Unobserved Actions of Mutual Funds

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Despite extensive disclosure requirements, mutual fund investors do not observe all actions of fund managers. We estimate the impact of unobserved actions on fund returns using the return gap—the difference between the reported fund return and the return on a portfolio that invests in the previously disclosed fund holdings. We document that unobserved actions of some funds persistently create value, while such actions of other funds destroy value. Our main result shows that the return gap predicts fund performance. (*JEL* G11, G23)

Despite extensive disclosure requirements, mutual fund investors do not observe all actions of fund managers. For example, fund investors do not observe the exact timing of trades and the corresponding transaction costs. On the one hand, fund investors may benefit from unobserved interim trades by skilled fund managers who use their informational advantage to time the purchases and the sales of individual stocks optimally. On the other hand, they may bear hidden costs, such as trading costs, agency costs, and negative investor externalities. In this paper, we analyze the impact of unobserved actions on mutual fund performance.

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We measure the impact of unobserved actions by comparing the actual mutual fund performance with the performance of a hypothetical portfolio that invests in the previously disclosed fund holdings. We term this return difference the *return gap*. The impact of unobserved actions is included in the investor return but not in the return of the hypothetical portfolio. For example, commissions paid by mutual funds to their brokers or stale-price arbitrage losses do not directly affect the returns of the holdings, but they do adversely affect the returns to investors. On the other hand, the value-creating interim trades increase the disclosed fund return relative to the return of a hypothetical portfolio that invests in the previously disclosed holdings. As a result, the return gap is negatively related to the hidden costs and positively related to the hidden benefits of a mutual fund. Consequently, the return gap is a direct measure of the value added (or subtracted) by the fund manager relative to the previously disclosed holdings.

Analyzing monthly return data on more than 2500 unique U.S. equity funds over the period 1984–2003, we show that the average return gap is close to zero. In particular, the equally weighted return gap for all mutual funds in our sample equals 1.1 basis points per month, while the value-weighted return gap equals −1.0 basis points per month. These results indicate that the magnitude of unobserved actions is relatively small in the aggregate. Thus, fund managers' trades in the aggregate create sufficient value to offset trading costs and other hidden costs of fund management.

At the same time, we document a substantial cross-sectional variation in the return gap, indicating that hidden costs are more important for some funds, while hidden benefits are more pronounced for others. We also find strong persistence in the return gap for up to 5 years into the future, which suggests that the return gap is driven by systematic factors. Moreover, we find persistence in the return gap not only for the worst performers but also for the best performers.

Our main result shows that the past return gap helps to predict fund performance. Funds with high past return gaps tend to perform consistently better before and after adjusting for differences in their risks and styles. Specifically, the decile portfolio of funds with the highest lagged return gap yields an average excess return of 1.2% per year relative to the market return, whereas the decile portfolio of funds with the lowest return gap generates an average excess return of −2.2% per year. The return difference between the two portfolios is statistically and economically significant.[1]

[1] An extensive literature examines the performance of mutual funds based on either investor returns or holdings returns. Some papers on fund performance include Jensen (1968), Grinblatt and Titman (1989, 1993), Grinblatt, Titman, and Wermers (1995), Malkiel (1995), Gruber (1996), Ferson and Schadt (1996), Carhart (1997), Daniel, Grinblatt, Titman, and Wermers (1997), Chen, Jagadeesh, and Wermers (2000), Wermers (2000), Baks, Metrick, and Wachter (2001), Pástor and Stambaugh (2002), Mamaysky, Spiegel, and Zhang (2004, 2007), Cohen, Coval, and Pástor (2005), Kacperczyk, Sialm, and Zheng (2005), Kacperczyk and Seru (2007), Kosowski, Timmermann, White, and Wermers (2006), and Cremers and Petajisto (2006).

To mitigate the potential impact of measurement error on the returns to our trading strategy, we apply a filtering technique, proposed by Mamaysky, Spiegel, and Zhang (2005). In our sample this method leads to a substantial increase in the performance difference between the top and bottom deciles and allows us to identify mutual funds that significantly outperform passive benchmarks, even after taking into account fund expenses. We further confirm the relation between a fund's return gap and its subsequent performance using pooled regressions with clustered standard errors, controlling for other fund characteristics and time-fixed effects.

We also examine the determinants of the return gap. We find that estimated trading costs are negatively related to the return gap. Also, most funds in our sample exhibit relatively large correlations between the hypothetical holdings returns and the investor returns, indicating that their actual investment strategies do not differ significantly from their disclosed strategies. However, some funds have relatively low correlations between holdings and investor returns. Our findings indicate that such opaque funds tend to exhibit particularly poor return gaps, which suggests that these funds may be subject to more agency problems, inducing them to camouflage their actual portfolio strategies. Further, we show that the return gap is positively related to the recent initial public offering (IPO) holdings of a fund, consistent with the evidence in Gaspar, Massa, and Matos (2006) and Reuter (2006). Finally, the return gap is related to other fund attributes, such as size, age, and average new money growth (NMG).

One issue with using portfolio holdings to evaluate fund performance is that the disclosed data reveal information about the major equity positions at particular dates but do not indicate the exact purchase and sale dates. As a result, the exact holding period of securities is unknown. Furthermore, some funds may window-dress their portfolios to hide their actual investment strategy from their investors or from competing funds, as shown by Meier and Schaumburg (2004). Thus, studies analyzing only the returns of the disclosed holdings might be subject to significant measurement error, as they do not capture interim trades and various hidden costs. Our paper examines the difference between holdings and investor returns and argues that this difference captures important determinants of mutual fund performance that cannot be detected by merely considering holdings returns.

Several papers compare the reported fund returns to hypothetical fund returns on the basis of disclosed portfolio holdings. Grinblatt and Titman (1989) use the difference between investor and holdings returns to estimate the total transactions costs for mutual funds. They point out that interim trades within a quarter and possible window-dressing activities may affect the estimated difference. Wermers (2000) uses investor and holdings returns to decompose fund performance into stock-picking talent, style selection,

transactions costs, and expenses. Frank, Poterba, Shackelford, and Shoven (2004) study the performance of "copy-cat" funds, that is, funds that purchase the same assets as actively managed funds as soon as these asset holdings are disclosed. Using related differences between investor and holdings returns, Meier and Schaumburg (2004) investigate the prevalence of window dressing in the mutual fund industry. Bollen and Busse (2006) study changes in mutual fund trading costs following two reductions in the tick size of U.S. equities by comparing investor and holdings returns. Our work differs from the previous studies in that we propose the return gap as a performance measure that captures mutual funds' unobserved actions. Also, we analyze the cross-sectional properties of the funds' unobserved actions and investigate whether the return gap measure could predict fund performance. Finally, we document several fund characteristics that are related to these unobserved actions.

The rest of the paper proceeds as follows. Section 1 motivates the use of the return gap in assessing the scope of unobserved actions. Section 2 describes the data sources and provides summary statistics. Section 3 quantifies the return gap. Section 4 examines the impact of unobserved actions on future fund performance. Section 5 investigates the determinants of the return gap. Section 6 discusses the economic significance and robustness of the performance predictability. Section 7 concludes.

1. The Return Gap

To evaluate the impact of unobserved actions, we define the return gap, which is based on the comparison of the net investor return and the net return of the fund's holdings. This section describes the computation of the return gap.

The net investor return of fund f at time t (RF) is computed as the relative change in the net asset value of the fund shares (NAV), including the total dividend (D) and capital gains (CG) distributions.

$$RF_t^f = \frac{NAV_t^f + D_t^f + CG_t^f - NAV_{t-1}^f}{NAV_{t-1}^f}. \tag{1}$$

Fund managers subtract management fees and other expenses on a regular basis from the assets under management. Thus, these fees will reduce investors' total return, RF. On the other hand, we define the return of the fund's holdings (RH) as the total return of a hypothetical buy-and-hold portfolio that invests in the most recently disclosed stock positions.

$$RH_t^f = \sum_{i=1}^{n} \tilde{w}_{i,t-1}^f R_{i,t}. \tag{2}$$

The weights of the individual asset classes depend on the number of shares held by the fund at the most recent disclosure date at time $t - \tau (N^f_{i,t-\tau})$ and the stock price at the end of the previous month ($P_{i,t-1}$). Further, we adjust the number of shares and the stock prices for stock splits and other share adjustments.

$$\tilde{w}^f_{i,t-1} = \frac{N^f_{i,t-\tau} P_{i,t-1}}{\sum_{i=1}^{n} N^f_{i,t-\tau} P_{i,t-1}}. \tag{3}$$

We define the return gap (RG) as the difference between the net investor return and the net holdings return:

$$RG^f_t = RF^f_t - (RH^f_t - EXP^f_t). \tag{4}$$

Thus, the return gap captures the funds' unobserved actions, which include hidden benefits and hidden costs. An important hidden benefit results from a fund's interim trades, as discussed in Ferson and Khang (2002). Even though we can observe fund holdings only at specific points in time, funds may trade actively between these disclosure dates. If these interim trades create value, then the fund return RF will increase, while the return of the disclosed holdings RH will remain unaffected. For example, if a fund purchases a well-performing stock, then the abnormal return will only be reflected in the fund return but not in the holdings return until the stock position is disclosed. Also, if a fund obtains an IPO allocation, then the return gap will tend to be positive on the first trading day if the market price of a newly listed stock increases relative to its IPO allocation price. Finally, hidden benefits can result from other fund actions, such as security lending.

The other component of the unobserved actions is the fund's hidden costs, which include trading costs and commissions,[2] agency costs,[3] and investor externalities.[4] For example, funds that are subject to a higher price impact, or funds that are exposed to higher commissions, will have higher hidden costs.

It is impossible to fully disentangle the hidden benefits and costs. Therefore, the primary interest of this study is to gauge the overall impact

[2] See, for example, Livingston and O'Neal (1996), Chalmers, Edelen, and Kadlec (1999), Wermers (2000), and Karceski, Livingston, and O'Neal (2005) for studies of the trading costs of mutual funds. Mahoney (2004) describes the various costs in more detail.

[3] See, for example, Brown, Harlow, and Starks (1996), Chevalier and Ellison (1997), Carhart, Kaniel, Musto, and Reed (2002), Gaspar, Massa, and Matos (2006), Meier and Schaumburg (2004), Nanda, Wang, and Zheng (2004), and Davis and Kim (2007).

[4] See, for example, Edelen (1999), Dickson, Shoven, and Sialm (2000), Goetzmann, Ivkovic, and Rouwenhorst (2001), Greene and Hodges (2002), Zitzewitz (2003), Johnson (2004), and Nanda, Wang, and Zheng (2005).

of unobserved actions on fund performance. By analyzing the sign and the magnitude of the return gap, we can infer the relative importance of unobserved actions for a given fund.

2. Data and Summary Statistics

For our empirical analysis, we merge the Center for Research in Security Prices (CRSP) Survivorship Bias Free Mutual Fund Database with the Thompson Financial CDA/Spectrum holdings database and the CRSP stock price data following the methodology of Kacperczyk, Sialm, and Zheng (2005). Our sample covers the time period between 1984 and 2003. The CRSP mutual fund database includes information on fund returns, total net assets (TNA), different types of fees, investment objectives, and other fund characteristics. The CDA/Spectrum database provides stockholdings of mutual funds. The data are collected both from reports filed by mutual funds with the SEC and from voluntary reports generated by the funds. During most of our sample period, funds are required by law to disclose their holdings semiannually. Nevertheless, about 49% of funds in our sample disclose their holdings quarterly.[5] Another 4.6% of observations with valid CRSP data do not have available holdings data during the previous 6 months.[6] We also link reported stockholdings to the CRSP stock database.

To focus our analysis on open-end domestic equity mutual funds, for which the holdings data are most complete and reliable, we eliminate balanced, bond, money market, international, and sector funds, as well as funds not invested primarily in equity securities. We also exclude funds that hold fewer than 10 stocks and those which in the previous month managed less than $5 million. For funds with multiple share classes, we eliminate the duplicated funds and compute the fund-level variables by aggregating across the different share classes.[7] Appendix A provides further details on the sample selection.

Table 1 reports summary statistics of the main fund attributes. Our sample includes 2543 distinct funds and 211,001 fund-month observations.

[5] Ge and Zheng (2005) investigate both the determinants and potential effects of portfolio disclosure frequency by comparing funds that provide quarterly voluntary disclosure with funds that provide only semiannual disclosure.

[6] We also compute hypothetical portfolio returns on the basis of the future holdings. We find that these forward-looking holdings returns are, on average, about 3% per year higher than the backward-looking holdings returns, mostly because many mutual funds tend to invest in stocks that recently performed well either because they follow momentum strategies or because they window-dress their portfolios toward recent winners. We also find that the forward-looking holdings return is less correlated with the reported return than the backward-looking holdings return. This indicates that the backward-looking return is a better proxy for the effective fund holdings than the forward-looking return. We do not analyze the forward-looking holdings return because of these look-ahead biases.

[7] For most variables, we use a value-weighted average for the fund-level observation. For fund age, we use the oldest of all share classes.

Table 1
Summary statistics

	Mean	Median	Standard deviation
Number of distinct mutual funds	2543		
Number of fund-month observations	211,001		
Number of funds per month	879	720	
Proportion of index funds (in %)	4.53		
Proportion of load funds (in %)	54.22		
TNA (total net assets) (in millions)	952	166	3,771
Age	13.49	8	13.98
Expense ratio (in %)	1.24	1.20	0.44
Turnover ratio (in %)	88.06	65.00	103.51
Mean of prior-year new money growth (in % per month; winsorized)	2.50	0.35	9.45
Mean investor return (in % per month)	0.85	1.15	5.79
Standard deviation of investor returns over prior year (in % per month)	5.27	4.87	2.48
Proportion invested in stocks (in %)	93.16	95.22	7.72
Proportion invested in cash (in %)	5.51	3.81	6.51
Proportion Invested in bonds (in %)	0.75	0	2.55
Proportion invested in preferred stocks (in %)	0.24	0	1.91
Proportion invested in other securities (in %)	0.33	0	2.60
Difference in TNA after adjusting for nonstock holdings (in %)	8.33	3.73	17.64
Trading costs per year (in %)	0.58	0.36	0.66
Weight of recent IPOs divided by length of disclosure period (in %)	0.22	0.01	0.49
Correlation between holdings and investor returns (in %)	97.96	99.11	5.06
Value of trades relative to market capitalization (in %)	0.28	0.11	0.45
Size score (score ranging between 1–5 using size quintiles)	4.05	4.44	0.97
Value score (score ranging between 1–5 using book-to-market quintiles)	2.58	2.57	0.51
Momentum score (score ranging between 1–5 using momentum quintiles)	3.33	3.29	0.61

This table presents the summary statistics for the sample of equity mutual funds over the period 1984 to 2003.

The number of funds ranges from 244 (January 1984) to 1816 (April 2002). The vast majority of mutual funds in our sample (95.47%) are actively managed.[8]

We report summary statistics on fund TNA, age, expenses, turnover, returns, and NMG. We define NMG as the growth rate of the assets under management (TNA) after adjusting for the appreciation of the mutual fund's assets (RF_t), assuming that all the cash flows are invested at the end of the period.[9]

$$NMG_t^f = \frac{TNA_t^f - TNA_{t-1}^f(1 + RF_t)}{TNA_{t-1}^f}. \tag{5}$$

[8] We identify index funds by their names using the CRSP mutual fund data set.

[9] Until 1990, the TNA was available only at a quarterly frequency. In this case, we compute the quarterly NMG and divide it equally across the 3 months in each quarter. We winsorize this variable at the 1% level to diminish the impact of extreme outliers.

Table 1 reports that our mutual funds, on average, invest 93.16% of their assets in stocks and considerably less in cash or cash equivalents (5.51%). Finally, the percentage holdings of bonds (0.75%), preferred stocks (0.24%), and other assets (0.33%) are relatively small.

The holdings database includes only common stock positions and excludes other nonequity holdings. To adjust fund holding returns for the returns on the various asset classes, we proxy for these assets' returns using published indices. For bonds we use the total return of the Lehman Brothers Aggregate Bond Index, while for cash holdings we use the Treasury bill rate.[10] No reliable index returns are available for preferred stocks and for other assets. Thus, we assume that the return on preferred stocks equals the return of the Lehman Brothers Aggregate Bond Index, and the return on other assets equals the Treasury bill rate.[11]

Table 1 also summarizes additional variables that we use as explanatory variables. Owing to size requirements, confidentiality considerations, and matching issues, the CDA holdings do not represent all the mutual fund equity securities holdings. In particular, small positions and foreign stocks might be unavailable. To investigate whether these coverage limitations pose a substantial concern, we compute the difference between the TNAs reported in the CRSP database (which includes the complete holdings) and in the CDA/Spectrum database (which includes only the reported stock holdings). The absolute difference between the two TNA values, on average, equals 8.33% of the average TNA after adjusting for nonequity holdings.[12] Thus, the sample represents the vast majority of the equity holdings.

To investigate the relation between the return gap and trading costs, we follow Wermers (2000) and estimate the funds' trading costs based on Keim and Madhavan (1997). In Appendix B, we describe in more detail the procedure used to estimate trading costs. We estimate average execution costs of 5.8 basis points per month or about 0.70% per year. The magnitude of our trading costs is consistent with the magnitude of trading costs estimated by Chalmers, Edelen, and Kadlec (1999), which combines spread costs and commission costs for a sample of 132 funds between 1984 and 1991. In particular, for a comparable period between 1984 and 1991

[10] Data on the Lehman Brothers Aggregate Bond Index are obtained from Datastream, and the risk-free interest is obtained from French's Web site: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french.

[11] The results remain qualitatively unchanged if we calculate the implied returns on different asset classes in each month by regressing the return of a fund on the weights invested in the five asset classes (equity, bonds, preferred stocks, cash, and other). The coefficients are estimates of the monthly imputed returns of the different asset classes. We find that these imputed returns are highly correlated with the returns of the corresponding index returns.

[12] The percentage deviation in the TNAs is defined as $Perc_{TNA} = \frac{|TNA_{CRSP} - TNA_{CDA}|}{0.5(TNA_{CRSP} + TNA_{CDA})}$. We divide the absolute difference in TNAs by the average TNA to reduce the impact of substantial outliers.

we obtain trading costs of 0.72% as compared to 0.78% documented in their study.

Another variable we consider is the funds' IPO allocations. Although we do not know which funds obtain IPO allocations directly, we observe stocks that go public and are subsequently held by mutual funds. On each disclosure date, we compute for each fund the weight of companies that recently went public. The funds might have obtained these stocks through an IPO allocation or they might have obtained them on the open market subsequent to the IPO. On average, mutual funds acquire in each month common stocks of recent IPOs accounting for 0.22% of their TNA. The median proportion of IPO stockholdings is close to zero, and a relatively small fraction of funds accounts for most of the IPO holdings.

To measure the transparency of a fund, we compute the correlation coefficient between monthly holdings returns and investor returns during the previous year. Funds with a lower correlation coefficient between holdings and investor returns tend to follow investment strategies that are more opaque. Investigating unobserved actions of these funds is thus particularly insightful. We find that the average correlation coefficient between holdings and investor returns equals 97.96 percent.

To obtain a proxy of a fund's market impact, we compute the relative trade size, defined as the average ratio of the absolute dollar trading amount over the market capitalization of a particular stock, weighted by the trade size. On average, funds trade during each disclosure period just 0.28% of the shares outstanding of a company.

The last three rows of Table 1 summarize holdings-based style characteristics for the mutual funds in our sample. We follow Kacperczyk, Sialm, and Zheng (2005) and group fund holdings according to their size, value, and momentum characteristics. Each stock listed in CRSP is grouped into respective quintiles according to its market value, its book-to-market ratio, and its lagged 1-year return. Using the quintile information, we compute the value-weighted size, value, and momentum scores for each mutual fund in each period.[13] For example, a mutual fund that invests only in stocks in the smallest size quintile would have a size score of 1, while a mutual fund that invests only in the largest size quintile would have a size score of 5.

3. Quantifying the Return Gap

In this section, we quantify the aggregate return gap between 1984 and 2003 and discuss the short- and long-term persistence of the return gap.

[13] We form the book-to-market and the momentum quintiles by dividing the stocks equally into the five groups. On the other hand, we form the size quintiles by using cut-offs from the NYSE only.

Table 2
Performance of investor and holdings returns

	Investor return	Holdings return	Return gap
Panel A: Equal-weighted returns			
Raw return	1.014***	1.003***	0.011
	(0.305)	(0.305)	(0.009)
CAPM alpha	−0.064	−0.077	0.012
	(0.056)	(0.056)	(0.010)
Fama–French alpha	−0.057	−0.062	0.005
	(0.044)	(0.045)	(0.009)
Carhart alpha	−0.068	−0.071	0.002
	(0.045)	(0.046)	(0.009)
Panel B: Value-weighted returns			
Raw return	0.988***	0.998***	−0.010
	(0.294)	(0.295)	(0.012)
CAPM alpha	−0.075**	−0.067**	−0.009
	(0.032)	(0.033)	(0.012)
Fama–French alpha	−0.064**	−0.045	−0.019*
	(0.031)	(0.032)	(0.011)
Carhart alpha	−0.072**	−0.051	−0.021*
	(0.032)	(0.033)	(0.012)

This table summarizes the monthly investor returns, the holdings returns after subtracting expenses, and the return gaps for the equal- and value-weighted portfolio of all funds in our sample over the period 1984 to 2003. The return gap has been defined as the difference between the investor return and the holdings return of the portfolio disclosed in the previous period. The holdings return is reported after subtracting fund expenses. We report the raw returns, the one-factor alpha of Jensen (1968), the three-factor alpha of Fama and French (1993), and the four-factor alpha of Carhart (1997). The returns are expressed in percent per month and the standard errors are summarized in parentheses.The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

3.1 Aggregate return gap

Table 2 presents the equal- and value-weighted averages of the return gaps for our sample. We obtain the returns by first computing the cross-sectional means in each month and then reporting the time-series means along with the corresponding standard errors.

The average investor return, reported in Panel A, is equal to 1.014% per month or about 12.17% per year. On the other hand, the average return of a portfolio that invests in the previously disclosed holdings amounts to 1.003% per month or 12.03% per year. Thus, the return gap equals 1.1 basis points per month and is not significantly different from zero. Likewise, if we use value-weighted portfolio returns, the average return gap equals −1.0 basis points per month and again is not statistically significantly different from zero, as reported in Panel B. In summary, we find that, in the aggregate sample, the return gap is very small, which is equivalent to saying that hidden costs are similar in magnitude to hidden benefits. This result indicates that fund managers, on average, have investment ability

that creates sufficient value to offset trading costs and other hidden costs, as suggested by several mutual fund studies (e.g., Berk and Green 2004).

To further examine whether the return gap is correlated with any risk or style factors, we report in Table 2 the return gap based on abnormal returns after adjusting for the factor loadings using the one-factor capital asset pricing model (CAPM), the Fama and French (1993) three-factor model, and the Carhart (1997) four-factor model. The Carhart model has the following general specification:

$$R_{i,t} - R_{F,t} = \alpha_i + \beta_{i,M}(R_{M,t} - R_{F,t}) + \beta_{i,SMB}SMB_t + \beta_{i,HML}HML_t + \beta_{i,MOM}MOM_t + e_{i,t}, \quad (6)$$

where the dependent variable is the monthly return on portfolio i in month t minus the risk-free rate, and the independent variables are given by the returns of the following four zero-investment factor portfolios. The term $R_{M,t} - R_{F,t}$ denotes the excess return of the market portfolio over the risk-free rate, SMB is the return difference between small and large capitalization stocks, HML is the return difference between high and low book-to-market stocks, and MOM is the return difference between stocks with high and low past returns.[14] The intercept of the model, α_i, is Carhart's measure of abnormal performance. The CAPM uses only the market factor, and the Fama and French model uses the first three factors.

On the basis of the results in Table 2, we conclude that the return gap is not affected by the adjustment for common risk or style factors. Using the four-factor Carhart (1997) model, we obtain an abnormal equal-weighted return gap of 0.2 basis points per month, which is not significantly different from zero.[15]

3.2 Persistence of the return gap

Many features of the unobserved actions indicate that such actions should be persistent. For example, if a fund's governance is weak in one period because of stale-price arbitrage (Zitzewitz 2003) or cross-subsidization (Gaspar, Massa, and Matos 2006), it is likely to remain poor in the next period. To test whether the return gap is persistent, we sort all funds in our sample into deciles according to their lagged return gap during the previous 12 months and compute the average return gap during the subsequent month by weighting all funds in each decile equally. Table 3 reports the raw and the abnormal four-factor return gaps of the decile

[14] The factor returns are taken from Kenneth French's Web site: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library.

[15] We do not obtain significant coefficients on the market and momentum factors. However, the size and book-to-market betas are statistically significantly positive, but the economic magnitude of the coefficient estimates is small. Both coefficients equal just 0.014, indicating that the actual mutual funds have a slightly higher exposure to small and value stocks than their previously disclosed holdings.

Table 3
Persistence of the return gap

	Raw return gap			Abnormal return gap using four-factor model		
	1 Year	3 Years	5 Years	1 Year	3 Years	5 Years
1. Decile (lowest RG)	−0.113*** (0.026)	−0.122*** (0.024)	−0.113*** (0.027)	−0.088*** (0.025)	−0.113*** (0.022)	−0.100*** (0.026)
2. Decile	−0.026 (0.020)	−0.040*** (0.014)	−0.055*** (0.020)	−0.015 (0.020)	−0.041*** (0.015)	−0.063*** (0.021)
3. Decile	−0.019 (0.011)	−0.024 (0.022)	−0.028** (0.013)	−0.017 (0.011)	−0.024 (0.023)	−0.028** (0.013)
4. Decile	−0.015 (0.010)	−0.016 (0.012)	−0.022* (0.012)	−0.024*** (0.009)	−0.018 (0.012)	−0.018 (0.012)
5. Decile	−0.008 (0.009)	−0.002 (0.011)	−0.010 (0.012)	−0.015 (0.010)	−0.012 (0.012)	−0.013 (0.012)
6. Decile	0.001 (0.011)	−0.001 (0.010)	−0.006 (0.012)	−0.013 (0.011)	−0.009 (0.010)	−0.013 (0.012)
7. Decile	−0.003 (0.012)	−0.013 (0.012)	−0.005 (0.014)	−0.016 (0.012)	−0.024** (0.012)	−0.019 (0.014)
8. Decile	0.018 (0.014)	0.029** (0.012)	0.020 (0.017)	0.002 (0.014)	0.013 (0.012)	−0.004 (0.016)
9. Decile	0.049*** (0.016)	0.053*** (0.019)	0.050* (0.028)	0.025* (0.015)	0.023 (0.018)	0.040 (0.030)
10. Decile (highest RG)	0.154*** (0.033)	0.111*** (0.025)	0.122*** (0.023)	0.116*** (0.031)	0.078*** (0.023)	0.088*** (0.022)
Decile 10—Decile 1	0.268*** (0.043)	0.234*** (0.031)	0.235*** (0.033)	0.204*** (0.040)	0.191*** (0.028)	0.188*** (0.031)
Second half—First half	0.080*** (0.016)	0.077*** (0.012)	0.082*** (0.012)	0.055*** (0.015)	0.058*** (0.011)	0.063*** (0.012)
Spearman correlation	0.988*** (0.000)	0.964*** (0.000)	1.000*** (0.000)	0.839*** (0.002)	0.906*** (0.000)	0.924*** (0.000)

This table reports the means and the standard errors (in parentheses) of the monthly return gaps for decile portfolios of mutual funds sorted by their average lagged return gaps during the previous 1, 3, and 5 years over the period 1984 to 2003. The return gap is defined as the difference between the reported return and the holdings return of the portfolio disclosed in the previous period. The first three columns summarize the raw return gaps, and the last three columns show the four-factor abnormal return gaps following Carhart (1997). The returns are expressed in percent per month. The table also calculates the differences in the return gaps between the top and the bottom deciles and the top and the bottom halves, along with the Spearman rank correlations and the corresponding *p*-values in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

portfolios formed according to the average return gaps during the previous 1-, 3-, and 5-year intervals. The first column shows that funds in the worst return gap decile, based on the previous 12 months, generate an average return gap of −11.3 basis points in the subsequent month. On the other hand, funds in the best return gap decile generate a return gap of 15.4 basis points. The difference in the return gaps between the two extreme deciles is economically and statistically significant, as is the difference between the top five and the bottom five deciles. Furthermore, the average return gaps line up almost monotonically.

In the second and the third columns, we show that the persistence pattern remains similar if we sort funds according to their average return

gaps during the prior 36 and 60 months. The last three columns indicate that the persistence findings remain unchanged even if we adjust the return gaps for the four factors of Carhart (1997).[16]

To provide evidence on the long-term stability of the observed patterns, we also track the return gap's persistence over the subsequent 5 years. Figure 1 depicts the future return gaps for decile portfolios formed according to the average return gaps during the 12 months prior to the portfolio formation. Panel A reports the raw return gaps, while Panel B additionally adjusts the gaps for common factors in stock returns using the Carhart (1997) model. The figure demonstrates that the raw return gap is also remarkably persistent over a longer time period. The ranking of the decile portfolios in the year after the formation period remains identical to that in the formation period. Consistent with the prediction in Berk and Green (2004), we find some evidence for reversion toward the mean for the extreme deciles. However, both top and bottom performers remain persistent over the longer term.[17]

Carhart (1997) shows that performance persistence is not significant for well-performing funds after accounting for momentum effects.[18] We find that the abnormal return gap, however, remains persistent in both tails of the return gap distribution even after controlling for momentum and other common factors in stock returns. We argue that by measuring the investor returns relative to the holdings returns we filter out the impact of common shocks to both returns and therefore are able to focus on a component of fund returns that has a higher signal-to-noise ratio.

4. Predictability of Fund Performance

In this section, we test whether unobserved actions contain valuable information that can predict fund performance. Given that the return gap is a persistent phenomenon, we should expect that funds with higher return gaps outperform funds with lower return gaps.

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[16] Persistent return gaps might result just because of persistent differences in the disclosure frequencies of mutual funds. However, this potential problem does not appear to affect our persistence results. We continue to find significant levels of persistence if we consider only funds that disclosed their holdings within the last 3 months and ignore funds that did not disclose their holdings during the last 3 months.

[17] The return gaps in the first period after the portfolio formation differ between Figure 1 and Table 3 because they cover a different estimation window. While in Figure 1 we calculate the average return gap over the whole *year* after the portfolio formation, in Table 3 we report the monthly return gap in the *month* after the portfolio formation to avoid overlapping observations. For example, funds in the top return gap decile based on the previous 12 months have an average return gap of 15.4 basis points during the first month after the portfolio formation (Table 3) and an average monthly return gap of 12.1 basis points during the first year after the portfolio formation (Figure 1).

[18] See Hendricks, Patel, and Zeckhauser (1993), Brown and Goetzmann (1995), Elton, Gruber, and Blake (1996), Carhart (1997), Bollen and Busse (2005), and Mamaysky, Spiegel, and Zhang (2005) for studies on the persistence of mutual fund performance.

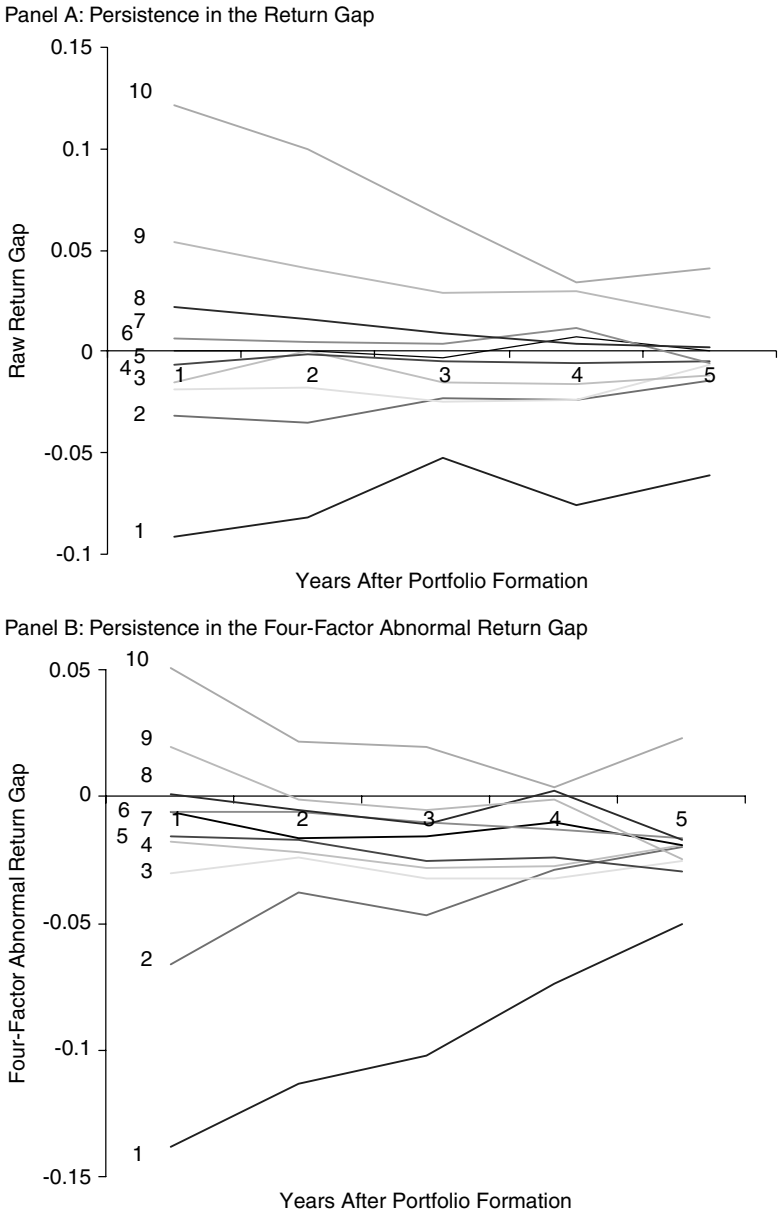

Figure 1
Persistence of the return gap
This figure depicts the average monthly return gap of portfolios tracked over a 5-year period between 1984 and 2003. The return gap is defined as the difference between the net investor return and the holdings return of the portfolio disclosed in the previous period and is expressed in percent per month. The portfolios are formed by sorting all the funds into deciles according to their initial return gap during the previous year. Subsequently, each portfolio is tracked over the next 5-year period. In Panel A, we report the raw return gap, and in Panel B we report the return gap adjusted for the four-factor Carhart (1997) model.

4.1 Trading strategies based on the return gap

Our first predictability test examines the performance of a trading strategy based on the past return gap. Specifically, we sort all funds in our sample into deciles according to their average monthly return gap during the previous 12 months. We then compute for each month the average subsequent return by weighting all the funds in a decile equally.

Since the holdings of the funds are not immediately publicly available, we introduce a 3-month lag in the return gap before implementing the trading strategy. This implies that the return of the decile-10 portfolio in January 2003 is based on the 10% of funds that had the highest return gaps between October 2001 and September 2002. This allows for at least a 4-month window for the holdings information to become public. Including this additional implementation lag does not affect the profitability of the trading strategy substantially since the return gap is relatively persistent.

In Table 4, we report the risk- and style-adjusted fund returns for each decile portfolio. Funds in decile 1 have an average return gap of −59.8 basis points per month during the formation period, whereas funds in decile 10 have an average return gap of 65.7 basis points per month during the formation period.

The first six performance measures are based on the investor returns, and the last two measures are based on the holdings returns. The first column reports excess returns of the deciles relative to the market portfolio. The next five columns report the intercepts from a time-series regression based on the one-factor CAPM, the three-factor model of Fama and French (1993), the four-factor model of Carhart (1997), the conditional four-factor model of Ferson and Schadt (1996),[19] and the five-factor model of Pástor and Stambaugh (2003).[20] The two holdings-based performance measures are the selectivity measure (CS) of Daniel, Grinblatt, Titman, and Wermers (DGTW) (1997) and the benchmark-free performance measure (GT) of Grinblatt and Titman (1993).[21]

[19] For the Ferson and Schadt (1996) conditional model, we regress the return of a portfolio of mutual funds on the four factors of Carhart (1997) and interaction terms between the four factors and five demeaned lagged macroeconomic variables (the 1-month Treasury bill yield, the dividend yield of the S&P 500 Index, the Treasury yield spread [long- minus short-term bonds], the quality spread in the corporate bond market [low- minus high-grade bonds], and an indicator variable for the month of January).

[20] Pástor and Stambaugh (2003) show that expected stock returns are related cross-sectionally to the sensitivities of returns to fluctuations in aggregate liquidity. We introduce a liquidity factor to capture such an effect, in addition to the market, size, book-to-market, and momentum factors. The liquidity factor is obtained through WRDS.

[21] We obtain the benchmark returns for the DGTW performance measures from Russ Wermers's Web site at http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm. The procedure for benchmark assignment is described on page 7 of Wermers (2004), and is a slight modification to the original assignments in Daniel, Grinblatt, Titman, and Wermers (1997).

Table 4
Portfolio returns based on the return gap

	Excess return	CAPM alpha	Fama French alpha	Carhart alpha	Pástor Stambaugh alpha	Ferson Schadt alpha	DGTW selectivity measure	GT performance measure
1. Decile:	−0.183*	−0.246**	−0.164***	−0.199***	−0.196***	−0.191***	0.065	0.195*
Mean: −0.598	(0.098)	(0.095)	(0.061)	(0.062)	(0.062)	(0.061)	(0.061)	(0.107)
2. Decile	−0.090	−0.118*	−0.110**	−0.123**	−0.110**	−0.093*	0.050	0.124
Mean: −0.245	(0.062)	(0.061)	(0.053)	(0.054)	(0.052)	(0.050)	(0.043)	(0.087)
3. Decile	−0.064	−0.051	−0.082*	−0.061	−0.047	−0.063*	0.054	0.126*
Mean: −0.137	(0.051)	(0.052)	(0.048)	(0.049)	(0.046)	(0.037)	(0.037)	(0.072)
4. Decile	−0.062	−0.044	−0.084*	−0.066	−0.052	−0.073**	0.045	0.090
Mean: −0.070	(0.049)	(0.049)	(0.047)	(0.048)	(0.046)	(0.035)	(0.033)	(0.063)
5. Decile	−0.066	−0.032	−0.090*	−0.059	−0.042	−0.067*	0.033	0.066
Mean: −0.019	(0.053)	(0.052)	(0.049)	(0.050)	(0.046)	(0.035)	(0.033)	(0.058)
6. Decile	−0.018	0.013	−0.032	−0.012	0.003	−0.027	0.053*	0.075
Mean: 0.026	(0.051)	(0.049)	(0.048)	(0.049)	(0.046)	(0.033)	(0.031)	(0.060)
7. Decile	−0.053	−0.037	−0.080	−0.069	−0.049	−0.077 *	0.042	0.127*
Mean: 0.078	(0.058)	(0.058)	(0.056)	(0.057)	(0.052)	(0.041)	(0.039)	(0.068)
8. Decile	−0.064	−0.063	−0.086*	−0.083	−0.065	−0.087**	0.025	0.110
Mean: 0.149	(0.058)	(0.059)	(0.051)	(0.052)	(0.048)	(0.040)	(0.039)	(0.077)
9. Decile	0.029	−0.003	0.022	−0.019	−0.008	0.026	0.091*	0.200**
Mean: 0.266	(0.082)	(0.082)	(0.056)	(0.056)	(0.055)	(0.052)	(0.048)	(0.098)
10. Decile:	0.101	0.012	0.156**	0.025	0.026	0.068	0.125*	0.322**
Mean: 0.657	(0.151)	(0.148)	(0.078)	(0.071)	(0.071)	(0.072)	(0.075)	(0.140)
Decile 10—	0.284***	0.259***	0.321***	0.225***	0.222***	0.258***	0.060*	0.127**
Decile 1	(0.078)	(0.078)	(0.059)	(0.054)	(0.054)	(0.053)	(0.038)	(0.055)
Second half—	0.092***	0.083***	0.102***	0.070***	0.071***	0.078***	0.018	0.047**
First half	(0.032)	(0.032)	(0.025)	(0.024)	(0.024)	(0.023)	(0.015)	(0.021)
Spearman	0.839***	0.697**	0.794***	0.649**	0.685**	0.661**	0.103	0.297
correlation	(0.002)	(0.025)	(0.006)	(0.042)	(0.029)	(0.038)	(0.770)	(0.405)

This table reports the mean monthly returns and the corresponding standard errors (in parentheses) for deciles of mutual funds sorted according to the lagged 1-year return gap over the period 1984 to 2003. The return gap is lagged for one additional quarter to account for the possible delay in reporting the holdings. The return gap is defined as the difference between the investor fund return and the return based on the previous holdings. In the first column we report the mean lagged return gap for the decile portfolios. We use the excess return over the market, the one-factor alpha of Jensen (1968), the three-factor alpha of Fama and French (1993), the four-factor alpha of Carhart (1997), the five-factor model of Pástor and Stambaugh (2003), and the Ferson and Schadt (1996) conditional measure based on the four-factor model to measure fund performance. Moreover, we report the Characteristic Selectivity (CS) measure of Daniel, Grinblatt, Titman, and Wermers (1997), and the Grinblatt and Titman (1993) performance measure. The returns are expressed in percent per month. The table also reports the differences in the return gaps between the top and the bottom deciles and the top and the bottom halves, along with the Spearman rank correlations and the corresponding *p*-values in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

We observe that funds with the least favorable past return gaps (decile 1) tend to significantly underperform funds with the most favorable past return gaps (decile 10). Investing in decile-10 funds would have generated an additional excess return of 28.4 basis points per month or about 3.41% per year compared to investing in decile-1 funds. The relation between past return gap and future performance is highly monotonic, which is confirmed by the Spearman rank correlation. Our results are not influenced substantially by the variation in risk or style factors, as reported in the next three columns. Also, controlling for macroeconomic information following Ferson and Schadt (1996) does not adversely affect our findings.[22] Panel A of Figure 2 presents a graphical illustration of the results discussed above.

The results, though still statistically significant, become a little weaker if we consider the remaining two holdings-based measures. This is plausible since these measures reflect fund managers' stock-picking abilities but do not directly reflect the unobserved actions of mutual funds. Nevertheless, the results still exhibit a positive relation between the holdings-based performance measures and the return gap, thus indicating that fund managers that have superior return gaps also tend to have skills based on their disclosed trades.

All the performance measures for the top-decile funds are positive, but many are not statistically significant. However, the trades of these funds create value that compensates investors at least for the expenses and the funds' trading costs.

To analyze the time-series performance of this trading strategy, we compute the average annual returns of each decile in each year. In unreported results, we find that the top five return gap decile funds outperform the bottom five return gap decile funds in 18 of 20 years (all years except 1992 and 2003), which indicates that the relation between the return gap and future performance is relatively stable over time. Further, the spread in the adjusted performance widens further if we form 20 instead of 10 portfolios on the basis of the lagged return gap. The difference in excess returns relative to the market between the top and the bottom 5% of funds amounts to 38.5 basis points, as compared to 28.4 basis points for the corresponding difference in the decile portfolios. Similarly, the difference in the Carhart abnormal returns between extreme portfolios increases from 22.5 to 34.4 basis points per month.

We also examine whether our results are driven by the short-term predictability in fund returns as described by Bollen and Busse (2005). In unreported tests, we form portfolios on the basis of lagged annual

[22] To investigate whether stale prices affect our risk- and style-adjustment, we also compute abnormal returns by adding 1-month lagged factors besides the contemporaneous factors. The loadings on the lagged factors are generally not statistically significant and the alpha estimates are not affected substantially by including lagged factors.

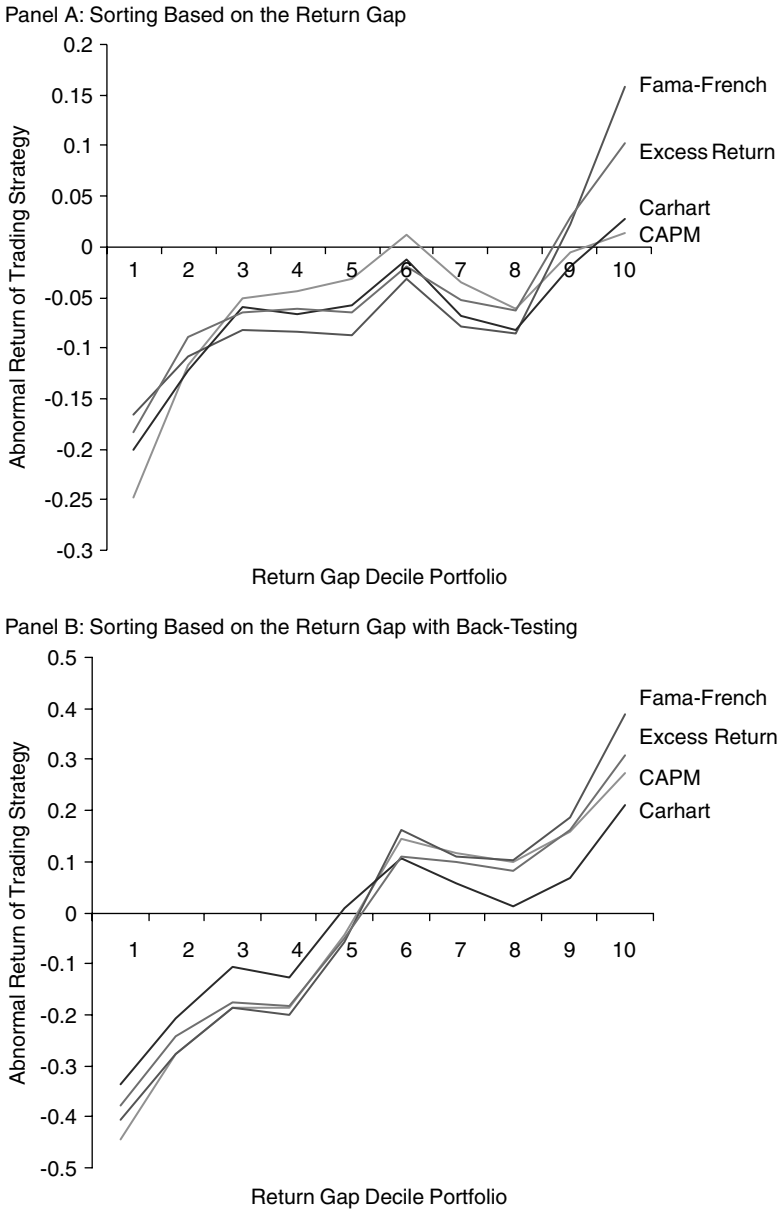

Figure 2
Returns of trading strategies
This figure shows the average monthly abnormal returns following the formation period over the period between 1984 and 2003, expressed in percent per month. The decile portfolios are formed on the basis of the previous 1-year return gap (Panel A) and on the previous 1-year return gap using the back-testing technique of Mamaysky, Spiegel, and Zhang (2005) (Panel B), in which decile 1 has the lowest return gap and decile 10 has the highest return gap. We use four measures of abnormal returns—the return in excess of the market return; the market-adjusted abnormal return (CAPM); the three-factor adjusted return as in Fama and French (1993); and the four-factor-adjusted return as in Carhart (1997).

return gaps using different horizons. We find that the bottom decile funds significantly underperform the top-decile funds using return gaps lagged up to 36 months. For example, the difference in the four-factor alphas between the top and the bottom deciles decreases from 22.5 basis points per month in the base case using a 3-month lag to 15.5 basis points per month using a 36-month implementation lag. Thus, although the return gap is defined to capture short-term fund actions, it performs well in predicting the performance over the longer term.

Since investors cannot short mutual funds, it is not feasible to generate returns given by the difference between the top and the bottom deciles. However, by conditioning on the return gap investors can avoid potential losses that are proportional to the return differences between the deciles.

4.2 Trading strategies with back-testing

In a recent study, Mamaysky, Spiegel, and Zhang (2005) provide evidence that previous performance studies are plagued by estimation problems. In particular, since many sorting variables are measured with noise, the top and the bottom deciles of a given trading strategy might not be populated by just the best and the worst funds, but also by funds that have the highest estimation errors. To alleviate this problem, they suggest using a back-testing technique in which the statistical model is required to exhibit some past predictive success for a particular fund before it is used to make predictions in the current period. They show that a strategy that uses modest *ex ante* filters to eliminate funds whose parameters likely derive primarily from estimation errors produces very significant out-of-sample risk-adjusted returns.

Motivated by their study, we eliminate funds for which the return gap has a different sign from the excess fund return in two non-overlapping time periods. In a first step, we sort all funds into deciles according to their average return gaps between 15 and 4 months prior to the portfolio formation month. This sorting yields exactly the same portfolios as those described in Table 4. In addition, we require that the average reported excess returns relative to the market during the 3 months immediately prior to the portfolio formation have the same sign as the lagged return gaps. Thus, in the trading strategy we consider only funds for which there is a concordance between the lagged return gap and the lagged excess return.

Our results, summarized in Table 5, show that the performance difference between the top and the bottom return gap decile portfolios widens dramatically for all performance measures. For example, the difference in the abnormal four-factor return increases from 22.5 basis points per month to 53.5 basis points per month. We also observe that the differences in the two holdings-based performance measures become larger and statistically more significant.

Table 5
Portfolio returns based on the return gap with back-testing

	Excess return	CAPM alpha	Fama French alpha	Carhart alpha	Pástor Stambaugh alpha	Ferson Schadt alpha	DGTW selectivity measure	GT performance measure
1. Decile:	−0.366***	−0.431***	−0.396***	−0.328***	−0.310***	−0.195**	−0.027	0.071
Mean: −0.600	(0.106)	(0.103)	(0.098)	(0.099)	(0.098)	(0.097)	(0.070)	(0.107)
2. Decile	−0.243***	−0.278***	−0.279***	−0.209**	−0.190**	−0.048	−0.012	0.066
Mean: −0.245	(0.088)	(0.088)	(0.088)	(0.089)	(0.086)	(0.085)	(0.052)	(0.090)
3. Decile	−0.166**	−0.175**	−0.182**	−0.098	−0.078	0.005	0.043	0.092
Mean: −0.137	(0.084)	(0.085)	(0.088)	(0.086)	(0.083)	(0.079)	(0.053)	(0.092)
4. Decile	−0.186**	−0.187**	−0.202***	−0.127*	−0.110	−0.001	0.016	0.036
Mean: −0.070	(0.074)	(0.075)	(0.077)	(0.076)	(0.074)	(0.069)	(0.044)	(0.081)
5. Decile	−0.047	−0.040	−0.054	0.011	0.033	0.104	0.056	0.022
Mean: −0.019	(0.069)	(0.070)	(0.072)	(0.071)	(0.067)	(0.068)	(0.039)	(0.077)
6. Decile	0.110	0.145*	0.164**	0.107	0.105	−0.000	0.107**	0.144*
Mean: 0.026	(0.084)	(0.083)	(0.076)	(0.077)	(0.077)	(0.072)	(0.045)	(0.084)
7. Decile	0.095	0.110	0.103	−0.020	0.004	−0.098	0.097*	0.204**
Mean: 0.078	(0.093)	(0.094)	(0.085)	(0.082)	(0.082)	(0.075)	(0.051)	(0.087)
8. Decile	0.076	0.095	0.097	0.008	0.016	−0.106	0.084*	0.203**
Mean: 0.149	(0.095)	(0.096)	(0.082)	(0.081)	(0.080)	(0.073)	(0.051)	(0.090)
9. Decile	0.169	0.164	0.194**	0.076	0.080	−0.000	0.123**	0.258**
Mean: 0.266	(0.113)	(0.115)	(0.091)	(0.087)	(0.087)	(0.085)	(0.057)	(0.103)
10. Decile:	0.307*	0.273*	0.387***	0.208*	0.204*	0.093	0.208**	0.385***
Mean: 0.640	(0.166)	(0.166)	(0.115)	(0.107)	(0.107)	(0.105)	(0.081)	(0.138)
Decile 10—	0.673***	0.704***	0.783***	0.535***	0.514***	0.288*	0.235**	0.314***
Decile 1	(0.183)	(0.185)	(0.167)	(0.156)	(0.155)	(0.150)	(0.095)	(0.098)
Second half—	0.359***	0.385***	0.416***	0.234*	0.213*	0.006	0.112*	0.180**
First half	(0.138)	(0.139)	(0.132)	(0.125)	(0.124)	(0.115)	(0.060)	(0.070)
Spearman	0.939***	0.939***	0.939***	0.855***	0.855***	0.304	0.939***	0.782***
Correlation	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)	(0.393)	(0.000)	(0.008)

This table reports the mean monthly returns and the standard errors (in parentheses) for deciles of mutual funds over the period 1984 to 2003 sorted according to the lagged 1-year return gap with back-testing as suggested by Mamaysky, Spiegel, and Zhang (2005). Mutual funds are sorted into deciles according to the average return gaps between 15 and 4 months prior to the portfolio formation. In addition, funds are considered only if the sign of the average return gap equals the sign of the excess reported fund return during the 3 months prior to the portfolio formation. In the first column we report the mean lagged return gap for the decile portfolios after back-testing. We use the performance measures described in Table 4. The returns are expressed in percent per month. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

After filtering out funds with diverging lagged performance measures, we find that the funds in the top return gap decile perform particularly well. The abnormal returns of the top-decile range between 1.12% (Ferson-Schadt) and 4.64% (Fama-French) per year. All abnormal returns are now significantly positive, except for the Ferson-Schadt measure. Panel B of Figure 2 presents a graphical illustration of the results.

4.3 Fund return decomposition

To understand the relative importance of the return gap in predicting performance we decompose the fund return into its three components: the return gap, the expense ratio, and the holdings return:

$$RF_t^f = RG_t^f - EXP_t^f + RH_t^f. \tag{7}$$

Table 6 presents evidence on predictability based on the three components. Specifically, we sort funds into deciles according to the lagged 1-year return gap, the lagged expense ratio, and the lagged 1-year holdings return, respectively, and then calculate the Carhart alphas for the resulting deciles with a 3-month implementation lag. The expense deciles are sorted in descending order, that is, highest expense funds are in decile 1 and lowest expense funds are in decile 10. We report results with and without back-testing. The results based on sorting on the return gap are identical to those reported in Tables 4 and 5. In addition, we find that funds with high expense ratios tend to perform worse than funds with low expense ratios. The performance difference between the lowest and the highest expense deciles (as well as the bottom and the top 50% of the sample) is positive and statistically significant. The performance spread between decile 10 and decile 1 sorting based on the expense ratio equals 0.135 basis points per month without back-testing and 0.337 basis points per month with back-testing. However, these numbers are substantially lower than those that use the return gap as the performance predictor. Thus, the results indicate that the return gap has more power in predicting fund performance than does the expense ratio.

Similarly, the last two columns of Table 6 condition on the past holdings return to predict abnormal fund performance. Without back-testing, higher lagged holdings returns do not predict superior four-factor-adjusted returns.[23] With back-testing, the performance spread between the high and low deciles is positive but remains statistically insignificant.

[23] This zero abnormal performance is due to the momentum adjustment of Carhart (1997). For example, the difference in the average abnormal returns (and the corresponding standard errors) between the top and the bottom deciles of funds sorted according to the prior-year excess holdings returns equals 0.237 (0.255) using the CAPM adjustment and 0.488 (0.232) using the Fama-French adjustment.

Table 6
Trading strategies using different portfolio formation methods

	Return gap (ascending)		Expenses (descending)		Holdings return (ascending)	
	Without back-testing	With back-testing	Without back-testing	With back-testing	Without back-testing	With back-testing
1. Decile	−0.199***	−0.328***	−0.098*	−0.262***	−0.049	−0.216*
	(0.062)	(0.099)	(0.052)	(0.097)	(0.123)	(0.125)
2. Decile	−0.123**	−0.209**	−0.125**	−0.270***	−0.021	−0.096
	(0.054)	(0.089)	(0.055)	(0.098)	(0.097)	(0.097)
3. Decile	−0.061	−0.098	−0.092	−0.274**	−0.058	−0.105
	(0.049)	(0.086)	(0.062)	(0.111)	(0.077)	(0.097)
4. Decile	−0.066	−0.127*	−0.093	−0.220**	−0.047	−0.085
	(0.048)	(0.076)	(0.058)	(0.097)	(0.057)	(0.072)
5. Decile	−0.059	0.011	−0.079	−0.189*	−0.047	−0.061
	(0.050)	(0.071)	(0.058)	(0.100)	(0.049)	(0.069)
6. Decile	−0.012	0.107	−0.051	0.049	−0.046	0.003
	(0.049)	(0.077)	(0.051)	(0.083)	(0.045)	(0.063)
7. Decile	−0.069	−0.020	−0.014	0.083	−0.089*	−0.083
	(0.057)	(0.082)	(0.053)	(0.085)	(0.046)	(0.062)
8. Decile	−0.083	0.008	−0.060	−0.016	−0.092*	−0.029
	(0.052)	(0.081)	(0.046)	(0.075)	(0.052)	(0.065)
9. Decile	−0.019	0.076	−0.029	−0.005	−0.127*	−0.056
	(0.056)	(0.087)	(0.036)	(0.072)	(0.069)	(0.082)
10. Decile	0.025	0.208*	0.038	0.074	−0.067	0.036
	(0.071)	(0.107)	(0.036)	(0.069)	(0.103)	(0.116)
Decile 10— Decile 1	0.225***	0.535***	0.135***	0.337**	−0.018	0.248
	(0.054)	(0.156)	(0.047)	(0.147)	(0.188)	(0.186)
Second half— First half	0.070***	0.234*	0.074***	0.280*	−0.040	0.088
	(0.024)	(0.125)	(0.022)	(0.153)	(0.094)	(0.108)
Spearman correlation	0.649**	0.855***	0.915***	0.818***	−0.656**	0.879***
	(0.042)	(0.002)	(0.318)	(0.004)	(0.039)	(0.001)

This table reports the abnormal monthly returns using the four-factor model of Carhart (1997), along with their standard errors (in parentheses), for deciles of mutual funds formed according to different sorting criteria over the period 1984 to 2003. Funds are sorted on the basis of the lagged return gap, the lagged expense ratio, and the lagged holdings return. For each measure we report, in addition, the performance using the back-testing technique suggested by Mamaysky, Spiegel, and Zhang (2005), by considering only funds where the performance measures of the various criteria are consistent with the excess reported fund return during the 3 months prior to the portfolio formation. The returns are expressed in percent per month. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

5. The Determinants of the Return Gap

This section analyzes the different determinants of the return gap using a pooled Prais-Winsten regression of the return gap on the various fund characteristics.[24] Each regression additionally includes time-fixed effects. We estimate the regressions with clustered standard errors by time to account for a possible contemporaneous correlation structure.[25]

[24] The results are almost identical using ordinary least squares without correcting for first-order auto-correlation.

[25] Clustering by time generally has higher standard errors than clustering by fund or by fund family. A comparison of the different methods can be found in Petersen (2005).

Table 7
Determinants of the return gap

	Dependent variables (in % per month)			
	Raw return gap		Abnormal four-factor return gap	
Trading costs per month	−0.754***	−0.826***	−0.792**	−0.865**
	(0.243)	(0.269)	(0.311)	(0.359)
Weight of recent IPOs	0.232***	0.243***	0.203***	0.227***
	(0.027)	(0.030)	(0.032)	(0.037)
Correlation between holdings and investor returns	0.706**	0.692**	1.085***	1.109***
	(0.314)	(0.333)	(0.361)	(0.391)
Expenses per month	−0.339*	−0.276	−0.237	−0.216
	(0.180)	(0.187)	(0.238)	(0.226)
Turnover	0.009	0.007	−0.018	−0.024
	(0.011)	(0.012)	(0.018)	(0.020)
Log of TNA	−0.012***	−0.024***	−0.014***	−0.025***
	(0.003)	(0.004)	(0.004)	(0.005)
Log of family TNA		0.013 ***		0.010**
		(0.003)		(0.004)
Log of age	−0.015***	−0.010	0.009	0.015
	(0.005)	(0.006)	(0.008)	(0.009)
New money growth	0.433***	0.422 **	0.674***	0.650**
	(0.148)	(0.165)	(0.251)	(0.289)
New money growth squared	−0.353*	−0.350	−0.451	−0.423
	(0.197)	(0.217)	(0.345)	(0.380)
Standard deviation of investor returns	0.011	0.014	0.015	0.004
	(0.010)	(0.011)	(0.010)	(0.010)
Load fund indicator variable	−0.005	−0.018**	0.006	−0.000
	(0.007)	(0.008)	(0.010)	(0.012)
Index fund indicator variable	−0.041**	−0.047***	−0.058***	−0.064***
	(0.016)	(0.016)	(0.020)	(0.022)
Size score	−0.032***	−0.038***	−0.040***	−0.042***
	(0.012)	(0.013)	(0.014)	(0.016)
Value score	−0.014	−0.013	−0.001	0.014
	(0.020)	(0.023)	(0.018)	(0.021)
Momentum score	−0.067 **	−0.076**	−0.114***	−0.125***
	(0.030)	(0.036)	(0.035)	(0.043)
Time-fixed effects	Yes	Yes	Yes	Yes
Number of observations	167,983	145,328	117,130	97,788
R-squared (in %)	1.64	1.56	1.69	1.62

This table reports the coefficients of the Prais-Winsten panel regressions of the monthly return gaps on various fund and fund family characteristics. The sample includes equity mutual funds and spans the period 1984–2003. The return gap is defined as the difference between the investor fund return and the return based on the previous holdings. All regressions include time-fixed effects and are performed at a monthly frequency. The standard errors (in parentheses) take into account clustering by time. The returns are expressed in percent per month. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 7 summarizes the regression results for four different specifications. The first two columns use the raw return gap as the dependent variable, whereas the last two columns use the abnormal four-factor-adjusted return gap as the dependent variable. As in the previous section, we use 3 years of past monthly return gaps to estimate the coefficients of the four-factor model. Subsequently, we subtract the expected return gap from the realized return gap to determine the abnormal return gap of a

fund in each month. Since the estimation of the factor loadings requires at least 3 years of data we lose the first 3 years' data.

The first variable we consider is the trading costs, which are estimated following Wermers (2000) and further described in Appendix B. We posit that funds with higher trading costs should perform worse, unless the interim trading benefits offset their trading costs. We document a negative relation between estimated trading costs and the return gap both before and after adjusting for common risk factors. The coefficient estimates on the trading costs are statistically significantly different from zero, but they are not significantly different from -1. A coefficient of -1 implies that an increase in the trading costs of 10 basis points also reduces the return gap by 10 basis points. Thus, as expected, trading costs have an important impact on the return gap.

IPO allocations are another important potential determinant of the return gap. Owing to their incentive to maximize family-level profits, fund families may allocate IPOs strategically to subsidize certain funds in the family (Nanda, Wang, and Zheng 2004; Nimalendran, Ritter, and Zhang 2004; Gaspar, Massa, and Matos 2006; and Reuter 2006). As a result, we expect funds that obtain more IPO allocations to exhibit a more favorable return gap since the IPO allocations tend to be significantly underpriced. We find a strong relation between IPO allocations and the return gap, indicating that funds that own stocks immediately after they go public have particularly favorable return gaps during this time interval. This result is consistent with the hypothesis that these funds obtain beneficial IPO allocations, which then generate significant first-day trading profits. The coefficient estimate on the IPO variable implies that a 1% increase in the holdings of IPO stocks increases the return gap by 23.2 basis points per month, which is generally consistent with the average underpricing during this time period.[26] The IPO variable remains significant, even after adjusting the return gap for common factors in fund returns using the Carhart (1997) model.

The third variable we consider measures the transparency of a fund's investment strategy and is defined as the correlation coefficient between monthly holdings and investor returns during the previous year. Funds with a low correlation between holdings and investor returns tend to follow investment strategies that are more opaque. The low correlation can result from high turnover or from window dressing. If the low correlation is due to agency problems, then we should observe that the low-correlation funds perform worse. On the other hand, if the low correlation is driven by managers opting to hide their valuable investment ideas, then we should find that the low-correlation funds perform better. We find a significantly

[26] For example, Ritter and Welch (2002) show that the average first-day return of IPOs between 1980 and 2001 amounts to 18.8%.

positive relation between the correlation and the return gap. This result suggests that the fund's opaqueness might proxy for agency problems.

In our subsequent analysis, we examine the relation between the return gap and other fund characteristics that the existing literature has shown to affect fund returns. We observe that funds do not compensate investors for their higher expenses by either having lower hidden costs or higher hidden benefits. In fact, we find a negative relation between expenses and the return gap, although the relation is usually not statistically significant. An alternative way to assess the impact of trading activities is to look at the relation between turnover and the return gap. We do not find a significant relation between turnover and the return gap.

Chen, Hong, Huang, and Kubik (2004) document that performance decreases with fund size but increases with fund family size. Consistent with their findings, we find that smaller funds and larger fund families tend to exhibit more favorable return gaps.[27] Furthermore, we find that a fund's age is negatively related to its return gap. However, the effect of age on the return gap is often insignificant. Consistent with the "smart-money" effect in Gruber (1996) and Zheng (1999), we find a significant and positive relation between the mean lagged money flow and the return gap. On the other hand, we find a weakly negative relation between squared *NMG* and the return gap, which might result from liquidity costs.

The regression results indicate that funds which focus on large and momentum stocks tend to exhibit lower return gaps before and after controlling for the four Carhart (1997) factors. We also find that the level of the return gap is similar for load and no-load funds after adjusting for the risk and style factors. Finally, index funds tend to have lower return gaps than actively managed funds. As index funds have only very limited opportunities to create value through interim trades, the return gap reflects primarily the hidden costs of fund management.[28]

In unreported tests, we also investigate whether funds that rotate their portfolios between different industries and styles exhibit superior return gaps. We do not find a significant relation between the return gap and the industry or the style rotation.

6. Robustness Tests

This section summarizes a number of robustness tests, which further strengthen our conclusion that the return gap predicts fund performance.

[27] In their theoretical models, Nanda, Narayanan, and Warther (2000) and Berk and Green (2004) study the impact of diseconomies of scale in fund management.

[28] This result is driven primarily by small index funds. The Vanguard 500 Index Fund, which has been the largest index fund, has an average positive return gap of 0.66 basis points per month, whereas other index funds have an average return gap of −1.93 basis points per month. The surprisingly large heterogeneity in the performance of index funds has been described by Elton, Gruber, and Busse (2004) and Hortacsu and Syverson (2004).

6.1 Return gap, expense ratios, and transactions costs

Previous studies suggest that expense ratios and transactions costs predict fund performance (e.g., Carhart 1997; Chalmers, Edelen, and Kadlec 1999). We examine whether differences in fund expense ratios and trading costs are primarily responsible for the performance predictability of the return gap.

In Table 8 we report the Carhart alphas for the return gap deciles after adjusting for expenses and estimated trading costs. Rather than observing a monotonic relation between the return gap and expense ratios, we observe a U-shaped pattern for fund expense ratios across deciles: the extreme deciles (funds with low and high return gaps) exhibit higher expenses than the middle deciles. Furthermore, if expenses are driving the performance results, we should observe no clear pattern in before-expense alphas. However, the before-expense alphas show a pattern very similar to that of the after-expense alphas: funds with low return gaps significantly underperform funds with high return gaps. The performance difference between the lowest and the highest return gap deciles (as well as the bottom 50% and the top 50%) is almost identical for the after-expense and the before-expense alphas. Thus, fund expenses are not driving the performance predictability of the return gap.

Similarly, to shed light on the importance of trading costs, Table 8 reports the estimated trading costs and the Carhart alphas before estimated transactions costs for the deciles sorted according to the lagged 1-year return gap. Again, we observe a U-shaped pattern for the estimated trading costs across the deciles. When we add back the estimated trading costs and study the fund performance before deducting all fund costs, we find a similar performance pattern for the deciles: funds with low return gaps significantly underperform funds with high return gaps even before deducting transactions costs and expenses. Thus, the estimated transactions costs cannot explain the performance predictability of the return gap. However, the actual fund trading costs might still be related to the return gap since the estimated trading costs do not take into account heterogeneous trading efficiency across funds.

Adding back expenses and estimated trading costs indicates that mutual fund managers in the top return gap decile follow investment strategies that persistently create value. For example, the before-cost abnormal return of funds in decile 10 equals 21.6 basis points per month or about 2.6% per year, which demonstrates substantial investment ability. On the other hand, the before-cost abnormal return of funds in decile 1 is insignificantly different from zero, which indicates that these funds tend to underperform primarily because of their expenses and trading costs.

Table 8
Portfolio returns after adjusting for expenses and trading costs

	Carhart alpha after expenses	Expenses	Carhart alpha before expenses	Trading costs	Carhart alpha before expenses and trading costs
1. Decile	−0.199***	0.109	−0.091	0.066	−0.010
	(0.062)		(0.062)		(0.062)
2. Decile	−0.123**	0.099	−0.024	0.047	0.027
	(0.054)		(0.054)		(0.054)
3. Decile	−0.061	0.093	0.033	0.039	0.078
	(0.049)		(0.049)		(0.049)
4. Decile	−0.066	0.088	0.022	0.033	0.061
	(0.048)		(0.048)		(0.049)
5. Decile	−0.059	0.086	0.027	0.031	0.064
	(0.050)		(0.050)		(0.050)
6. Decile	−0.012	0.086	0.074	0.031	0.109**
	(0.049)		(0.049)		(0.049)
7. Decile	−0.069	0.089	0.020	0.036	0.063
	(0.057)		(0.057)		(0.057)
8. Decile	−0.083	0.094	0.011	0.042	0.056
	(0.052)		(0.052)		(0.053)
9. Decile	−0.019	0.100	0.081	0.053	0.135**
	(0.056)		(0.056)		(0.057)
10. Decile	0.025	0.112	0.137*	0.076	0.216***
	(0.071)		(0.071)		(0.072)
Decile 10—	0.225***	0.003***	0.227***	0.010***	0.226***
Decile 1	(0.054)	(0.001)	(0.054)	(0.001)	(0.053)
Second half—	0.070***	0.001***	0.071***	0.005***	0.072***
First half	(0.024)	(0.000)	(0.024)	(0.000)	(0.024)
Spearman	0.649**	0.170	0.661**	0.171	0.697**
correlation	(0.042)	(0.638)	(0.038)	(0.637)	(0.025)

This table reports the means and the standard errors (in parentheses) of monthly abnormal returns, expenses, and estimated trading costs for deciles of mutual funds sorted according to the lagged 1-year return gap over the period 1984 to 2003. The return gap is lagged for one additional quarter to account for the possible delay in reporting the holdings. The return gap is defined as the difference between the investor fund return and the return based on the previous holdings. We use the four-factor alpha of Carhart (1997) to measure fund performance. The returns are expressed in percent per month. The table also reports the differences in the return gaps between the top and the bottom deciles and the top and the bottom halves, along with the Spearman rank correlations and the corresponding *p*-values in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

6.2 Trading strategies based on alternative selection criteria

Table 9 reports the abnormal four-factor returns of decile portfolios of mutual funds on the basis of various portfolio formation criteria. As a benchmark, the first column repeats the performance differences of portfolios formed according to the return gap over the previous 12 months. Columns two and three report the performance results by forming portfolios on the basis of the return gaps over the previous 36 and 60 months. The results remain qualitatively unaffected using the alternative formation windows.

Column four reports results obtained from sorting funds according to their return gap before expenses, which is defined as the raw return gap minus the monthly expense ratio. This measure corresponds to the total

Table 9
Portfolio returns based on the return gap: various sorting criteria

	Return gap 1 Year	Return gap 3 Years	Return gap 5 Years	Return gap subtracting expenses	Return gap for no-load funds	Return gap for nonindex funds
1. Decile	−0.199***	−0.234***	−0.146**	−0.221***	−0.183***	−0.203***
(lowest RG)	(0.062)	(0.060)	(0.068)	(0.062)	(0.068)	(0.062)
2. Decile	−0.123**	−0.100*	−0.115*	−0.135**	−0.131**	−0.128**
	(0.054)	(0.055)	(0.063)	(0.053)	(0.059)	(0.054)
3. Decile	−0.061	−0.060	−0.097*	−0.057	−0.072	−0.070
	(0.049)	(0.049)	(0.054)	(0.051)	(0.058)	(0.050)
4. Decile	−0.066	−0.029	−0.112**	−0.074	−0.004	−0.073
	(0.048)	(0.043)	(0.049)	(0.052)	(0.059)	(0.049)
5. Decile	−0.059	−0.090**	−0.053	−0.057	−0.027	−0.056
	(0.050)	(0.046)	(0.050)	(0.050)	(0.063)	(0.052)
6. Decile	−0.012	−0.055	−0.087*	−0.013	−0.000	−0.019
	(0.049)	(0.050)	(0.049)	(0.050)	(0.052)	(0.051)
7. Decile	−0.069	−0.075	−0.100	−0.085	−0.008	−0.072
	(0.057)	(0.057)	(0.061)	(0.054)	(0.062)	(0.058)
8. Decile	−0.083	−0.067	−0.013	−0.067	−0.109*	−0.086
	(0.052)	(0.057)	(0.066)	(0.051)	(0.058)	(0.052)
9. Decile	−0.019	0.019	0.038	0.012	−0.078	−0.015
	(0.056)	(0.060)	(0.069)	(0.053)	(0.057)	(0.056)
10. Decile	0.025	−0.017	0.012	0.028	0.029	0.026
(highest RG)	(0.071)	(0.067)	(0.070)	(0.071)	(0.079)	(0.072)
Decile 10—	0.225***	0.217***	0.158***	0.249***	0.212***	0.229***
Decile 1	(0.054)	(0.056)	(0.054)	(0.057)	(0.081)	(0.055)
Second half—	0.070***	0.063***	0.074***	0.084***	0.050	0.072***
First half	(0.024)	(0.023)	(0.023)	(0.024)	(0.031)	(0.024)
Spearman	0.649**	0.697**	0.879***	0.736**	0.515	0.721**
correlation	(0.042)	(0.025)	(0.001)	(0.015)	(0.128)	(0.019)

This table reports the monthly abnormal returns according to the four-factor model of Carhart (1997), along with their standard errors (in parentheses), for deciles of mutual funds formed according to different sorting criteria over the period 1984 to 2003. The returns are expressed in percent per month. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

gap between investor return and holdings return. Taking into account expenses only slightly improves the performance of decile 10 relative to decile 1.

In calculating returns on our strategies we do not consider the loads that need to be paid to purchase the funds. Perhaps high return gap funds also have high loads, which subsequently could reduce the overall performance of the proposed strategies. To assess the sensitivity of our results to this possibility, we exclude load funds and form decile portfolios on the basis of the return gap. The results remain qualitatively similar.

Finally, we exclude index funds from the analysis since index funds should have return gaps close to zero. The results with nonindex funds are very similar to the base case.

6.3 Market impact

The trades of mutual funds might exert a nontrivial impact on market prices. If funds' transactions induce market impact, the return gap measure may be affected. For example, suppose that a fund gradually liquidates one of its positions and the resulting selling pressure leads to a decline in the company's stock price. The hypothetical holdings portfolio assumes that the fund held the company's stock for the whole disclosure period, while the actual fund held the average stock for a shorter time period. In this case, the return gap would be positive even if this transaction caused significant trading costs. A positive return gap would also occur if a fund gradually purchased a given stock within a disclosure period. Thus, the return gap would be a biased measure of the fund's trading costs. However, the return gap is still an unbiased measure of the unobserved actions of a mutual fund, which consist of market impact costs (which are negative) and interim trading benefits (which are positive in this example).

Such gradual trading strategies should result in higher average return gaps for funds that generate higher market impact and might explain the persistence of the return gap. On the other hand, such trading strategies will be unable to explain our main performance predictability results, because we find a significant impact of the lagged return gap on the abnormal *investor* return. Actually, if such sequential trading strategies were the main determinant of the cross-sectional variation in the return gap, then we would probably observe a *negative* relation between the return gap and investor returns, because funds with persistently high market impact levels would experience consistently low investor returns because of their high trading costs.

In Table 10, we investigate in more detail whether the market impact affects the return gap and the profitability of the trading strategies. We first sort funds into quintiles according to their potential market impact. We measure the market impact by the relative trade size, defined as the average ratio of the absolute dollar trading amount over the market capitalization of a stock, weighted by the trade size. On average, funds in the bottom quintile trade 0.025% of the shares outstanding of a particular company, whereas funds in the top quintile trade 1.026% of the shares outstanding. Thus, the market impact should affect top quintile funds more significantly than bottom quintile funds.

Next, we compute the average return gaps for each quintile. We find that the average return gaps are quite similar in magnitude for the different market impact groups. Moreover, funds in the fifth quintile exhibit the lowest average return gap, which contradicts the hypothesis that the return gap is driven primarily by market impact effects.

To assess the relative predictive power of the market impact measure and the return gap, we further sort funds within each market impact quintile into quintiles according to their lagged 1-year return gap. We

Table 10
Portfolio returns based on the return gap conditional on market impact

	Market impact quintiles					
	1. Quintile (lowest market impact)	2. Quintile	3. Quintile	4. Quintile	5. Quintile (highest market impact)	Quintile 5–Quintile 1
Mean relative trade size (in %)	0.025	0.081	0.173	0.350	1.026	1.000
Mean return gap (in % per month)	−0.002	0.004	0.012	0.015	−0.011	−0.009
	(0.009)	(0.012)	(0.013)	(0.012)	(0.015)	(0.015)
Abnormal return All funds	−0.048	−0.097**	−0.057	−0.060	−0.091	−0.044
	(0.030)	(0.043)	(0.049)	(0.057)	(0.068)	(0.055)
1. RG quintile	−0.162***	−0.169***	−0.153**	−0.133*	−0.135	0.027
	(0.040)	(0.052)	(0.071)	(0.072)	(0.090)	(0.089)
2. RG quintile	0.015	−0.118**	−0.043	−0.073	−0.133*	−0.148*
	(0.038)	(0.046)	(0.054)	(0.065)	(0.080)	(0.075)
3. RG quintile	−0.041	0.015	−0.014	−0.047	−0.111	−0.070
	(0.037)	(0.050)	(0.063)	(0.073)	(0.070)	(0.062)
4. RG quintile	−0.042	−0.132**	−0.003	−0.041	−0.038	0.005
	(0.046)	(0.053)	(0.062)	(0.065)	(0.079)	(0.074)
5. RG quintile	−0.012	−0.052	−0.004	0.048	0.003	0.016
	(0.050)	(0.062)	(0.060)	(0.083)	(0.089)	(0.082)
Quintile 5−Quintile 1	0.150***	0.118**	0.148**	0.181**	0.138*	−0.012
	(0.055)	(0.056)	(0.072)	(0.074)	(0.084)	(0.105)
Quintile 5−Quintile 1 With back-testing	0.153	0.247*	0.234	0.365*	0.534***	0.381**
	(0.123)	(0.140)	(0.165)	(0.192)	(0.203)	(0.163)

This table reports the monthly abnormal returns according to the four-factor model of Carhart (1997), along with their standard errors (in parentheses), for quintiles formed according to the relative trade size and for quintiles formed according to the lagged return gap between 15 and 4 months prior to the portfolio formation over the period 1984 to 2003. The relative trade size is defined for each mutual fund as the weighted average of the ratio between the absolute value of a trade and the market capitalization of the corresponding stock. The average is weighted by the absolute value of all the trade transactions of a fund. The last row reports the abnormal return difference between the top and the bottom return gap quintiles using the back-testing technique suggested by Mamaysky, Spiegel, and Zhang (2005), by considering only funds in which the performance measures of the various criteria are consistent with the excess reported fund return during the 3 months prior to the portfolio formation. The returns are expressed in percent per month. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

find that for each market impact quintile, funds with low return gaps significantly underperform funds with high return gaps. The magnitude of the performance difference between the lowest and the highest return gap quintiles is consistent across the different market impact groups.

We also compute the performance of quintile portfolios using the back-testing technique suggested by Mamaysky, Spiegel, and Zhang (2005) and report the difference between the two extreme return gap quintiles in the last row. Back-testing tends to increase the performance difference between the extreme return gap quintiles.

Table 11
Portfolio returns based on the return gap conditional on unidentified holdings

	Quintiles according to the relative difference in TNAs					
	1. Quintile (lowest difference)	2. Quintile	3. Quintile	4. Quintile	5. Quintile (highest difference)	Quintile 5–Quintile 1
Mean difference in TNAs (in %)	0.70	2.35	4.56	8.28	26.68	25.98
Mean return gap (in % per month)	0.013	0.015	0.012	0.012	−0.027	−0.039*
	(0.009)	(0.010)	(0.010)	(0.012)	(0.021)	(0.020)
Abnormal return	−0.062	−0.085*	−0.101*	−0.069	−0.050	0.013
All funds	(0.054)	(0.051)	(0.053)	(0.049)	(0.050)	(0.059)
1. RG quintile	−0.111	−0.174**	−0.289***	−0.135**	−0.138*	−0.028
	(0.074)	(0.069)	(0.067)	(0.068)	(0.071)	(0.088)
2. RG quintile	−0.059	−0.030	−0.120**	−0.094	−0.016	0.043
	(0.059)	(0.059)	(0.056)	(0.060)	(0.067)	(0.078)
3. RG quintile	0.006	−0.041	−0.018	−0.012	−0.081	−0.087
	(0.058)	(0.060)	(0.061)	(0.056)	(0.060)	(0.064)
4. RG quintile	−0.019	−0.108*	−0.035	−0.081	−0.029	−0.009
	(0.064)	(0.058)	(0.066)	(0.062)	(0.058)	(0.071)
5. RG quintile	−0.071	−0.015	−0.019	0.026	0.010	0.081
	(0.072)	(0.066)	(0.074)	(0.066)	(0.089)	(0.091)
Quintile 5−Quintile 1	0.039	0.159**	0.270***	0.160**	0.148**	0.109
	(0.066)	(0.069)	(0.070)	(0.069)	(0.080)	(0.096)
Quintile 5−Quintile 1	0.362**	0.342**	0.577***	0.455***	0.383**	0.025
With back-testing	(0.165)	(0.163)	(0.159)	(0.175)	(0.171)	(0.128)

This table reports the monthly abnormal returns according to the four-factor model of Carhart (1997), along with their standard errors (in parentheses), for quintiles formed according to the percentage absolute deviation between the disclosed equity holdings and the TNA and for quintiles formed according to the lagged return gap between 15 and 4 months prior to the portfolio formation over the period 1984 to 2003. The last row reports the abnormal return difference between the top and the bottom return gap quintiles using the back-testing technique suggested by Mamaysky, Spiegel, and Zhang (2005), by considering only funds where the performance measures of the various criteria are consistent with the excess reported fund return during the 3 months prior to the portfolio formation. The returns are expressed in percent per month. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Thus, we conclude that systematic differences in market impact do not drive the performance predictability of the return gap.

6.4 Unidentified holdings

One of the potential problems of our analysis results from the fact that we do not identify all stockholdings from the CDA/Spectrum database. Although on average we identify 92% of the stockholdings, this fraction varies across funds. As a result, the unidentified holdings can have unique characteristics that might affect the return gap and fund performance. For example, unidentified holdings might be less liquid and might perform differently from the reported holdings.

In Table 11, we study the effect of unidentified holdings on the performance predictability of the return gap. We first sort funds into quintiles according to the percentage of their unidentified holdings after

adjusting for the percentage of nonstock holdings. Quintile 1 consists of funds with the lowest percentage of unidentified holdings (0.70%), while quintile 5 includes funds with the highest percentage of unidentified holdings (26.68%). We observe that the monthly return gap is similar for the four bottom quintiles and varies between 1.2 and 1.5 basis points per month, and is lowest for the top quintile (–2.7 basis points per month). Thus, the unidentified holdings seem to perform slightly worse

Table 12
Predictability of future returns: regression evidence

	Dependent variable: abnormal Carhart four-factor returns (in % per month)				
Prior-year return gap	0.151***	0.216***	0.213***	0.189***	0.178***
	(0.035)	(0.044)	(0.045)	(0.048)	(0.051)
Prior-year expenses		−1.499***	−1.672***	−1.242***	−1.034**
		(0.489)	(0.464)	(0.352)	(0.399)
Prior-year excess holdings return		0.141**	0.144**	0.153**	0.157**
		(0.067)	(0.068)	(0.074)	(0.077)
Log of lagged TNA			−0.021**	−0.024***	−0.034***
			(0.010)	(0.007)	(0.012)
Log of lagged family TNA					0.011
					(0.007)
Log of age			−0.022*	−0.024*	−0.013
			(0.012)	(0.013)	(0.015)
Prior-year turnover			−0.047	0.023	0.021
			(0.034)	(0.026)	(0.029)
Index fund indicator variable			−0.014	−0.019	−0.012
			(0.032)	(0.034)	(0.035)
Load fund indicator variable			−0.016	−0.020	−0.034*
			(0.015)	(0.017)	(0.019)
Trading costs per month				−2.183***	−2.172***
				(0.619)	(0.701)
Weight of recent IPOs				0.238***	0.264***
				(0.067)	(0.077)
Correlation between returns				0.210	0.180
				(0.300)	(0.316)
New money growth				−0.037	0.045
				(0.673)	(0.762)
New money growth squared				−0.431	−0.580
				(0.817)	(0.919)
Standard deviation of investor returns				−0.012	−0.008
				(0.047)	(0.050)
Size score				−0.081**	−0.080**
				(0.036)	(0.039)
Value score				0.002	0.024
				(0.075)	(0.086)
Momentum score				−0.184*	−0.221*
				(0.097)	(0.113)
Time-fixed effects	Yes	Yes	Yes	Yes	Yes
Number of observations	150,946	150,946	150,210	142,083	120,969
R-Squared (in %)	8.33	8.88	9.01	9.42	9.72

This table reports the coefficients of Prais-Winsten regressions of monthly abnormal returns on various fund attributes. The sample includes all equity mutual funds in our sample and spans the period 1984–2003. The dependent variable is the four-factor abnormal return of Carhart (1997). All regressions include time fixed effects and are performed at a monthly frequency. Cluster-corrected standard errors have been provided in parentheses. The returns are expressed in percent per month. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

than the reported holdings. Further, we sort funds within each quintile according to their lagged 1-year return gap and examine the monthly abnormal returns from the Carhart four-factor model. Except for quintile 1 (funds with the lowest unmatched holdings), funds with low return gaps significantly underperform funds with high return gaps. Using back-testing, the performance difference between the lowest and highest return gap quintiles increases and is statistically significant for all five quintiles on the basis of unidentified holdings. Thus, the effect of unidentified holdings on return predictability does not appear to be substantial.

6.5 Multivariate regression approach

This section uses a pooled multivariate Prais-Winsten regression approach to confirm that the return gap has predictive power for future excess and abnormal returns, controlling for other fund-specific characteristics. Table 12 summarizes the estimates using the four-factor Carhart (1997) abnormal return as the dependent variable. We estimate the factor loadings by regressing the fund returns on the common factors during a 36-month window prior to the relevant monthly observation. In addition, all regressions include time-fixed effects and the standard errors are corrected for clustering by time.

The results, reported in Table 12, demonstrate that the return gap has an important impact on future fund performance, even after controlling for other fund characteristics and for time-fixed effects. For example, a 1-standard-deviation increase in the past return gap (0.44% per month) increases the future fund return by between 6.6 and 9.5 basis points per month. Lagged expenses and lagged excess holdings returns also exhibit a significant impact on the four-factor-adjusted returns.

The signs of the remaining coefficients are consistent with the existing evidence. For example, we find a negative relation between size and fund performance, confirming Chen, Hong, Huang, and Kubik's (2004) diseconomies of scale argument. On the other hand, age, turnover, and the index fund indicator variable play a secondary role.

7. Conclusions

In this paper, we analyze the impact of unobserved actions on fund performance using a large sample of US equity mutual funds between 1984 and 2003. We estimate the extent of unobserved actions by taking the difference between the investor returns and the buy-and-hold returns of the portfolio disclosed in the most recent past. This difference, termed the *return gap*, presents us with several interesting findings. First, the effect of unobserved actions is persistent in the long run both for the bottom and the top performing funds. Second, funds differ substantially with respect to the impact of such actions. Third, the cross-sectional difference in unobserved actions has significant predictive power for fund performance.

Even though estimating the impact of unobserved actions may serve as a helpful tool to evaluate mutual funds, an alternative and simpler way to judge any fund's actions could be just to consider its net returns. We argue that by benchmarking the investor returns against the holdings returns, we filter out the impact of common shocks to both returns and are able to obtain a more precise measure of the short-term unobserved actions.

The return gap measures a fund's short-term performance due to unobserved actions and captures the manager's value added relative to the previously disclosed holdings. It may reflect investment skills, trading costs, and agency costs. We show that the return gap is important for predicting fund performance and for identifying funds with negative unobserved actions that adversely affect investor returns.

Appendix A: Sample Selection

We start with a sample of all mutual funds in the CRSP mutual fund database covering the period between 1984 and 2003. The focus of our analysis is on domestic equity mutual funds, for which the holdings data are the most complete and reliable. As a result, we eliminate balanced, bond, money market, sector, and international funds, as well as funds not invested primarily in equity securities. We base our selection criteria on the objective codes and on the disclosed asset compositions. First, we select funds with the following ICDI objectives: AG, GI, LG, or IN. If a fund does not have any of the above ICDI objectives, we select funds with the following Strategic Insight objectives: AGG, GMC, GRI, GRO, ING, or SCG. If a fund has neither the Strategic Insight nor the ICDI objective, then we go to the Wiesenberger Fund Type Code and pick funds with the following objectives: G, G-I, AGG, GCI, GRI, GRO, LTG, MCG, and SCG. If none of these objectives is available and the fund has a CS policy (Common Stocks are the securities mainly held by the fund), then the fund is included. We exclude funds that have the following Investment Objective Codes in the Spectrum Database: International, Municipal Bonds, Bond and Preferred, and Balanced. Since the reported objectives do not always indicate whether a fund portfolio is balanced or not, we also exclude funds that, on average, hold less than 80% or more than 105% in stocks.

Elton, Gruber, and Blake (2001) and Evans (2004) identify a form of survival bias in the CRSP mutual fund database, which results from a strategy used by fund families to enhance their return histories. Fund families might incubate several private funds and they will only make public the track record of the surviving incubated funds, while the returns for those funds that are terminated are not made public. To address this incubation bias, we exclude the observations where the year for the observation is prior to the reported fund-starting year and we exclude observations where the names of the funds are missing in the CRSP database. Data may be reported prior to the year of fund organization if a fund is incubated before it is made publicly available, and these funds might not report their names or some other fund attributes, as shown by Evans (2004). Incubated funds also tend to be smaller, which motivates us to exclude funds that had in the previous month less than US$5 million in assets under management.

In the next step, we are able to match about 94% of the CRSP funds to the Spectrum database. The unmatched funds tend to be younger and smaller than the funds for which we find data in Spectrum. Wermers (2000) mentions that the Spectrum data set often does not have any holdings data available during the first few quarters listed in the CRSP database.

Mutual fund families introduced different share classes in the 1990s. Since different share classes have the same holdings composition, we aggregate all the observations pertaining

to different share classes into one observation. For the qualitative attributes of funds (e.g., name, objectives, year of origination), we retain the observation of the oldest fund. For the TNA under management, we sum the TNAs of the different share classes. Finally, for the other quantitative attributes of funds (e.g., returns, expenses, loads), we take the weighted average of the attributes of the individual share classes, where the weights are the lagged TNAs of the individual share classes. The aggregation of multiple share classes reduces our sample size to 3171 unique funds.

For most of our sample period, mutual funds are required to disclose their holdings semiannually. A large number of funds disclose their holdings quarterly, while a small number of funds have gaps between holdings disclosure dates of more than 6 months. To fill these gaps, we impute the holdings of missing quarters using the most recently available holdings, assuming that mutual funds follow a buy-and-hold strategy. In our sample, 72% of the observations are from the most recent quarter and less than 5% of the holdings are more than two quarters old. We exclude funds that have fewer than 10 identified stock positions and funds that did not disclose their holdings during the last year. This final selection criterion reduces the number of mutual funds used in this study to 2543 funds.

Appendix B: Trading Costs

We follow Wermers (2000) in estimating the execution costs of mutual funds. His estimates follow Keim and Madhavan (1997), who provide fitted regressions for total institutional execution costs (commissions and market impact) for a sample of investors between 1991 and 1993. The execution costs are estimated separately for the costs of buying and selling stocks. The costs of buying or selling particular stocks are calculated as follows:

$$C_{i,t}^{Buy} = 1.098 + 0.336 D_{i,t}^{Nasdaq} + 0.092 TradeSize_{i,t} - 0.084 Log(MktCap) + 13.807 \frac{1}{P_{i,t}}$$

$$C_{i,t}^{Sell} = 0.979 + 0.058 D_{i,t}^{Nasdaq} + 0.214 TradeSize_{i,t} - 0.059 Log(MktCap) + 6.537 \frac{1}{P_{i,t}}.$$

The total costs (in percentage of the trade value) of a given purchase and sale transaction of stock i in quarter t are denoted by $C_{i,t}^{Buy}$ and $C_{i,t}^{Sell}$. *TradeSize* denotes the dollar value of a trade divided by the market capitalization of the stock, *MktCap* denotes the market capitalization of the stock (expressed in thousands), $P_{i,t}$ is the stock price, and $D_{i,t}^{Nasdaq}$ is an indicator variable equal to 1 if the stock is traded on NASDAQ and 0 otherwise. Monthly execution costs are obtained by dividing the quarterly costs equally over the 3 months.[29]

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[29] Unlike Wermers (2000), we do not adjust the trading costs by a year factor, since consistent measures of trading costs are not available for our whole sample period. Instead, the regressions include time-fixed effects that would capture changes in aggregate trading costs. However, our estimates of the trading costs are not affected significantly if we adjust the trading costs with a year factor. An alternative specification adjusts the annual trading costs by the time-series of the aggregate execution costs on the different markets (NYSE and NASDAQ) between 1984 and 1992, as in Stoll (1995), and the time-series of the execution costs between 1992 and 2004, obtained from Abel/Noser. The correlation between the two measures is 97.09%, which justifies the small impact of the adjustment.

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