. In Panel C, we measure factor loadings using three-year rolling window. Standard errors in Panel B and C are clustered at the month level. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Gross alpha						Net alpha		
	CAPM	FF3	FFC4	FF5	FFC6	HXZ4	CAPM	FF3	FFC4	FF5	FFC6	HXZ4
Panel A: Fama-MacBeth regression												
Expense ratio	-0.05	0.28	0.14	0.79**	0.56*	0.92**	-0.96*	-0.64**	-0.78***	-0.12	-0.35	0.01
	(-0.08)	(0.92)	(0.47)	(2.43)	(1.85)	(2.15)	(-1.71)	(-2.08)	(-2.70)	(-0.38)	(-1.17)	(0.02)
Panel B: sample period 1998 to 2017												
Expense ratio	-0.12	0.01	-0.13	1.06***	0.87***	0.72	-1.08*	-0.95**	-1.09***	0.10	-0.09	-0.24
	(-0.19)	(0.02)	(-0.31)	(3.18)	(2.74)	(1.41)	(-1.69)	(-2.47)	(-2.65)	(0.31)	(-0.29)	(-0.46)
Adjusted R-squared	0.106	0.074	0.084	0.075	0.086	0.060	0.105	0.074	0.085	0.075	0.086	0.060
Month FE and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C: three-year rolling window												
Expense ratio	0.33	0.57	0.18	1.32***	0.84**	1.30**	-0.61	-0.36	-0.75*	0.38	-0.09	0.37
	(0.45)	(1.43)	(0.47)	(3.44)	(2.59)	(2.31)	(-0.83)	(-0.91)	(-1.93)	(0.99)	(-0.28)	(0.65)
Adj. R^2	0.099	0.071	0.077	0.073	0.082	0.056	0.099	0.071	0.077	0.073	0.082	0.056
Month FEs and controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes