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# Peer Versus Pure Benchmarks in the Compensation of Mutual Fund Managers

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## Abstract

We examine the role of peer (e.g., Lipper manager indices) versus pure (e.g., S&P 500) benchmarks in fund manager compensation. We model their impact on manager incentives and then test those predictions using novel data. We find that 71% of managers are compensated based on peer benchmarks. Consistent with the model, peer-benchmarked fund managers exhibit higher effort generating higher gross performance and collect higher fee income. Analyzing advisors' choice between benchmark types, we show that peer-benchmarking advisors cater to more sophisticated and performance-sensitive investors, and are more likely to sell through direct channels, consistent with investor heterogeneity and market segmentation.

## I. Introduction

Performance evaluation of mutual fund managers has been a subject of enduring interest to financial economists. At the core of this issue is the benchmark

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against which a manager's investment performance is measured.[1] The literature on portfolio delegation, primarily consisting of theoretical work, focuses almost exclusively on securities market indices as the benchmarks (i.e., pure benchmarks) against which performance is measured.[2] However, benchmarks can also be constructed from groups of funds overseen by peer managers (i.e., peer benchmarks). Brown, Harlow, and Starks (1996), e.g., find evidence consistent with tournament behavior among fund managers, suggesting that peer comparisons matter. Similarly, Cohen, Coval, and Pástor (2005) propose a performance measure that compares a given manager to a composite of peer managers with similar returns and portfolio holdings. In spite of the importance of peer manager comparisons suggested by these articles, the literature has largely ignored this benchmarking option though practitioners have not. Based on hand-collected data of portfolio manager compensation contracts in the U.S. mutual fund industry, we find that, for approximately 71% of funds, the manager's compensation depends entirely or partly on peer-benchmarked performance. In this article, we study, for the first time, the choice of peer versus pure benchmarks in the compensation contracts of individual portfolio managers, and its implications for contact design, portfolio decisions, and fund performance.

As a first step in our analysis, we examine the implications of peer versus pure benchmarks in a portfolio delegation model that builds on Kapur and Timmermann (2005). There are two assets in the model: a risky stock and a risk-less bond. Individual portfolio managers are offered a contract with a base salary and variable compensation (the incentive fees) based both on the fund's absolute and relative performance. The relative fee depends on the manager's performance relative to either a peer or a pure benchmark. The proportion of managers compensated relative to either type is exogenously given. Investors decide the optimal incentive fee depending on the benchmark type. Managers then choose their utility-maximizing level of costly and unobservable effort before receiving a signal partially correlated with the stock's return. Based on their effort, the signal received, and the contract offered, they choose the optimal portfolio. Managers with different benchmarks may receive different signals.

This theoretical setting allows us to examine how managerial effort and risk-taking might differ across the two types of benchmarks and, ultimately, whether the benchmark choice might impact fund performance. The primary intuition as to why these characteristics might differ has to do with the nature of the benchmarks. While a pure benchmark constitutes an exogenous performance hurdle for managers, the

[1]There is a large literature on this issue (e.g., Heinkel and Stoughton (1994), Admati and Pfleiderer (1997), Das and Sundaram (2002), Ou-Yang (2003), Basak, Shapiro, and Teplá (2006), Basak, Pavlova, and Shapiro (2008), Binsbergen, Brandt, and Koijen (2008), Li and Tiwari (2009), Dybvig, Farnsworth, and Carpenter (2010), Agarwal, Gómez, and Priestley (2012), Basak and Pavlova (2013), Gârleanu, Panageas, and Yu (2020), Kashyap, Kovrijnykh, Li, and Pavlova (2023), and Sockin and Xiaolan (2023)).

[2]For example, in Admati and Pfleiderer (1997), the "… benchmark is equal to the passive portfolio that an uninformed investor would hold…" and in Basak et al. (2008), "… the benchmark …relative to which her performance is evaluated is a value-weighted portfolio…" The only exception is Kapur and Timmermann (2005), where the manager is evaluated relative to average peer performance, though they do not compare pure versus peer benchmarks.

model shows that for peer benchmarks, managers' effort and active portfolio decisions are impounded into the benchmark return (i.e., the peer average).

Theoretically, it is well understood that when a manager is compensated relative to a benchmark, she structures her optimal portfolio by first *replicating* the benchmark. She then adds an *active portfolio* that depends on the expected return and covariance of the available investment assets and her risk aversion. When the benchmark is a pure index, like the S&P 500, its return distribution (in particular, mean and variance) is public knowledge, and the benchmark's performance can be replicated and fully hedged. When the benchmark is based on the performance of other managers whose private information and effort are not observable, the benchmark cannot be fully hedged. Our model shows that this information asymmetry creates an additional partial-hedging component for peer relative to pure-benchmarked managers. This *wedge* affects the manager's optimal effort, tracking error volatility (TEV), and compensation of peer-evaluated managers.

The first implication is that, unlike managers compensated relative to a pure benchmark, those compensated relative to peer performance cannot *undo* the relative performance incentive fee. The issue of the "undo effect," whereby adjusting their optimal portfolio choice managers can undo the principal's incentive fee, has received ample attention in the portfolio delegation literature.[3] While research examining how to undo the "undo effect" has focused on more complex, non-linear contract structures (e.g., Basak et al. (2008), Li and Tiwari (2009)) or portfolio constraints (e.g., Gómez and Sharma (2006), Dybvig et al. (2010)), we find that a simple linear contract that is common in practice (although it has been largely ignored by the literature) can also address the issue. Including a relative performance fee based on peer performance prevents managers from undoing the incentives they are offered. The reason is that managers cannot fully hedge their exposure to the portfolio of other peer managers with unobservable private information. In the presence of moral hazard, we show that managerial effort increases with the peer-adjusted incentive fee, since a larger proportion of the manager's compensation is tied to other managers' performance that she cannot fully hedge. This additional hedging component also induces a wedge in the TEV of peer-benchmarked managers. We show that they must take more risk than pure-benchmarked managers to beat peers' performance. As managers are risk averse, higher TEV must be compensated. Consistent with this intuition, we predict that managers compensated relative to their peers should receive higher compensation than similar managers paid relative to a pure benchmark.

Therefore, our model yields three predictions. It predicts that peer-benchmarked contracts, first, induce greater managerial effort and, second, are associated with higher TEV. Third, the model suggests that investors would set higher compensation for contracts with peer benchmarks. Based on these predictions, we postulate that peer-benchmarked managers should exhibit higher

[3]A manager compensated relative to a market index can adjust her portfolio for any performance incentive fee (absolute or relative) offered in such a way that performance fees can be undone by the manager and fail to affect her effort choice to gather information. This is the well-known *undo effect* studied by Stoughton (1993) and Admati and Pfleiderer (1997) among others.

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expected gross investment performance (before fees) compared with pure-benchmarked managers.

Using a hand-collected data set of the performance benchmarks employed in portfolio manager compensation contracts in the U.S. mutual fund industry, we empirically test our model's predictions.[4] For the funds whose managers receive a bonus based on relative performance, investment advisors must disclose the benchmark(s) used to assess the manager's performance. While the SEC requires mutual funds to compare their performance to pure benchmarks only (i.e., "broad-based securities market index") in their prospectus, the investment advisors' choice of benchmarks for determining portfolio manager compensation is not similarly restricted.[5] As a result, the manager compensation benchmark is based on peer performance (hence, different from the prospectus benchmark) for many funds.

Our sample of funds consists of 1,043 U.S. domestic equity funds across 153 fund families from 2006 to 2012. We manually collect information on the components of the manager's compensation from each fund's Statement of Additional Information (SAI), including the specific benchmarks stated in the contract. We find that to determine the manager's relative performance bonus, 21% of funds in our sample use a peer benchmark (e.g., Lipper Small-Cap Growth Fund index[6]), 29% of funds use a pure benchmark (e.g., S&P 500 index), and the remaining 50% of funds use a compensation benchmark comprised of both peer and pure indices. In other words, for about 71% of funds, the manager's compensation depends entirely or partly on the fund's performance relative to the average performance of peer funds from the same investment objective.

We begin our empirical analysis by examining, jointly, the first two predictions of our model: peer-benchmarked managers will exhibit greater effort and portfolio activeness. In our analysis, we use three measures of fund activeness that are commonly used in the literature: i) active share (Cremers and Petajisto (2009)), ii) tracking error, and iii) $R^2$ (Amihud and Goyenko (2013)). We find that peer-benchmarked managers have a higher active share and tracking error, but lower $R^2$ compared with pure-benchmarked managers, with the differences being both statistically and economically significant. This evidence is consistent with the first two predictions of the model.

Because we do not have the actual contracts or dollar amounts paid to portfolio managers, the prediction regarding higher incentive fees cannot be tested directly. However, the fund-level advisory fee income collected by the investment advisor can serve as a reasonable proxy since the compensation paid to the manager by the investment advisor is plausibly funded from that fee revenue. By using advisory fee rates and total fee revenue generated (i.e., advisory fee rate multiplied by fund size), we find empirical evidence that supports the model's prediction. Specifically, our

[4]The availability of this data is due to the 2005 SEC regulation that began requiring mutual funds to disclose the determinants of portfolio manager compensation. See Ma, Tang, and Gómez (2019) for detailed description of the rule.

[5]For the SEC's requirement on prospectus benchmark, see "CFR Final Rule: Disclosure of Mutual Fund Performance and Portfolio Managers," 1993, Securities and Exchange Commission, CFR Financial Assistance to Individuals, 17 C.F.R. §239, 270, 274 (1993), page 13.

[6]An unmanaged, equal-weighted performance index comprised of the 30 largest mutual funds based on fund total net assets in the Lipper Small-Cap classification.

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findings show that funds managed by peer-benchmarked managers earn, on average, a 6 bps higher advisory fee rate and $1.32 million more income than those managed by pure-benchmarked managers. Moreover, the results indicate that peer-benchmarked funds have a higher overall expense ratio than pure-benchmarked funds. Both of these differences are statistically significant at the 1% level.

While the model does not have a prediction regarding fund performance, we conjecture that the previously discussed predictions regarding manager effort and activeness are likely to result in increased gross-of-fees risk-adjusted performance for peer-benchmarked managers. To test this conjecture, we use four abnormal performance measures before fees in our analysis: i) Carhart (1997) 4-factor alpha, ii) prospectus benchmark-adjusted alpha, iii) DGTW characteristic-adjusted portfolio return (Daniel, Grinblatt, Titman, and Wermers (1997)), and iv) Morningstar ratings. Across all four measures, we find significant outperformance for managers with peer compensation benchmarks compared to those with pure compensation benchmarks. For instance, peer-benchmarked funds outperform by 78 bps (50 bps) annually based on gross prospectus benchmark-adjusted alpha (4-factor alpha), statistically significant at the 5% level.[7]

While peer or pure benchmarks are exogenously assigned in the model, our empirical observation of both types of benchmarks in practice raises a broader question: how can both types be used in equilibrium? One plausible explanation would be customer heterogeneity and the associated market segmentation. To explore this possible explanation, we examine both fund flows and the determinants of an investment advisor's choice between peer- and pure-benchmarked manager compensation. The flow results are consistent with such heterogeneity, showing that investors in peer-benchmarked funds are significantly more sensitive to performance than pure-benchmarked managers. In a more direct test of possible market segmentation, we examine the determinants of an investment advisor's choice of peer or pure-benchmark compensation. We first find evidence that the decision is largely made at a family level. We then explore what family-level determinants drive the decision and find that peer compensation benchmarks are less likely when the fraction of the fund total net assets (TNAs) sold via the broker channel is high. Prior studies have shown that the broker-sold and direct-sold mutual fund distribution channels appear segmented and one characteristic of this segmentation is that investors who purchase broker-sold funds are less performance conscious (e.g., Del Guercio and Reuter (2014)). We also find that peer compensation benchmarks are more likely when the fund has a higher percentage of assets coming from sophisticated investors. Finally, the tests show that advisors that promote internal cooperation (measured by the cooperative incentives index of Evans, Prado, and Zambrana (2020)) are also more likely to use pure benchmarks instead of peer benchmarks (which our model suggests provide more competitive incentives). Overall, the differences in investor sophistication and performance sensitivity, the related difference in manager incentive structure, and the difference in distribution channel between investment advisors using peer and pure benchmarks is

[7]We also find similar outperformance in funds with peer benchmarks using net alphas, which suggests that fund managers do not capture all of the surplus and a substantial portion of the outperformance is passed on to fund investors.

suggestive of different underlying advisor business models focusing on different investor segments.

Our article adds to the literature on managerial incentives in the asset management industry. When it comes to benchmarking in performance evaluation, the literature focuses almost exclusively on pure benchmarks. Our evidence shows that, in practice, peer benchmarks are often used exclusively or partially in fund managers' compensation contracts.[8] One contribution of our study is to develop a model to analyze, for the first time, the difference between pure versus peer compensation benchmarks. We uncover that peer compensation benchmarks result in an externality in portfolio choice that makes effort an increasing function of linear peer-based incentives fees.

Our empirical evidence on compensation design is also related to other theoretical studies on optimal benchmark design. Several theoretical models predict that consistent with the "informativeness principle" of Hölmstrom (1979), the optimal benchmark should reflect the manager's investment style (e.g., Li and Tiwari (2009), Gârleanu et al. (2020)). Our empirical evidence supports this prediction. We show that pure benchmarks coincide with prospectus benchmarks, arguably reflecting the fund's investment objective, and that peer benchmarks are clustered by investment style.[9] Additionally, several theoretical models predict that the fund managers compensated with a pure benchmark act more like closet indexers (see, e.g., Admati and Pfleiderer (1997), Cuoco and Kaniel (2011), and Basak and Pavlova (2013)). Our results confirm this prediction and, simultaneously, show that managers compensated relative to peer funds are less likely to behave as closet indexers. Moreover, we find that benchmark choice is determined, in part, by both market segmentation related to investor sophistication and incentive structures of fund management companies.

Finally, our article contributes to the nascent literature that studies the compensation of individual portfolio managers. To the best of our knowledge, this article is the first to analyze the choice of performance benchmarks in portfolio manager compensation contracts.[10] The prior literature has focused primarily on the design of the advisory contracts between fund investors and investment advisors due to lack of data on portfolio managers' compensation.[11] A recent study by Ma et al. (2019) analyzes the compensation structures of the individual portfolio managers in the United States. A related study by Ibert, Kaniel, Nieuwerburgh, and Vestman (2018) examines what factors determine the compensation of mutual

[8]In a related empirical study, Hunter, Kandel, Kandel, and Wermers (2014) propose an empirical methodology that uses peer fund performance to increase precision in measuring fund risk-adjusted performance via factor models. Moreover, our study is also related to prior work that studies how to use peer funds to evaluate fund performance in various other settings (e.g., Brown et al. (1996), Chevalier and Ellison (1997), Cohen et al. (2005), and Brown and Wu (2016)).

[9]Sensoy (2009) and, more recently, Cremers et al. (2022) find evidence consistent with a strategic mismatch between the prospectus benchmark and the fund's investment strategy in certain cases.

[10]See Bizjak, Kalpathy, Li, and Young (2022) for a comparison between market-based and peer-based benchmarks in the design of explicit performance-based awards of U.S. firm CEOs.

[11]Among others, Elton, Gruber, and Blake (2003) and Golec and Starks (2004) study performance-adjusted advisory fees among U.S. fund advisors. More recently, Servaes and Sigurdsson (2022) analyze these fees among European mutual funds.

fund managers in Sweden. While both of these studies examine determinants of manager compensation, neither examines the important issue of performance benchmark choices. Thus, our article complements both Ma et al. (2019) and Ibert et al. (2018), and together these three studies offer a more complete picture of compensation contracts of portfolio managers. Relatedly, Lee, Trzcinka and Venkatevan (2019) examine the risk-shifting implications of performance-based compensation contracts, and Evans et al. (2020) examine competitive and cooperative incentive mechanisms for managers. None of these articles study the benchmark choices between pure versus peer benchmarks and the implications for portfolio decisions and fund performance, which is the focus of this study.

The remainder of this article proceeds as follows: Section II introduces the model. Section III describes the data and variable construction. Section IV presents the empirical results. Finally, Section V sets forth our conclusions.

# II. The Model

We first develop a model to analyze the implications of peer versus pure benchmarks in portfolio manager compensation. Kapur and Timmermann (2005) propose a model examining manager compensation when performance is measured relative to peers. We extend the model of Kapur and Timmermann (2005) in several dimensions. First, to better understand the tradeoffs between peer and pure benchmarks, we incorporate in their setting the possibility that managers are compensated relative to an exogenous, pure benchmark. Second, we assume that managers have a proprietary technology that allows them to receive private signals partially correlated with the stock's return. The precision of the signals increases with the manager's costly and unobservable effort. Third, managers differ in their technologies: not all of them receive the same signal although they could be partially correlated. All proofs are included in Appendix B.

## A. Assets and Agents

Assume a one-period model where portfolio managers can invest in two assets: a risky stock and a risk-free bond with price 1 and gross return $r$. The stock has initial price 1 and final, period-end gross return $\tilde{P}=\bar{P}+\tilde{\epsilon}$ with $\tilde{\epsilon}\sim N\left(0,\sigma_{\epsilon}^{2}\right)$. Let $\tilde{K}=\tilde{P}-r$ denote the excess return on the stock over the bond. $\tilde{K}$ is therefore normally distributed with mean excess return $\bar{K}=\bar{P}-r$ and variance $\sigma_{\epsilon}^{2}$.

There is a continuum of investors over the interval $[0,1]$ with identical utility functions. Every investor invests in a single fund managed by a risk-averse portfolio manager. The investor and the fund are perfectly aligned. Thus, in our model, we use both terms interchangeably to denote the principal. The manager is the agent. At the beginning of the period, the manager is offered a contract that specifies a fixed salary $I\geq 0$ paid at the end of the period, an absolute performance incentive fee defined as a percentage $\beta$ of the fund's performance at the end of the period, and a relative incentive fee defined as a percentage $\theta$ of the fund's performance at the end of the period net of the benchmark performance. The manager then decides whether to accept the contract or reject it.

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## B. Information Structure and the Manager's Problem

All managers and funds are in the same investment objective or category. Regarding the relative performance incentive, we assume that a given percentage $0<\delta<1$ of funds compensate managers relative to the average fund performance across all managers. The remaining $1-\delta$ funds compensate their managers relative to a pure, exogenous benchmark that coincides with the fund prospectus benchmark. Let superscript $e$ (alternatively, $u$) denote managers compensated relative to a peer (alternatively, pure) benchmark. If a pure-benchmarked manager accepts the contract (i.e., if her expected utility is higher than her reservation utility, $U_0 \geq 0$), she will receive a signal $s^u$ after putting effort $\alpha^u$. Likewise, after accepting the contract and putting effort $\alpha^e$, managers compensated relative to their peers, receive a signal $s^e$. We can think about these signals as some proprietary data processing technology that allows managers to time the market, ultimately producing better risk-adjusted returns. Managers with the same benchmark use the same technology and observe the same signal, which is unobservable to managers with a different type of benchmark. Signals are drawn from a distribution partially correlated with the stock return: $\tilde{s}^i = \tilde{\epsilon} + \tilde{n}^i$, with $\tilde{n}^i \sim N\left(0, \frac{1-\alpha^i}{\alpha^i}\sigma_\epsilon^2\right)$ for $i=\{e,u\}$, the corresponding noise distribution. More effort $\alpha$ results in a more precise signal. We further assume that noise and stock return distributions are uncorrelated (i.e., $E\left(\tilde{\epsilon}\tilde{n}^i\right)=0$ for $i=\{e,u\}$) and that the noise terms are uncorrelated across signals (i.e., $E(\tilde{n}^e\tilde{n}^u)=0$). Under these assumptions, the signals are distributed as follows:

$$\begin{pmatrix} \tilde{s}^e \\ \tilde{s}^u \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \sigma_\epsilon^2 \begin{pmatrix} \frac{1}{\alpha^e} & 1 \\ 1 & \frac{1}{\alpha^u} \end{pmatrix}\right). \tag{1}$$

Let $\tilde{K}(\alpha, s)$ denote the stochastic conditional (on effort $\alpha$ and signal $s$) excess return of the stock. Given (1), fund returns for each type of benchmark conditional on the signal received are normally distributed:

$$\begin{pmatrix} \tilde{K}(\alpha^e, s^e) \\ \tilde{K}(\alpha^u, s^u) \end{pmatrix} \sim N(\mu, \Sigma) \tag{2}$$

with conditional (on the signal realization) mean return vector:

$$\mu = \begin{pmatrix} \bar{K} + \alpha^e s^e \\ \bar{K} + \alpha^u s^u \end{pmatrix}$$

and covariance matrix:

$$\Sigma = \sigma_\epsilon^2 \begin{pmatrix} (1-\alpha^e) & \sqrt{1-\alpha^e}\sqrt{1-\alpha^u} \\ \sqrt{1-\alpha^e}\sqrt{1-\alpha^u} & (1-\alpha^u) \end{pmatrix}. \tag{3}$$

Effort choice $\alpha$ is neither observed by the investor nor by the other managers. Moreover, it is costly for the manager. Let $c(\alpha)$ denote the effort disutility function. We assume $c(\alpha)$ is increasing and convex in $\alpha$.

Conditional on the signal and its precision, each manager chooses the number of shares $\lambda$ of the risky stock that maximizes the expected utility of her period-end compensation. Let $W_0$ denote the investor's wealth at the beginning of the period. We assume that investors delegate all their wealth to managers and that managers have no other source of income besides their compensation. Thus, given signal $s$ and effort $\alpha$, the value of the portfolio at the end of the period can be written as $\tilde{W}(\alpha,s) = \lambda\tilde{K}(\alpha,s) + W_0 r$. This represents the fund's net asset value (NAV) at the end of the period before management fees. Therefore, $\tilde{W}(\alpha,s)/W_0$ is the fund's gross return before management fees when the manager puts an effort $\alpha$ and receives the signal $s$; $\lambda/W_0$ is the fund's percentage holdings in the risky stock. In this model, the fund's NAV increases with the manager's portfolio performance (a function of her effort), but not with flows across funds.[12]

After accepting the contract $(I^u,\beta^u,\theta^u)$, a manager rewarded relative to a pure benchmark puts effort $\alpha^u$ before receiving a signal $s^u$ on the return of the risky asset. She then decides her optimal portfolio $\lambda^u(\alpha^u,s^u)$. Her compensation (conditional on signal $s^u$) at period-end is equal to $I^u + \beta^u\tilde{W}^u(\alpha^u,s^u) + \theta^u\tilde{R}^u(\alpha^u,s^u)$, where $\tilde{W}^u(\alpha^u,s^u) = \lambda^u(\alpha^u,s^u)\tilde{K}(\alpha^u,s^u) + W_0 r$ is the fund's NAV and

$$\tilde{R}^u(\alpha^u,s^u) = \left(\lambda^u(\alpha^u,s^u) - \lambda^b\right)\tilde{K}(\alpha^u,s^u) \tag{4}$$

is the fund's (dollar) performance relative to an exogenous benchmark that invests $\lambda^b$ shares in the risky asset.

If the manager is compensated relative to a peer benchmark, after accepting the contract $(I^e,\beta^e,\theta^e)$, she puts in effort $\alpha^e$ before receiving a signal $s^e$. She then decides her optimal portfolio $\lambda^e(\alpha^e,s^e)$. Her compensation (conditional on signal $s^e$) at the end of the period is equal to $I^e + \beta^e\tilde{W}^e(\alpha^e,s^e) + \theta^e\tilde{R}^e(\alpha^e,s^e)$ with

$$\tilde{R}^e(\alpha^e,s^e) = \tilde{W}^e(\alpha^e,s^e) - \bar{W}, \tag{5}$$

where $\tilde{W}^e(\alpha^e,s^e) = \lambda^e(\alpha^e,s^e)\tilde{K}(\alpha^e,s^e) + W_0 r$ is the fund's NAV, and $\bar{W}$ represents the (conditional) average fund performance of the peers:

$$\bar{W} = \delta\lambda^e(\alpha^e,s^e)\tilde{K}(\alpha^e,s^e) + (1-\delta)\lambda^u(\alpha^u,s^u)\tilde{K}(\alpha^u,s^u) + W_0 r. \tag{6}$$

Managers, regardless of the benchmark, are assumed to have identical utility functions with constant absolute risk aversion parameter $\rho > 0$ defined over the stochastic compensation. The (unconditional) indirect utility function is given by the following expression:[13]

[12]Fund flows may qualify our results if they introduce non-linearities in the manager's compensation through implicit incentives, like the convex flow-performance evidence first documented by Sirri and Tufano (1998). Theoretically, this convexity would incentivize the manager to take extra risk at the expense of the investors' welfare. Funds would internalize this effect by decreasing explicit incentive fees, affecting quantitatively our predictions. Heuristically, however, our qualitative predictions about the different effects of peer versus pure benchmarks on effort, TEV, and compensation should not be affected since these are based on the asymmetry of private information across managers, which is unaffected by the convexity of fund flows.

[13]For simplicity, we omit superscripts whenever they are not strictly necessary.

$$V(I,\beta,\theta) = I + \int_{-\infty}^{\infty} \left(\beta E(\tilde{W}) + \theta E(\tilde{R})\right) df(s) - \frac{\rho}{2}\int_{-\infty}^{\infty} \left(\beta^2 \mathrm{var}(\tilde{W}) + \theta^2 \mathrm{var}(\tilde{R}) + 2\beta\theta \mathrm{cov}(\tilde{W},\tilde{R})\right) df(s), \tag{7}$$

where $\tilde{W} \equiv \tilde{W}(\alpha(\beta,\theta,s),s))$ and $\tilde{R} \equiv \tilde{R}(\alpha(\beta,\theta,s),s))$ are, respectively, the absolute and relative fund NAV conditional on the signal $s$; $\alpha(\beta,\theta,s)$ is the manager's optimal effort function conditional on the signal $s$; $f(s)$ denotes the density function of signal $\tilde{s}$.

We solve this problem recursively. Given the contract, we first solve for the manager's optimal portfolio for each possible signal $s$ and effort $\alpha$. Then, we estimate the manager's unconditional expected utility (7) across all possible signals and solve for the effort choice that maximizes it. The following proposition summarizes the main results from the optimal portfolio problem.

*Proposition 1.* Given the contract $(I^u,\beta^u,\theta^u)$, a manager with risk aversion $\rho$ compensated relative to a pure benchmark $\lambda^b$ chooses, for each signal $s^u$, the portfolio:

$$\lambda^u(\alpha^u,s^u) = \frac{\bar{K} + \alpha^u s^u}{(\beta^u + \theta^u)\rho(1-\alpha^u)\sigma_\epsilon^2} + \frac{\theta^u}{\beta^u + \theta^u}\lambda^b. \tag{8}$$

Likewise, given the contract $(I^e,\beta^e,\theta^e)$, a manager with risk aversion $\rho$ compensated relative to peer performance chooses, for each signal $s^e$, the portfolio:

$$\lambda^e(\alpha^e,s^e) = \frac{\bar{K} + \alpha^e s^e}{(\beta^e + \theta^e(1-\delta))\rho(1-\alpha^e)\sigma_\epsilon^2} + \frac{\theta^e(1-\delta)}{\beta^e + \theta^e(1-\delta)}\frac{\sqrt{1-\alpha^u}}{\sqrt{1-\alpha^e}}\bar{\lambda}^u(\alpha^u,\alpha^e,s^e), \tag{9}$$

where

$$\bar{\lambda}^u(\alpha^u,\alpha^e,s^e) = \frac{\bar{K} + \alpha^u\alpha^e s^e}{(\beta^u + \theta^u)\rho(1-\alpha^u)\sigma_\epsilon^2} + \frac{\theta^u}{\beta^u + \theta^u}\lambda^b \tag{10}$$

denotes the expected portfolio of managers compensated relative to a pure benchmark inferred by peer-benchmarked managers after receiving the signal $s^e$.

Equation (8) shows that the optimal portfolio can be interpreted as a weighted average of two portfolios. A proportion $\frac{\beta^u}{\beta^u+\theta^u}$ times the optimal *active* portfolio $\frac{\bar{K}+\alpha^u s^u}{\beta^u\rho(1-\alpha^u)\sigma_\epsilon^2}$ (that ignores any relative performance fee) plus the remaining $\frac{\theta^u}{\beta^u+\theta^u}$ times the benchmark portfolio $\lambda^b$. Therefore, the immediate implication of relative performance evaluation is that the manager replicates the benchmark proportionally to the weight of the relative performance fee in her total compensation. This can be interpreted as *undoing* the effect of the benchmark since both the relative portfolio and, as a consequence, the fund's NAV at the end of the period in equation (4) become independent of the benchmark portfolio $\lambda^b$. Notice that the deviation of the manager's optimal portfolio from the benchmark increases with effort.

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A similar decomposition underlies the optimal portfolio in equation (9) when the manager is compensated relative to her peers. In the absence of other managers compensated relative to a pure benchmark (i.e., when $\delta = 1$), the peer benchmark coincides with the manager's optimal portfolio. Hence, by choosing this portfolio, the manager fully hedges her relative compensation risk, since all peers choose the same portfolio. The optimal portfolio (9) becomes the active portfolio:

$$\lambda^e(\alpha^e, s^e) = \frac{\bar{K} + \alpha^e s^e}{\beta^e \rho (1 - \alpha^e) \sigma_\epsilon^2} \tag{11}$$

independent of the relative performance fee $\theta^e$. In this case, there is no difference between peer and pure benchmarking: in both cases, managers fully undo the effect of the relative fee $\theta$ by replicating the benchmark.

However, when $\delta < 1$, we observe two simultaneous effects. On one hand, the incentive fee $\theta^e$ is scaled down by a factor of $(1-\delta)$ to $\theta^e(1-\delta)$. The manager optimally holds a percentage $\frac{\beta^e}{\beta^e + \theta^e(1-\delta)}$ to replicate the active portfolio (11) chosen by a proportion $\delta$ of peer managers who are also compensated relative to peers.

On the other hand, a percentage $1-\delta$ of peer managers are compensated relative to a pure benchmark. To hedge the risk of deviating from the portfolio (8) chosen by peer managers compensated relative to $\lambda^b$, the peer-compensated manager would like to replicate portfolio $\lambda^u$ in (8). While she does not observe signal $s^u$, which is private, she does observe her private signal $s^e$, which is partially correlated with $s^u$ as shown in (1). Therefore, the manager invests a proportion $\frac{\theta^e(1-\delta)}{\beta^e + \theta^e(1-\delta)}$ in portfolio $\bar{\lambda}^u$, defined as the expected portfolio (across all possible private signals $s^u$) in (8) inferred by peer-benchmarked managers after learning the private signal $s^e$.[14] This additional portfolio component is a direct consequence of the asymmetry of information across managers. When $\delta = 1$, this information asymmetry disappears and peer benchmarks yield the same portfolio as pure benchmarks. In other words, it is not only peer benchmarks but also the existence of a moral hazard problem what triggers our results.

Notice that, when $0 < \delta < 1$, the manager can no longer *neutralize* the relative performance fee $\theta^e$ since she needs to hedge the risk of deviating from the portfolio chosen by her peer managers compensated relative an exogenous benchmark $\lambda^b$. This difference is key relative to the case where the benchmark is pure. This will have implications for the manager's optimal effort choice, the optimal compensation contract, and the fund's risk and performance.

Replacing each portfolio in the corresponding expected utility function and averaging across all possible signal realizations, managers estimate their unconditional expected utility function. Then, managers choose the effort that maximizes their unconditional expected utility function net of the cost of effort. The following proposition presents the optimal effort choice problem for each benchmark type.

[14]When $\beta^e = 0$, an alternative interpretation of the effect of peer-benchmarking on her optimal portfolio (9) is that the manager becomes more risk tolerant: $\rho$ becomes $\rho(1-\delta)$. Under this interpretation, keeping up with the performance of her peers partially hedges her portfolio risk exposure making the manager, effectively, more risk tolerant. Given the covariance matrix (3), the ratio $\frac{\sqrt{1-\alpha^u}}{\sqrt{1-\alpha^e}}$ in (9) can be interpreted as the estimated slope in the regression of $\tilde{K}(\alpha^u, s^u)$ on $\tilde{K}(\alpha^e, s^e)$.

*Proposition 2.* Provided that there is an interior solution to the optimal effort problem, the optimal effort $\alpha^u$ of a manager compensated relative to a pure benchmark is independent of the benchmark and both the absolute ($\beta^u$) and relative ($\theta^u$) incentive fees:

$$\text{(12)} \qquad \alpha^u = \arg\max_\alpha \frac{\bar{K}^2 + \alpha\sigma_\epsilon^2}{2\rho(1-\alpha)\sigma_\epsilon^2} - c(\alpha).$$

Provided that there is an interior solution to the optimal effort problem, the optimal effort $\alpha^e$ of a manager compensated relative to the peer performance is such that

$$\text{(13)} \quad \alpha^e(\theta^e) = \arg\max_\alpha \frac{\bar{K}^2 + \alpha\sigma_\epsilon^2}{2\rho(1-\alpha)\sigma_\epsilon^2} + \theta^e(1-\delta)\frac{\sqrt{1-\alpha^u}}{\sqrt{1-\alpha}}\left(\frac{\bar{K}^2 + \alpha^u\alpha\sigma_\epsilon^2}{(\beta^u+\theta^u)\rho(1-\alpha^u)\sigma_\epsilon^2} + \lambda^b\bar{K}\right) - \frac{\rho}{2}(\theta^e(1-\delta))^2\frac{(1-\alpha)\alpha^u}{(\beta^u+\theta^u)^2\rho^2(1-\alpha^u)} - c(\alpha),$$

which is independent of $\beta^e$.

A manager compensated relative to a pure benchmark can adjust her portfolio for any performance incentive fee (absolute or relative) that she is offered. This means that both fees can be undone or neutralized by the manager. This is the *undo effect* studied by Stoughton (1993) and Admati and Pfleiderer (1997) among others. The relative incentive fee $\theta^u$ becomes irrelevant since the manager optimally replicates the benchmark. As per the absolute performance fee $\beta^u$, the manager can scale the composition to her active portfolio $\frac{\bar{K}+\alpha^u s^u}{\beta^u\rho(1-\alpha^u)\sigma_\epsilon^2}$ to neutralize the effect of the absolute performance fee: if $\beta^u$ increases (decreases), the manager's optimal active portfolio decreases (increases) in by $1/\beta^u$, *canceling* the incentive fee. Ultimately, her optimal effort is only a function of her risk aversion, the model parameters from the stock and signal distributions, and the cost function.

However, when the manager is compensated relative to the peer performance, she can still scale her active portfolio (11) to neutralize the effect of the absolute incentive fee $\beta^e$. However, the peer-adjusted incentive fee $\theta^e(1-\delta)$ enters the optimal problem since the manager cannot undo the (average) portfolio chosen by peer managers compensated relative to a pure benchmark. Since the manager must beat the performance of peer managers compensated relative to a pure benchmark, when the relative performance fee increases, she must in return put higher effort since a larger share of her compensation is tied to her performance relative to those peers. This wedge will motivate the manager to put an extra effort relative to a situation in which she can fully hedge her exposure to a pure benchmark. This is summarized in the following prediction.

*Prediction 1.* For a given investment objective and $\delta < 1$, provided there exists a solution to the optimal effort problem, the optimal effort of a manager compensated relative to peer performance is higher than the optimal effort of a manager compensated relative to a pure benchmark. Moreover, this difference increases with the incentive fee $\theta^e$ and decreases with the percentage of managers compensated relative to peer performance, $\delta$. The effort is independent of the absolute incentive fee $\beta^e$.

The proof of this prediction follows immediately after comparing equations (12) and (13): the marginal utility of effort is increasing with respect to $\theta^e(1-\delta)$ in (13) and both equations coincide when $\theta^e(1-\delta)=0$. Notice that $\alpha^e$ depends on the optimal effort chosen by managers compensated relative to a pure benchmark, $\alpha^u$. Although this effort choice is not directly observed, it can be perfectly inferred from the solution to problem (12) as a function of publicly known fundamental parameters.

We study next whether the two types of benchmarks affect fund active management differently. To estimate the portfolio's active management, we calculate the TEV of each portfolio relative to the corresponding benchmark.

Given (4), the expected TEV of a fund that compensates the portfolio manager relative to a pure benchmark across of possible signals $s^u$ is

$$(14)\qquad \text{TEV}^u = \int_{-\infty}^{\infty} \text{var}\left(\tilde{R}^u(\alpha^u, s^u)\right) df(s^u) = \frac{\bar{K}^2 + \alpha^u \sigma_\epsilon^2}{\rho^2(1-\alpha^u)\sigma_\epsilon^2},$$

where $f(s^u)$ denotes the density function of the signal $\tilde{s}^u$. Likewise, given (5), when the fund compensates the manager relative to peer performance, the fund's expected TEV across of possible signals $s^e$ is

$$(15)\qquad \text{TEV}^e = \int_{-\infty}^{\infty} \text{var}\left(\tilde{R}^e(\alpha^e, s^e)\right) df(s^e) = \frac{\bar{K}^2 + \alpha^e \sigma_\epsilon^2}{\rho^2(1-\alpha^e)\sigma_\epsilon^2} + (1-\delta)^2 \frac{(1-\alpha^e)\alpha^u}{\rho^2(1-\alpha^u)},$$

where $f(s^e)$ denotes the density function of the signal $\tilde{s}^e$. Comparing (14) and (15), it follows that $\text{TEV}^e - \text{TEV}^u > 0$ since, according to Prediction 1, $\alpha^e > \alpha^u$ for all $\delta < 1$.

Comparing equations (14) and (15), we observe that both coincide when $\delta = 1$, since, in that case, Proposition 2 predicts that $\alpha^u = \alpha^e$. When $\delta < 1$, the TEV induced by peer benchmarks is higher than that induced by a pure benchmark because of two reasons. First, as shown in (8), the manager's active portfolio relative to the pure benchmark increases with effort. The same is true for managers compensated relative to her peers. Prediction 1 shows that peer-based benchmarks induce higher effort and, therefore, a larger (in absolute terms) portfolio deviation from the benchmark. This results in higher TEV. Simultaneously, when the manager is compensated relative to her peers and some of them are compensated relative to a pure benchmark (i.e., $\delta < 1$), a second term higher than 0 emerges in equation (15). This term arises because peer-evaluated managers must also beat the (expected) portfolio of pure-evaluated managers. To do that, they must increase the fund's TEV relative to other funds where the manager is compensated relative to a pure benchmark. This leads to our second empirical prediction.

*Prediction 2.* For a given fund objective and $\delta < 1$, the active management of funds that compensate their managers relative to peer performance is expected to be larger than that of funds whose managers are compensated relative to the prospectus benchmark.

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Finally, we derive the expected compensation of both types of managers in the following proposition.

*Proposition 3.* Provided there exists an optimal contract such that the manager's participation constraint coincides with her reservation utility $U_0$, then, if the manager is compensated relative to a pure benchmark, her expected dollar compensation is given by the following expression:

$$C^u = U_0 + \frac{\bar{K}^2 + \alpha^u \sigma_\epsilon^2}{2\rho(1-\alpha^u)\sigma_\epsilon^2}, \tag{16}$$

where $\alpha^u$ solves the optimal effort problem (12). If the manager is compensated relative to her peers' performance, then her expected dollar compensation is given by the following expression:

$$C^e(\theta^e) = U_0 + \frac{\bar{K}^2 + \alpha^e(\theta^e)\sigma_\epsilon^2}{2\rho(1-\alpha^e(\theta^e))\sigma_\epsilon^2} + (\theta^e(1-\delta))^2 \frac{(1-\alpha^e(\theta^e))\alpha^u}{2\rho(\theta^u)^2(1-\alpha^u)}, \tag{17}$$

where $\alpha^e(\theta^e)$ solves the optimal effort problem (13).

Regardless of the type of benchmark, the manager's participation constraint is binding $(V(I,\beta,\theta) \geq U_0)$.[15] Therefore, since the manager is risk averse, she is paid her reservation salary $U_0$ plus a compensation for the disutility of the TEV of her optimal portfolio. Consistently with the TEV in equation (14), when the manager is compensated relative to a pure benchmark, her expected dollar compensation is independent of the absolute and relative incentive fees. When the manager is compensated relative to her peers, the TEV of her compensation consists of two terms, as shown in (15). The compensation in (17) maps these two terms on the manager's dollar compensation. Since $\alpha^e > \alpha^u$ for $\delta < 1$, the first term, also independent of performance fees, is higher that the equivalent term in (16): the higher effort induced by peer benchmarking must be compensated with higher pay. But there is an additional term: the manager must also be compensated for beating peers compensated relative to a pure benchmark. This creates a wedge in effort, TEV, and ultimately, compensation.

Therefore, comparing (16) with (17), and given that $\alpha^e(\theta^e) > \alpha^u$ for all $\delta < 1$ (Prediction 1), we obtain a new empirical prediction.[16]

*Prediction 3.* For a given investment objective and $\delta < 1$, the expected compensation of a manager evaluated relative to her peers, $C^e(\theta^e)$, is higher than the expected compensation of a manager evaluated relative to a pure benchmark, $C^u$.

In the following sections, we test empirically our model's predictions. Namely, managers compensated relative to their peers performance are expected to exert

[15]We assume that $U_0$ is large enough such that there exists a strictly positive fixed salary $I > 0$ that makes the participation constraint saturate. See Kapur and Timmermann (2005) for the case when the participation constraint is not saturated.

[16]Notice that this prediction depends on the higher effort exerted by managers compensated relative to peers as shown in Prediction 1, which only requires $\theta^e(1-\delta) > 0$.

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more effort and have a higher TEV. Based on these predictions, we postulate that funds with managers compensated relative to their peers are expected to outperform before fees. This allows peer-benchmarked funds to extract higher fees to compensate their risk-averse managers for their funds' higher TEV.[17]

# III. Data, Variables, and Descriptive Statistics

The manager contracting problem characterized previously gives us a rich set of predictions that guide our empirical analysis. In this section, we describe the unique data set collected to test these specific hypotheses, the construction of the variables. We then provide descriptive statistics regarding these variables.

## A. Data

We construct our sample from several data sources. The first data source is the Morningstar Direct Mutual Fund (MDMF) survivorship-bias-free database, which covers U.S. open-end mutual funds and contains information on fund names, tickers, CUSIP numbers, net-of-fee returns, AUM, inception dates, expense ratios, portfolio turnover ratios, investment objectives (i.e. Morningstar Category), Morningstar ratings, fund primary prospectus benchmarks, benchmark portfolio returns, portfolio manager names, advisor names, fund family names, and other fund characteristics.

Our sample consists of actively managed U.S. diversified domestic equity funds in the MDMF database over the period of 2006 to 2012. We exclude money market funds, bond funds, balanced funds, international funds, sector funds, and fund of funds from the sample. We identify and exclude index funds using fund names and index fund indicators from MDMF database. To address the incubation bias documented in Evans (2010), we drop the first 3 years of return history for every fund in our sample. Following Elton, Gruber, and Blake (2001), Chen, Hong, Huang, and Kubik (2004), and Pástor, Stambaugh, and Taylor (2015), we further exclude funds with less than $15 million in TNAs. Since multiple share classes are listed separately in the MDMF database, we aggregate the share class-level data to the fund level. Specifically, we calculate fund TNA as the sum of assets across all share classes and compute the value-weighted average of other fund characteristics across share classes.

The second data source is the SEC EDGAR (Electronic Data Gathering, Analysis, and Retrieval) database. In 2005, the SEC adopted a new federal rule that requires mutual funds to disclose the compensation structure of their portfolio managers in the Statement of Additional Information (SAI). The new rule applies to all fund filing annual reports after Feb. 28, 2005. Following the procedures of Ma et al. (2019), we retrieve from EDGAR the SAI for each fund and year in our sample from 2006 to 2012. We then manually collect the information on the structure and the method used to determine the compensation of portfolio managers. Consistent

[17]Notice that all the empirical predictions are partial equilibrium results that hold *independently* of the general equilibrium value of the risk premium $\bar{K}$. Our empirical tests are based of these partial equilibrium predictions. A derivation of the general equilibrium $\bar{K}$, as in Kapur and Timmermann (2005), is beyond the scope of this article.

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with Ma et al. (2019), about 80% of our sample funds have explicit performance-based incentives in their managers' compensation contracts. For those funds that pay their managers based on investment performance, the SEC requires them to identify any benchmark used to measure performance. We find that the majority of our sample funds comply with this regulation and disclose a benchmark in the compensation contract. We exclude those funds that do not identify any benchmark in their contract to minimize data error.

Finally, we obtain data on investment advisor characteristics contained in Form ADV from the SEC. Form ADV is the form used by investment advisors to register with the SEC. This form provides information about the advisor's business practices, AUM, clientele, ownership structure, and other advisor-level characteristics. To match the investment advisors of our sample funds to the sample of advisors that filed Form ADV, we use the fund ticker to obtain the SEC File Number, which is a unique identifier that the SEC assigns in Form ADV to each investment advisor.

## B. Key Variables

### 1. Pure Versus Peer Compensation Benchmarks

For any given fund, there are two different types of benchmarks. The first is the performance benchmark provided in the fund's prospectus, often referred to as their prospectus benchmark. The second is the benchmark provided in the compensation contract of portfolio managers, which is referred to as the compensation benchmark. The choice of prospectus benchmark is constrained by regulation to be a broad-based securities market index.[18] In contrast, there is no such regulation in place regarding performance benchmark in portfolio managers' compensation contracts. That is, the compensation benchmark can be the same as the prospectus benchmark, a broad-based securities market index; alternatively, the compensation benchmark can be an index based on a fund peer group. In the former case, the market index benchmark is used to measure how much value is added by a portfolio manager relative to the market, while in the latter case, a portfolio manager's investment performance is evaluated against peer funds with similar investment objectives.

While prior research has looked at fund prospectus benchmarks, compensation benchmarks have received little attention due to the lack of data. Based on information we collect from fund SAIs, we use two indicator variables to differentiate the two types of compensation benchmarks: i) PURE_BENCHMARK which equals 1 if in their compensation contract, managers' investment performance is measured relative to a pure market index, and ii) PEER_BENCHMARK which takes a value 1 if the performance is relative to a peer benchmark.

### 2. Fund Performance

To measure fund performance, we first estimate the factor loadings using the preceding 36 monthly fund returns:

[18]For policy regarding fund prospectus benchmarks, see www.sec.gov/rules/final/33-6988.pdf.

$$R_{i,s} = \hat{\alpha}_{i,t-1} + \sum_{k=1}^{N} \hat{\beta}_{i,k,t-1} F_{k,s} + \epsilon_{i,s}, \quad s = t-36, \ldots t-1,$$

where $s$ and $t$ indicate months, $i$ indicates funds, $R_i$ is the monthly excess return of fund $i$ over the 1-month $T$-bill rate, and $F$ is the monthly return of either one factor (corresponding market index or peer group returns) or the four factors of Carhart (1997) (i.e., market, size, book-to-market, and momentum factors). We then calculate monthly out-of-sample alpha as the difference between a fund's return in a given month and the sum of the product of the estimated factor loadings and the factor returns during that month:

$$\alpha_{i,t} = R_{i,t} - \sum_{k=1}^{N} \hat{\beta}_{i,k,t-1} F_{k,t}.$$

The primary performance measures we use in the analysis are prospectus benchmark-adjusted alpha (PROSPECTUS_ALPHA) and Carhart (1997) 4-factor alpha (4F_ALPHA). We also supplement the performance measures using Daniel et al. (1997) characteristic-adjusted returns (DGTW_RET.) and Morningstar ratings (MS_RATINGS).

### 3. Other Variables

ACTIVE_SHARE is calculated by aggregating the absolute differences between the weight of a portfolio's actual holdings and the weight of its closest matching index (Cremers and Petajisto (2009)). It captures the percentage of a fund's portfolio that differs from its benchmark index. TRACKING_ERROR is a measure of the volatility of excess fund returns relative to either the pure or the peer benchmarks. $R^2$ is calculated as the $R^2$ of Carhart (1997) 4-factor model regressions following Amihud and Goyenko (2013).

FUND_SIZE is the sum of AUM across all share classes of the fund; FUND_AGE is the age of the oldest share class in the fund; EXPENSE is determined by dividing the fund's operating expenses by the average dollar value of its AUM; TURNOVER is defined as the minimum of sales or purchases divided by TNAs of the fund; NET_FLOWS is the annual average of monthly net growth in fund assets beyond reinvested dividends (Sirri and Tufano (1998)). MANAGER_TENURE measures the length of time that a manager has been at the helm of a mutual fund; TEAM is a dummy variable that equals 1 if a fund is managed by multiple managers, and 0 otherwise; PCT._NO_LOAD is defined as the percentage of no-load funds in the fund's family and it proxies for the investor's sophistication.[19] We also use, as alternative proxies for investor sophistication, PCT._HEDGE_-FUND_CLIENT, defined as an indicator variable that equals 1 if the largest clientele of the fund advisor by percentage AUM are hedge funds, 0 otherwise; and (the logarithm of) the fund's AVG._ACCOUNT_SIZE. We describe all the variables in detail in Appendix A.

[19]We include this variable as a control because it could be related to compensation contracting choices and it has been shown to predict performance (e.g., Del Guercio and Reuter (2014)).

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## C. Descriptive Statistics

Our final sample consists of 1,043 unique U.S. domestic equity funds from 153 fund families, covering 6,966 fund-year observations that contain at least one performance benchmark, pure or peer, in the portfolio manager's compensation contract. We report the summary statistics of compensation benchmark variables, fund performance, and other characteristics for our final sample in Table 1.

While the funds in our sample funds comply with the SEC and report a market index as the prospectus benchmark,[20] our focus is on the compensation benchmark. Of fund-year observations, 20.9% use only a peer benchmark (e.g., Lipper Small-Cap Growth Fund index) to determine fund manager bonus compensation, while 29.3% use only a peer benchmark (e.g., S&P 500 index). We also find that pure and peer benchmarks are no necessarily mutually exclusive, as 49.8% of observations use both a peer and a pure benchmark to determine fund manager bonus compensation.

In addition, we find that pure compensation benchmarks coincide with prospectus benchmarks and that peer compensation benchmarks are clustered by investment style. For those with pure compensation benchmarks, the market index used in the compensation benchmark coincides with the prospectus benchmark in all but 37 cases (1.8% of our sample). For those with peer compensation benchmarks, Lipper and Morningstar manager benchmarks are employed in more than 51.2% cases. The remaining cases are typically reported as "applicable/appropriate peer group." In those instances, we assign a Morningstar or Lipper benchmark based on the stated investment objective of the fund. Except in 54 cases (2.56% of the sample), peer benchmarks are closely aligned with a fund's style. Overall, these findings are consistent with the theoretical prediction that the optimal benchmark should reflect the manager's investment style (e.g., Li and Tiwari (2009), Gârleanu et al. (2020)).

The average fund in our sample has $443 million in AUM, is just over 5 years old, and has an annual turnover of 50.1%. The average expense ratio is 1.07%, the active share is 75.72% and the TEV is 4.2%. In terms of performance, the average fund has an annualized gross (net) 4-factor alpha of 0.35% (−0.72%).

Table 2 reports the top 10 most frequent (by fund-year observations) pure and peer benchmarks in our sample. When managers are compensated relative to a pure benchmark, 24.4% of cases use the S&P 500. This more than doubles the number of observations of the next benchmark in the list, Russell 1000 Growth index (11.7%). The Russell benchmarks occupy 8 of the top 10 most used pure benchmarks in our sample.[21] For the peer-benchmarked subsample, 17.8% of fund-years have managers whose compensation is determined by performance relative to the Lipper

[20]Of the original hand-collected sample, a small percentage (less than 0.1%) did not have a prospectus benchmark and we excluded those observations from our analysis. In addition to the primary prospectus benchmark, 25.6% of our sample funds also have a secondary prospectus benchmark. In terms of the distribution of prospectus benchmark, the most popular market index is S&P 500 (33%) followed by Russell 1000 Growth (8.6%), Russell 1000 Value (8.5%), Russell 2000 (8.5%), and Russell 2000 Growth (5.5%).

[21]For the S&P 500 benchmark, the fraction based on total assets under management is higher because funds with this benchmark tend to have higher TNA.

TABLE 1
Summary Statistics

Table 1 reports the sample distribution (Panel A) and summary statistics of the main variables used in this study (Panel B). Our sample includes 6,966 fund-year observations of U.S. actively managed domestic equity mutual funds. In Panel A, we break down the distribution across the two main compensation variables: PEER_BENCHMARK versus PURE_BENCHMARK. Peer (Pure) Benchmark takes a value 1 if the manager's performance-based incentive is evaluated relative to a peer (pure) benchmark, and 0 otherwise. All variables in Panel B except indicator variables are winsorized at the 1% and 99% levels. All variables are defined in Appendix A.

*Panel A. Sample Distribution Across Peer Versus Pure Benchmarks*

| | | PEER_BENCHMARK | |
|---|---|---|---|
| | | 0 | 1 |
| PURE_BENCHMARK | 0 | – | 1,457 (20.9%) |
| | 1 | 2,041 (29.3%) | 3,468 (49.8%) |

*Panel B. Summary Statistics of Main Variables*

| | | | | Distribution | | |
|---|---|---|---|---|---|---|
| Variables | No. of Obs. | Mean | Std. Dev. | 10th | 50th | 90th |
| PEER_BENCHMARK | 6,966 | 0.707 | 0.455 | 0 | 1 | 1 |
| PURE_BENCHMARK | 6,966 | 0.791 | 0.407 | 0 | 1 | 1 |
| PROSPECTUS_BENCHMARK_ADJ._ALPHA | 6,716 | −0.055 | 5.326 | −5.983 | −0.231 | 6.248 |
| 4_FACTOR_ALPHA | 6,734 | −0.715 | 5.246 | −6.793 | −0.621 | 5.401 |
| DGTW_RETURNS | 6,048 | 0.393 | 4.996 | −5.446 | 0.225 | 6.380 |
| MORNINGSTAR_RATING | 6,925 | 3.139 | 0.870 | 2.000 | 3.042 | 4.250 |
| ACTIVE_SHARE | 6,079 | 75.719 | 23.033 | 51.179 | 81.463 | 96.536 |
| TRACKING_ERROR | 6,916 | 4.202 | 2.613 | 1.318 | 3.779 | 7.494 |
| $R^2$ | 6,480 | 92.054 | 7.355 | 82.350 | 94.052 | 99.177 |
| ADVISORY_FEE_RATE | 6,811 | 0.655 | 0.270 | 0.246 | 0.698 | 0.985 |
| EXPENSE_RATIO | 6,942 | 1.070 | 0.409 | 0.500 | 1.094 | 1.568 |
| FLOWS% | 6,966 | 0.284 | 3.660 | −2.392 | −0.446 | 3.202 |
| log(FUND_SIZE) | 6,966 | 19.906 | 1.606 | 17.850 | 19.870 | 21.985 |
| log(FUND_AGE) | 6,966 | 5.023 | 0.648 | 4.159 | 5.043 | 5.784 |
| log(TURNOVER) | 6,892 | 3.914 | 0.973 | 2.639 | 4.043 | 5.004 |
| PERFORMANCE_ADV._FEE | 6,966 | 0.017 | 0.130 | 0 | 0 | 0 |
| TEAM | 6,949 | 0.726 | 0.446 | 0 | 1 | 1 |
| log(MANAGER_TENURE) | 6,949 | 3.961 | 0.808 | 2.890 | 4.060 | 4.890 |
| log(FAMILY_SIZE) | 6,966 | 24.087 | 1.839 | 21.515 | 24.518 | 25.815 |

Large-Cap Core Fund benchmark. The peer benchmark list is dominated by Lipper manager benchmarks. Only a single Morningstar benchmark (Large-Cap Growth Funds) makes it to the top 10.

# IV. Empirical Results

## A. Fund Activeness and Compensation Benchmarks

The first two predictions of our model are that peer benchmarking induces greater managerial effort and, as a consequence, is associated with higher active share/tracking error relative to pure benchmarking. We test these predictions empirically by examining whether or not there are differences in portfolio activeness between funds using peer versus pure compensation benchmarks. To ensure a clean comparison, we focus on the sample funds with only a pure or only a peer benchmark in our main analysis throughout the article.

In particular, we carry out a multivariate regression analysis using the following OLS specification:

TABLE 2

Top 10 Pure and Peer Benchmarks

Table 2 reports the summary statistics on the top peer and pure benchmarks disclosed in portfolio manager compensation. We rank all benchmarks based on the number of fund-year observations and report the top 10 pure and peer benchmarks in Panels A and B, respectively. We also report for each benchmark the percentage of funds, the total assets under management, and the percentage of the assets in column 3–5, respectively.

*Panel A. Top 10 Pure Benchmarks*

| Benchmark | # Funds Rank | # Funds | % Funds | Assets (in Billions) | % Assets |
|---|---|---|---|---|---|
| S&P 500 index | 1 | 1,251 | 24.4% | 61,198.8 | 54.0% |
| Russell 1000 Growth index | 2 | 600 | 11.7% | 5,814.1 | 5.1% |
| Russell 1000 Value index | 3 | 585 | 11.4% | 7,043.1 | 6.2% |
| Russell 2000 index | 4 | 364 | 7.1% | 2,567.0 | 2.3% |
| Russell 2000 Growth index | 5 | 326 | 6.4% | 1,062.3 | 0.9% |
| Russell Mid-Cap Growth index | 6 | 287 | 5.6% | 2,162.4 | 1.9% |
| Russell 2000 Value index | 7 | 271 | 5.3% | 1,461.9 | 1.3% |
| Russell 3000 index | 8 | 171 | 3.3% | 2,179.3 | 1.9% |
| S&P Mid-Cap 400 index | 9 | 162 | 3.2% | 4,527.0 | 4.0% |
| Russell 3000 Growth index | 10 | 162 | 3.2% | 1,616.1 | 1.4% |
| Total | | 4,179 | 81.5% | 89,632 | 79.1% |

*Panel B. Top 10 Peer Benchmarks*

| Benchmark | # Funds Rank | # Funds | % Funds | Assets (in Billions) | % Assets |
|---|---|---|---|---|---|
| Lipper Large-Cap Core Funds | 1 | 807 | 17.8% | 11,827.2 | 14.1% |
| Lipper Large-Cap Growth Funds | 2 | 784 | 17.3% | 11,939.3 | 14.3% |
| Lipper Large-Cap Value Funds | 3 | 492 | 10.9% | 8,721.5 | 10.4% |
| Lipper Mid-Cap Growth Funds | 4 | 446 | 9.8% | 3,996.3 | 4.8% |
| Lipper Small-Cap Growth Funds | 5 | 405 | 8.9% | 2,374.3 | 2.8% |
| Lipper Small-Cap Core Funds | 6 | 327 | 7.2% | 2,641.8 | 3.2% |
| Lipper Mid-Cap Value Funds | 7 | 169 | 3.7% | 2,452.1 | 2.9% |
| Lipper Mid-Cap Core Funds | 8 | 161 | 3.6% | 1,482.2 | 1.8% |
| Lipper Small-Cap Value Funds | 9 | 138 | 3.0% | 792.5 | 0.9% |
| Morningstar Large-Cap Growth Funds | 10 | 114 | 2.5% | 1,326.8 | 1.6% |
| Total | | 3,843 | 84.8% | 47,553.9 | 56.8% |

(18) $$Y_{i,t} = \alpha + \beta \text{BENCHMARK}_{i,t-1} + \gamma \text{CONTROLS}_{i,t-1} + \lambda_k + \mu_{i,t},$$

where the dependent variable $Y_{i,t}$ represents the portfolio activeness of fund $i$ in year $t$, $\text{BENCHMARK}_{i,t-1}$ represents compensation benchmark variables of fund $i$ at year $t-1$. We also include a comprehensive set of control variables typically associated with fund performance: FUND_SIZE, FUND_AGE, EXPENSE, TURNOVER, TEAM, MANAGER_TENURE, FAMILY_SIZE, and PCT._NO_LOAD. All variables are defined in Appendix A. We measure all the independent variables as of the previous year-end to address potential reverse causality concerns. To alleviate any concern that some fund categories use certain types of compensation benchmarks and, at the same time, exert a positive impact on portfolio activeness (e.g., Frazzini, Friedman, and Pomorski (2016)), we include fund category × year fixed effects $(\lambda_k)$. Standard errors are adjusted for heteroscedasticity and clustered at the fund level.

We measure a fund's portfolio activeness using ACTIVE_SHARE (Cremers and Petajisto (2009)), TRACKING_ERROR, or $R^2$ from the 4-factor model (Amihud and Goyenko (2013)). All measures have been widely used in the literature to measure how active portfolio managers are in managing the fund's portfolio. That is, the lower the active share measure and tracking error, or the higher $R^2$ measure, the more portfolio managers behave like closet indexers in managing the fund's portfolio.

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The results of our main specification are reported in Table 3. Consistent with Prediction 2, managers compensated relative to a peer benchmark show higher active share than those compensated relative to a pure benchmark. In particular, looking at column 1, ACTIVE_SHARE is 2.2 percentage points higher for portfolio managers compensated relative only to a peer benchmark versus those compensated relative only to a pure benchmark and this difference is statistically significant at the 10% level. The results are similar when we replace ACTIVE_SHARE with TRACKING_ERROR or $R^2$ as the dependent variable. Thus, managers evaluated relative to a peer compensation benchmark on average have a 2.4% lower $R^2$ (column 2) and a 0.24% higher TRACKING_ERROR (column 3) compared to managers evaluated relative to a pure benchmark. Both differences are statistically significant at the 1% level. These effects are economically large, given that the standard deviations of $R^2$ and TRACKING_ERROR and in our sample are 2.6% and 7.4%, respectively. In general, consistent with the theoretical prediction, fund managers compensated relative to a peer market benchmark are more active and choose portfolios that follow their performance benchmarks less closely.

Because the results in columns 1–3 of Table 3 are calculated relative to a pure benchmark, one concern is that the calculation itself is biased toward finding a result of more active peer-benchmarked managers. To assuage this concern, we repeat the analysis for $R^2$ and TRACKING_ERROR calculated relative to a peer benchmark in specifications (4) and (5). The results show that even relative to the peer benchmark, peer-benchmarked managers are more active than pure.

We also perform several additional sets of robustness tests. First, we consider alternative measures of ACTIVE_SHARE and $R^2$ that account for the strategic efforts of managers to generate the appearance of managerial effort rather than true managerial effort. In particular, we use minimum active share (Cremers, Fulkerson, and Riley (2022)) as an alternative active share measure. Also, we calculate alternative $R^2$ measures using 4-factor (Carhart (1997)) and 7-factor (Cremers, Petajisto, and Zitzewitz (2012)) models plus additional factors following Cremers et al. (2022).[22] Our results continue to hold with these alternative fund activeness measures (see Table A1 in the Supplementary Material). Finally, while our primary specification focuses on the subsample of funds that specify only a peer or a pure benchmark to determine manager compensation, we saw in Table 1 that the use of one type is not mutually exclusive. As a result, we repeat the analysis with the full sample, including those funds that employ both types of benchmarks by using both PURE_BENCHMARK and PEER_BENCHMARK dummies simultaneously in the regression. We obtain qualitatively similar results using the full sample (see Table A2 in the Supplementary Material). Again, the results show that peer-benchmarked managers tend to be more active when compared with pure-benchmarked managers.

The analysis in this section clearly reveals the differences in active management between portfolio managers evaluated relative to a pure versus a peer

[22]These additional factors include Fama and French (2015) profitability and investment factors, the Stambaugh and Yuan (2017) management and performance factors, the Frazzini and Pedersen (2014) betting against-beta factor, the Asness, Frazzini, and Pedersen (2019) quality-minus-junk factor, and the Pástor and Stambaugh (2003) traded liquidity factor.

TABLE 3

Compensation Benchmarks and Fund Activeness

Table 3 examines the relation between compensation benchmarks and proxies of fund activeness. The dependent variable is ACTIVE_SHARE in column 1, $R^2$ and TRACKING_ERROR relative to the pure benchmarks in columns 2 and 3, respectively. We also construct the $R^2$ and TRACKING_ERROR relative to the peer benchmarks and report the results in columns 4 and 5, respectively. Standard errors are adjusted for heteroscedasticity and clustered by fund. $t$-Statistics are reported below the coefficients in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

| | Versus Pure Benchmark | | | Versus Peer Benchmark | |
|---|---|---|---|---|---|
| | ACTIVE_SHARE | $R^2$ | TRACKING_ERROR | $R^2$ | TRACKING_ERROR |
| | 1 | 2 | 3 | 4 | 5 |
| PEER_BENCHMARK | 2.162* | −2.418*** | 0.239*** | −0.863** | 0.075* |
| | (1.85) | (−4.77) | (5.01) | (−2.25) | (1.83) |
| log(FUND_SIZE) | 0.690 | −0.249 | 0.066*** | 0.044 | 0.018 |
| | (1.25) | (−1.24) | (3.49) | (0.28) | (1.07) |
| log(FUND_AGE) | −1.110 | 0.955** | −0.105*** | 0.903*** | −0.103*** |
| | (−1.11) | (2.18) | (−2.72) | (2.90) | (−3.26) |
| EXPENSE | 18.820*** | −5.688*** | 0.651*** | −4.020*** | 0.433*** |
| | (8.42) | (−8.15) | (9.56) | (−7.55) | (7.84) |
| log(TURNOVER) | 2.398** | 0.125 | 0.022 | −0.057 | 0.036 |
| | (2.56) | (0.48) | (0.82) | (−0.28) | (1.64) |
| TEAM | 3.174** | 0.779 | −0.052 | 0.482 | −0.071* |
| | (2.53) | (1.60) | (−1.02) | (1.26) | (−1.66) |
| log (MANAGER_TENURE) | 1.506** | −0.624** | 0.060** | −0.585*** | 0.072*** |
| | (2.27) | (−2.37) | (2.35) | (−2.85) | (3.48) |
| log(FAMILY_SIZE) | −1.131*** | 0.318** | −0.044*** | 0.181 | −0.017 |
| | (−2.95) | (2.09) | (−3.02) | (1.61) | (−1.32) |
| PCT._NO_LOAD | 3.424* | −2.230*** | 0.149** | −1.939*** | 0.147*** |
| | (1.80) | (−3.12) | (2.31) | (−3.63) | (2.71) |
| MS category × year FEs | Yes | Yes | Yes | Yes | Yes |
| No. of obs. | 2,562 | 2,815 | 2,900 | 2,846 | 2,906 |
| Adj. $R^2$ | 0.583 | 0.405 | 0.396 | 0.402 | 0.345 |

benchmark. Regardless of the measure we use, compensation with respect to a pure benchmark is associated with lower active management, more closet indexing, and, presumably, lower managerial effort. This is consistent with the prediction from the theoretical literature (e.g., Admati and Pfleiderer (1997), Cuoco and Kaniel (2011), and Basak and Pavlova (2013)). In contrast, peer-benchmark-based compensation is associated with more active management (and, according to our model, more effort). This evidence jointly suggests that pure benchmarks may encourage portfolio managers to closet index, while peer benchmarks incentivize portfolio managers to be more active in portfolio management.

## B. Mutual Fund Fees and Compensation Benchmarks

We now turn our attention to the third prediction of the model, namely, the relation between fund fees and compensation benchmarks. Specifically, the model implies that peer-benchmarked managers will receive higher advisory fee income.

To examine this hypothesis empirically, we replace the dependent variable $Y_{i,t}$ in equation (18) with ADVISORY_FEE or EXPENSE_RATIO. The former captures the advisory fee income earned by fund advisors for their investment advisory services, while the latter captures the total annual expense ratio income charged for operating a fund. We consider fees and expenses in both dollar and percentage terms.

For the dollar term, these variables are calculated by first multiplying the advisory fee and expense fee rates by fund size and then a natural logarithm is taken. For the percentage term, these variables are calculated as a percentage of fund AUM.

While our model prediction relates specifically to manager compensation, we do not have the actual dollar amounts paid to managers. Instead, we proxy for this compensation by using the advisory fee income received by the investment advisor for managing the fund. Because managers' compensation is likely paid from this fee revenue and the advisory fee is separated out in fund disclosures for the express purpose of identifying such revenue, we believe that it is a reasonable proxy. We also repeat the analysis with expense ratios in case manager compensation is paid, in part, from other categories of expense revenue collected by the fund management company. We include the same controls as in the previous tables. Standard errors are adjusted for heteroscedasticity and clustered at the fund level. The results are reported in Table 4.

Using only peer/only pure sample, we analyze fund advisory fee income in columns 1 and 2 of Table 4 and fund expense ratio income in columns 3 and 4. For the measures in both the dollar and percentage terms, we find statistically strong evidence that funds with peer benchmarks generate higher advisory fee and expense ratio fund income. For instance, the coefficient on PEER_BENCHMARK in column 1 is 0.278, statistically significant at the 1% level. Economically, this result suggests that peer-benchmarked funds earn 29.0% higher advisory fee dollar income, after controlling for various fund characteristics, than pure-benchmarked funds.

We find similar results when using advisory fee rate as the dependent variable in column 2 of Table 4: This fee is 6.3 basis points higher for peer-benchmarked funds. When analyzing expense ratio fee income, we reach the same conclusion. The coefficients on PEER_BENCHMARK are positive and significant at the 1% level in both columns 3 and 4. The coefficient in column 3 is very similar to that reported in column 1 for the advisory fee: 0.267. The result in column 4 suggests that the expense ratio of peer-benchmarked funds is 18.7 basis points higher than pure-benchmarked funds. We obtain similar results when we use the full sample of funds that exclusively use either a peer or pure benchmark or use both (see Table A3 in the Supplementary Material). Overall, the results show that funds managed by peer-benchmarked managers tend to earn higher advisory fee income, consistent with such managers being paid higher compensation.

## C. Compensation Benchmarks and Mutual Fund Performance

After finding empirical support for our model predictions, we investigate now whether the incentives for managerial effort outweigh the cost of higher TEV for the manager, in which case, peer-benchmarked managers will outperform pure-benchmarked managers on a gross-return basis. While our model has no prediction about the overall implications for investors, we also examine the implications using net-of-fee performance measures. This gives additional insight into whether peer-benchmarked funds also earn higher alphas for their investors or the investment advisor/manager captures all the surplus. To test these ideas, in this section, we compare both the gross and net performance of funds whose managers are evaluated against a pure benchmark versus a peer benchmark.

TABLE 4

Compensation Benchmarks and Mutual Fund Fees

Table 4 examines the relation between fund fees and compensation benchmarks: advisory fee in columns 1 and 2, and expense ratio in columns 3 and 4. The former captures the advisory fee income earned by fund advisors for their investment advisory services, while the latter captures the total annual expense ratio income charged for operating a fund. We consider fees and expenses in both dollar and percentage terms. To calculate dollar fees, the percentage ADVISORY_FEE and EXPENSE_RATIO are multiplied by FUND_SIZE, and we use the natural logarithm of dollar fees in the analysis. Standard errors are adjusted for heteroscedasticity and clustered by fund. *t*-Statistics are reported below the coefficients in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

| | ADVISORY_FEE ($) | ADVISORY_FEE_RATE | EXP._RATIO ($) | EXPENSE_RATIO |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| PEER_BENCHMARK | 0.278*** | 0.063*** | 0.267*** | 0.187*** |
| | (4.50) | (3.39) | (6.82) | (7.20) |
| log(FUND_SIZE) | 0.991*** | −0.001 | 0.952*** | −0.038*** |
| | (41.86) | (−0.18) | (63.32) | (−3.73) |
| log(FUND_AGE) | −0.052 | −0.034** | −0.033 | 0.009 |
| | (−1.06) | (−2.33) | (−1.08) | (0.44) |
| log(TURNOVER) | 0.248*** | 0.069*** | 0.149*** | 0.104*** |
| | (6.49) | (6.43) | (6.50) | (7.16) |
| TEAM | 0.324*** | 0.057*** | 0.118*** | 0.012 |
| | (4.60) | (3.13) | (2.95) | (0.50) |
| log(MANAGER_TENURE) | 0.056 | 0.043*** | 0.067*** | 0.053*** |
| | (1.51) | (4.28) | (2.99) | (3.81) |
| log(FAMILY_SIZE) | −0.185*** | −0.055*** | −0.091*** | −0.057*** |
| | (−7.24) | (−9.37) | (−6.67) | (−7.13) |
| PCT._NO_LOAD | −0.357*** | −0.089*** | −0.471*** | −0.385*** |
| | (−3.87) | (−3.51) | (−8.92) | (−11.72) |
| MS category × year FEs | Yes | Yes | Yes | Yes |
| No. of obs. | 2,846 | 2,846 | 2,906 | 2,906 |
| Adj. $R^2$ | 0.738 | 0.407 | 0.880 | 0.491 |

We estimate a version of equation (18) where the dependent variable $Y_{(i,t)}$ represents the relative performance of fund $i$ in year $t$. We use four abnormal fund performance measures in our analysis: i) prospectus benchmark-adjusted alpha (gross and net), ii) Carhart (1997) 4-factor alpha (gross and net), iii) DGTW characteristic-adjusted portfolio return (Daniel et al. (1997)), and iv) Morningstar ratings. The independent variables and controls are defined as in equation (18). To alleviate the concern that some fund categories use certain types of compensation benchmarks and, at the same time, exert a positive impact on fund performance, we include fund category × year fixed effects ($\lambda_k$). Standard errors are adjusted for heteroscedasticity and clustered at the fund level.

We report the estimation results of our main specification in Table 5. In column 1, we use the fund's gross prospectus benchmark-adjusted alpha as the measure of fund performance. The peer benchmark has a coefficient of 0.78, suggesting that funds with peer compensation benchmarks outperform ones with pure benchmarks by 0.78% per year on a gross-of-fee basis, with the difference statistically significant at the 1% level. Given that the sample average prospectus benchmark-adjusted alpha is −0.06% per year, the effect on performance we document is economically large. The results are very similar when we use the gross Carhart 4-factor alpha to measure fund performance. As shown in column 3, funds whose portfolio managers are evaluated relative only to a peer benchmark in determining their compensation outperform funds with a pure benchmark by 0.50% per year, with the difference statistically significant at the 5% level.

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TABLE 5

Compensation Benchmarks and Mutual Fund Performance

Table 5 examines the relationship between compensation benchmarks and fund performance. Fund performance is measured by gross prospectus benchmark-adjusted alpha in column 1, gross 4-factor alpha in column 3, DGTW returns in column 5, and Morningstar ratings in column 6. We also construct net-of-fee prospectus benchmark-adjusted alpha and 4-factor alpha as performance measures and report the estimation results in columns 2 and 4, respectively. All variables are defined in Appendix A. Standard errors are adjusted for heteroscedasticity and clustered by fund. *t*-Statistics are reported below the coefficients in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

| | GROSS | NET | GROSS | NET | | MS_ |
|---|---|---|---|---|---|---|
| | PROS._ALPHA | PROS._ALPHA | 4F_ALPHA | 4F_ALPHA | DGTW_RET. | RATINGS |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| PEER_BENCHMARK | 0.779*** | 0.783*** | 0.504** | 0.488** | 0.449** | 0.310*** |
| | (3.41) | (3.42) | (2.06) | (1.99) | (2.36) | (4.75) |
| log(FUND_SIZE) | −0.248*** | −0.259*** | −0.360*** | −0.366*** | −0.123* | 0.129*** |
| | (−2.98) | (−3.08) | (−4.14) | (−4.19) | (−1.69) | (5.20) |
| log(FUND_AGE) | 0.162 | 0.153 | 0.134 | 0.136 | −0.008 | −0.236*** |
| | (0.93) | (0.88) | (0.75) | (0.77) | (−0.05) | (−4.55) |
| EXPENSE | −0.563 | −1.481*** | −1.074*** | −1.989*** | −0.264 | −0.288*** |
| | (−1.44) | (−3.78) | (−2.77) | (−5.10) | (−0.79) | (−2.78) |
| log(TURNOVER) | −0.309** | −0.317** | −0.331** | −0.332** | −0.415*** | −0.130*** |
| | (−2.32) | (−2.37) | (−2.44) | (−2.43) | (−3.76) | (−3.51) |
| TEAM | 0.174 | 0.193 | 0.398 | 0.402 | 0.187 | 0.211*** |
| | (0.71) | (0.78) | (1.59) | (1.60) | (0.87) | (3.60) |
| log(MANAGER_TENURE) | 0.042 | 0.049 | 0.104 | 0.115 | −0.102 | 0.104*** |
| | (0.29) | (0.33) | (0.74) | (0.82) | (−0.85) | (3.03) |
| ACTIVE_SHARE | 0.014** | 0.013** | −0.0002 | −0.001 | 0.010* | 0.005*** |
| | (2.20) | (2.10) | (−0.04) | (−0.15) | (1.94) | (2.89) |
| PERFORMANCE_ADV._FEE | −0.508 | −0.507 | −0.626 | −0.622 | −0.434 | 0.056 |
| | (−1.18) | (−1.15) | (−1.12) | (−1.12) | (−0.77) | (0.28) |
| log(FAMILY_SIZE) | 0.061 | 0.079 | 0.073 | 0.084 | 0.029 | −0.012 |
| | (0.92) | (1.20) | (1.10) | (1.25) | (0.54) | (−0.65) |
| PCT._NO_LOAD | 0.632** | 0.678** | −0.072 | −0.020 | 0.140 | 0.399*** |
| | (2.06) | (2.19) | (−0.22) | (−0.06) | (0.50) | (4.48) |
| MS category × year FEs | Yes | Yes | Yes | Yes | Yes | Yes |
| No. of obs. | 2,493 | 2,510 | 2,500 | 2,517 | 2,544 | 2,562 |
| Adj. $R^2$ | 0.226 | 0.226 | 0.221 | 0.226 | 0.198 | 0.191 |

Results are also similar when we measure fund performance using DGTW returns or Morningstar ratings. For instance, based on results on DGTW characteristic-adjusted returns in column 5 of Table 5, funds with peer-benchmarked managers outperform those with pure-benchmarked managers by 0.45% per year. Based on results on Morningstar ratings in column 6, funds with peer-benchmarked managers have a 0.31 higher star rating compared to those with pure-benchmarked managers. Both differences are economically large and statistically significant at the 5% level or lower. Regarding the control variables, the results are consistent with the patterns documented in the previous literature. For instance, fund performance decreases with fund size and the expense ratio and increases with the fund's active share and the percentage of assets with no-load fees.

To sum up, we find robust evidence that mutual funds that use peer benchmarks in portfolio manager compensation are associated with better gross performance than those using pure benchmarks. Taken together, the results of Tables 3–5 strongly support the model's predictions and the underlying intuition. They suggest that when portfolio managers are compensated relative to their peers, the incentives from this "tournament-type" compensation deliver higher gross fund performance by inducing managers to be more active in their portfolio strategies. The superior performance of these managers is rewarded with higher advisory fee income, which contributes to the higher expense ratio income collected by these funds.

Turning our attention to the results on net returns, we find that funds with peer compensation benchmarks also have superior net-of-fee performance compared to those with pure benchmarks. For instance, the results in column 4 of Table 5 suggest that funds with peer compensation benchmarks outperform ones with pure benchmarks by 0.49% per year based on net 4-factor alpha, with the difference similar in magnitude with the difference based on gross 4-factor alpha (i.e., 0.50% per year). Our results indicate that the management team does not capture all of the surplus and a substantial portion of the outperformance of funds with a peer compensation benchmark is passed on to fund investors.[23]

We conduct a number of additional tests to ensure the robustness of our results. First, our results are not sensitive if we use alternative proxies of investor sophistication: i) percent of hedge fund clients and ii) average investor account size (see Table A4 in the Supplementary Material). Second, we repeat our analysis using alternative measures of fund performance: i) the minimum-active-share-benchmark-adjusted returns (Cremers et al. (2022)) and ii) Cremers et al. (2012) 4- and 7-factor alphas.[24] Our results are again robust and consistent using various performance measures (see Table A5 in the Supplementary Material). Third, our results remain unchanged when we further add fund activeness measures ($R^2$ with respect to peer benchmarks) as an additional control in the regression (see Table A6 in the Supplementary Material). Finally, we obtain qualitatively similar results using the full sample of funds, including the subset of funds that use both types of benchmarks (see Table A7 in the Supplementary Material). Again, we find that peer-benchmarked managers have superior performance than pure-benchmarked managers, both gross and net of fees.

Furthermore, our model implies that the externality effect of peer benchmarks could be small if there are many funds in the same peer category. We test this idea by creating two indicator variables: i) PEER_BENCHMARK_TOP_5 for cases where a peer benchmark is top 5 most frequently used benchmark, and ii) PEER_-BENCHMARK_OTHERS for peer benchmarks ranked outside top 5. We compare both groups with those funds that have no peer benchmark. The results support the conjecture that funds with less frequently used peer benchmarks are associated with greater alphas than the counterparts, though the statistical significance is only around 10% (see Table A8 in the Supplementary Material).

[23]This evidence on net performance is consistent with our later finding that fund investors of peer-benchmarked funds are more performance sensitive, and may have greater bargaining power with these investment advisors.

[24]The index-based 4- and 7-factor models proposed by Cremers et al. (2012) refer to IDX4 (S5, R2-S5, R3V-R3G, UMD) and IDX7 (S5, RM-S5, R2-RM, S5V-S5G, RMV-RMG, R2V-R2G, UMD), respectively, in their article. S5 is S&P 500, R2-S5 is Russell 2000 minus S&P 500, R3V-G3G is Russell 3000 Value minus Russell 3000 Growth, R2-S5 is Russell Midcap minus S&P 500, S5V-S5G is S&P 500 Value minus S&P 500 Growth, RMV-RMG is Russell Midcap Value minus Midcap Growth, and UMD is the momentum factor of Carhart (1997).

Lastly, we note that our results are consistent with increased effort on the part of managers due to enhanced incentives. However, they are also consistent with a separating equilibrium, where more (less) skilled managers are selected by or attracted to advisors with peer-benchmarked (pure-benchmarked) compensation. While we cannot perfectly distinguish between these two explanations, we try to offer some guidance by exploring the changes in advisors in our sample in Table A9 in the Supplementary Material. Starting with the list of advisor changes identified by Ma et al. (2019),[25] we find 78 funds experience an advisor change in our sample. In only 37 of these 78 cases, there is a change in the compensation benchmark type and the other 41 have the same type of benchmark before and after the advisor change. Of those 37 cases, only 17 funds that change from one of our three benchmark types (only peer, only pure, or both) to a different type. In terms of performance, despite the small size of our advisory change sample, we observe that an advisory change associated with a shift from pure-benchmarked to peer-benchmarked compensation is associated with higher fund performance. This is consistent with an incentive effect playing a role either in place of or above and beyond a possible selection effect.

## D. Mutual Fund Flows

Due to its partial equilibrium nature, the model does not address the question of why pure-benchmarked funds hold significant market share despite their inferior performance. We conjecture that a plausible explanation is investor heterogeneity and the associated market segmentation. To test this conjecture, we examine fund flows in this section and the determinants of an investment advisor's choice between peer- and pure-benchmarked manager compensation in the next section.

Table 6 reports the OLS estimates of investor flow-performance sensitivity regressions for funds with peer- versus pure-benchmarked portfolio managers. The dependent variable is monthly net flows as a percentage of fund TNA. We first use the performance rank based on prospectus benchmark-adjusted alpha in our analysis in columns 1–3. For robustness, we also use the performance rank based on the commonly used Carhart (1997) 4-factor alpha in columns 4–6. We control for the same set of fund characteristics as in Table 3 and fund category × year fixed effects in the regressions.

The estimates in columns 1 and 2 of Table 6 show a positive relationship between past performance and fund flows for the sample of funds with only peer or pure benchmarks. However, the pure-benchmarked funds have less flow-performance sensitivity than the peer-benchmark funds, with the coefficient on past performance being 3.103 in column 1 and 1.792 in column 2. The difference in flow-performance sensitivities between peer- and pure-benchmarked funds is 1.311 and statistically significant at the 5% level. Next, we combine both groups of funds in one regression and run a specification including an interaction term between past performance and an indicator variable for whether or not the fund manager is compensated based only on a peer benchmark. As shown in column 3 of Table 6, the coefficient on the interaction term of past performance times indicator variable

[25]See the full list reported in "Table IA.VII – List of Changes in the Advisory Firm" in the Supplementary Material of Ma et al. (2019).

TABLE 6

Compensation Benchmarks and Flow-Performance Relationship

Table 6 reports the estimation results of flow-performance relationship for funds with peer- versus pure-benchmarked portfolio managers. The dependent variable is average monthly net flows within a year. The main variables of interest include performance rank based on prospectus benchmark-adjusted alpha and 4-factor alpha, both interacted with an indicator variable indicating whether or not the fund manager is compensated based solely on peer benchmarks. All variables are defined in Appendix A. Standard errors are adjusted for heteroscedasticity and clustered by fund. *t*-Statistics are reported below the coefficients in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

| | PERF. = PROSP._BENCH._ADJ._ALPHA | | | PERF. = 4_FACTOR_ALPHA | | |
|---|---|---|---|---|---|---|
| | Only Peer | Only Pure | Only Peer and Only Pure | Only Peer | Only Pure | Only Peer and Only Pure |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| PERFORMANCE_RANK | 3.103*** | 1.792*** | 1.821*** | 3.841*** | 2.587*** | 2.614*** |
| | (9.91) | (4.67) | (4.79) | (9.17) | (5.60) | (5.71) |
| PEER_BENCHMARK × PERFORMANCE_RANK | | | 1.139** | | | 1.125** |
| | | | (2.44) | | | (2.02) |
| PEER_BENCHMARK | | | −0.726*** | | | −0.709** |
| | | | (−2.68) | | | (−2.50) |
| log(FUND_SIZE) | −0.131* | −0.203* | −0.154** | −0.079 | −0.212** | −0.131** |
| | (−1.72) | (−1.96) | (−2.47) | (−1.01) | (−2.02) | (−2.07) |
| log(FUND_AGE) | −0.525*** | −1.008*** | −0.832*** | −0.526*** | −1.046*** | −0.847*** |
| | (−3.04) | (−4.90) | (−6.10) | (−3.15) | (−5.01) | (−6.20) |
| EXPENSE | −0.117 | −0.346 | −0.243 | 0.013 | −0.325 | −0.222 |
| | (−0.33) | (−1.00) | (−0.97) | (0.04) | (−0.91) | (−0.89) |
| log(TURNOVER) | −0.173 | 0.538*** | 0.263* | −0.078 | 0.509** | 0.297** |
| | (−1.28) | (2.65) | (1.86) | (−0.60) | (2.54) | (2.14) |
| TEAM | −0.145 | 0.044 | 0.004 | −0.161 | 0.034 | −0.001 |
| | (−0.64) | (0.19) | (0.02) | (−0.71) | (0.15) | (−0.01) |
| log(MANAGER_TENURE) | 0.113 | 0.283** | 0.189** | 0.064 | 0.266* | 0.136* |
| | (1.06) | (2.08) | (2.28) | (0.62) | (1.96) | (1.67) |
| log(FAMILY_SIZE) | 0.072 | 0.092 | 0.062 | 0.083 | 0.066 | 0.051 |
| | (1.06) | (1.45) | (1.37) | (1.25) | (1.04) | (1.13) |
| PCT._NO_LOAD | 0.214 | 0.509 | 0.345 | 0.089 | 0.602* | 0.351* |
| | (0.77) | (1.55) | (1.62) | (0.32) | (1.86) | (1.69) |
| Constant | 1.734 | 4.202** | 3.818*** | 0.251 | 5.185*** | 3.715*** |
| | (0.89) | (2.27) | (2.88) | (0.12) | (2.65) | (2.71) |
| MS category × year FEs | Yes | Yes | Yes | Yes | Yes | Yes |
| No. of obs. | 1,213 | 1,657 | 2,870 | 1,185 | 1,618 | 2,803 |
| Adj. $R^2$ | 0.103 | 0.082 | 0.082 | 0.104 | 0.091 | 0.089 |

of only peer benchmark is positive significant at the 5% level. This finding further confirms a stronger flow-performance sensitivity of peer-benchmarked funds compared with pure-benchmarked funds. We repeat our analysis in columns 1–3 using Carhart (1997) 4-factor alpha, and find that the results remain qualitatively similar.

This evidence suggests that fund investors are heterogeneous in terms of their flow-performance sensitivity and that funds with peer versus pure compensation benchmarks possibly cater to a different investor clientele. This clientele segmentation may help explain why money does not flow out of (underperforming) funds where managers are compensated with respect to pure benchmarks and into funds where managerial incentives are based on performance relative to a peer benchmark.

## E. Determinants of Portfolio Manager Compensation Benchmarks

While the flow results of the previous section are consistent with heterogeneous investors and the possibility of segmented markets, we further examine this possible explanation from the perspective of an investment advisor. To this end, we analyze the determinants of the investment advisor's choice of portfolio manager compensation benchmarks. While peer or pure benchmarks are exogenously assigned in the model, the empirical observation of both types of benchmarks in practice raises a natural question as to what underlying economic forces drive the benchmark choice. To explore the economic forces possibly driving this decision, we carry out determinant analyses that relate the choices of compensation benchmark to a set of advisor-, manager-, and fund-level features.

In the analysis, we are interested in how compensation benchmark choices relate to three dimensions of the investment advisor strategy that relate to segmentation: distribution channel, investor sophistication, and advisor incentive structure. First, we examine the relationship between benchmark choice and the primary distribution channel of the investment advisor as proxied by the percentage of the advisor's assets sold through a no-load or direct channel. Del Guercio and Reuter (2014) document important market segmentation related to distribution channel, with more performance sensitive (arguably, more sophisticated) investors investing through the direct (no-load) distribution channel.

Second, we analyze whether benchmark choices are related to other proxies of investor sophistication as measured by two variables. The first variable is the percentage of assets sourced from hedge fund clients, as determined from the data collected in Form ADV. The second variable is the logarithm of the average investor account size of an investment advisor. The higher the average account size, which may be indicative of clients being either institutional or high net worth investors, the greater the level of financial sophistication. If there is a difference in the sophistication level of the average investor of an investment advisor that uses peer-benchmarking relative to pure-benchmarking advisors, this would be a dimension of client segmentation observed in the industry.

Third, a recent study by Evans et al. (2020) finds that there is cross-sectional variation in the incentive structure of fund families, where some investment advisors have a more competitive incentive scheme, whereas other investment advisors use more cooperative incentives. They provide evidence that this choice between competitive and cooperative incentives is related to investment advisor strategy regarding market segmentation. Since peer-based benchmark fosters competition rather than cooperation, we expect that families that choose more cooperative incentives to be less likely to use peer-based compensation benchmarks.

To test our hypotheses, we employ the following logistic model to analyze the determinants of the compensation benchmark choices:

$$
\begin{aligned}
(19) \qquad y^*_{i,t} &= \alpha + \beta \text{DETERMINANTS}_{i,t-1} + \epsilon_{i,t}, \\
y^j_{i,t} &= 1\left[y^{*j}_{i,y} > 0\right],
\end{aligned}
$$

where the dependent variable $y^j_{i,t}$ represents compensation benchmark choice variables, only peer versus only pure benchmark, of fund $i$ at year $t$; $\text{DETERMINANTS}_{i,t-1}$ is a vector of determinant variables including the percentage of no-load funds in the fund's family (PCT._NO_LOAD), average investor account size (AVG._ACCOUNT_SIZE), and the percentage of assets managed by the fund's advisor being hedge fund clients (PCT._HEDGE_FUND_CLIENT), and the family-level NET_COOPERATIVE_INDEX of Evans et al. (2020). We also include the same set of control variables as in Table 3. To alleviate reverse causality concerns, we lag all determinant and control variables by 1 year. We adjust standard errors accounting for heteroscedasticity and clustering at the fund level.

We report the estimation results in Panel A of Table 7. We start our analysis by including a family-level variable corresponding to the percentage of other funds in the family (excluding the fund of interest) that have peer or pure benchmarks in specification (1). The results show that these two variables are statistically the strongest predictors and the regression has a very high pseudo $R^2$ (0.681). This evidence supports the idea that variation in compensation benchmark choices is driven more by family-level than fund-level considerations.

In specifications (2) and (6), we see that investment advisors who predominantly sell through the direct distribution channel are more likely to use peer benchmarking to determine manager compensation. This is consistent with the results of Del Guercio and Reuter (2014) showing greater performance sensitivity of direct-sold investors and segmentation with regards to both channels.

In columns 3, 4, and 6 of Table 7, we see that the coefficients on both measures of clientele sophistication are positive and statistically significant at the 5% level or higher. This suggests that a peer compensation benchmark is more likely to be used when a fund's family is more focused on clients with greater financial sophistication. Given this heterogeneity between investors in peer- and pure-benchmarked funds, this is consistent with more sophisticated clients identifying and investing in higher performing peer-benchmarked funds. Lastly, in specifications (5) and (6), we find that the coefficient on NET_COOPERATIVE_INDEX is negative and significant at the 1% level. This finding is consistent with the idea that since peer benchmarks generate higher competition incentives, mutual fund families with a greater tendency to promote a cooperative environment are less likely to use such compensation benchmarks. In summary, the previous evidence suggests that the usage of peer versus pure benchmarks is consistent with investor heterogeneity and the associated market segmentation.

The strong statistical significance of the family-level peer variable suggests important family-level effects. To examine how these family effects relate to our fund-level analysis, we revisit the question in Panel B of Table 7 at a family level. Specifically, we regress the percentage of funds within a family where peer manager benchmarks are used to determine manager compensation on family-level determinants. These determinants include the natural logarithm of both family age and size and the average fund turnover. They also include a measure of family concentration (HHI of family assets across funds), the net cooperative index, the percentage of both no load funds and hedge fund clients within the investment advisor, in addition to family averages of fund expense ratio, manager team size and manager tenure. As the Panel B shows, larger, older, less concentrated families are more likely to use peer benchmark manager compensation incentives. Consistent with the fund-level results, less cooperative families that sell through direct channels and that have more sophisticated investors, as proxied for by the percentage of hedge fund clients, are also more likely to use peer benchmarks. In specification (7), we

TABLE 7

Determinants of Portfolio Manager Compensation Benchmarks

Table 7 presents the estimation results regarding the determinants of portfolio manager compensation benchmarks. In Panel A, we conduct a logistic regression to analyze the choice between pure (=0) and peer (=1) compensation benchmark options, utilizing a set of fund-level regressor. In Panel B, we perform an OLS regression to examine the percentage of funds within the mutual fund family that exclusively employ peer compensation benchmarks, using a set of family-level regressor. The family age is defined as the age of the oldest share class in the family, while the family HHI is constructed as the Herfindahl–Hirschman index of family assets across all their funds. Other family-level variables are computed as averages of the corresponding fund-level variables which are defined in Appendix A. Standard errors are adjusted for heteroscedasticity in both panels and are clustered by fund in Panel A. *t*-Statistics are reported below the coefficients in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

*Panel A. Fund-Level Determinants*

| | Only Peer Versus Only Pure | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| FAMILY_PCT._PEER_ BENCHMARKS | 0.054***<br>(7.57) | | | | | |
| FAMILY_PCT._PURE_ BENCHMARKS | −0.056***<br>(−9.35) | | | | | |
| PCT._NO_LOAD | | 0.883***<br>(3.16) | | | | 1.311***<br>(2.59) |
| PCT._HEDGE_FUND_CLIENT | | | 1.182***<br>(3.11) | | | 1.715***<br>(3.68) |
| log(AVG._ACCOUNT_SIZE) | | | | 1.412***<br>(3.29) | | 1.743**<br>(2.04) |
| NET_COOPERATIVE_INDEX | | | | | −2.711***<br>(−3.60) | −2.867***<br>(−3.00) |
| log(FUND_SIZE) | 0.014<br>(0.09) | 0.063<br>(0.74) | 0.098<br>(0.94) | −0.037<br>(−0.36) | −0.128<br>(−1.18) | −0.154<br>(−1.04) |
| log(FUND_AGE) | −0.066<br>(−0.23) | 0.427**<br>(2.49) | 0.176<br>(0.88) | 0.381*<br>(1.88) | 0.530**<br>(2.49) | 0.453<br>(1.46) |
| EXPENSE | 0.789*<br>(1.70) | 2.188***<br>(6.56) | 1.052***<br>(2.92) | 1.178***<br>(3.23) | 1.860***<br>(4.86) | 2.179***<br>(3.76) |
| log(TURNOVER) | 0.226<br>(1.00) | −0.275***<br>(−2.62) | −0.412***<br>(−3.04) | −0.500***<br>(−3.81) | −0.378***<br>(−3.13) | −0.396**<br>(−2.08) |
| TEAM | 0.235<br>(0.68) | −0.056<br>(−0.30) | −0.295<br>(−1.26) | −0.297<br>(−1.26) | 0.241<br>(1.07) | 0.109<br>(0.33) |
| log(MANAGER_TENURE) | 0.100<br>(0.53) | −0.318***<br>(−2.98) | −0.078<br>(−0.66) | −0.083<br>(−0.67) | −0.244*<br>(−1.96) | −0.286<br>(−1.60) |
| log(FAMILY_SIZE) | −0.122<br>(−0.82) | 0.156**<br>(2.46) | −0.017<br>(−0.23) | 0.091<br>(1.22) | 0.212***<br>(2.69) | 0.191*<br>(1.67) |
| MS category × year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| No. of obs. | 2,836 | 2,906 | 2,000 | 1,660 | 2,011 | 1,007 |
| Pseudo $R^2$ | 0.681 | 0.103 | 0.077 | 0.080 | 0.113 | 0.201 |

*Panel B. Family-Level Determinants*

| | % of Funds Peer Benchmarked | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| log(FAMILY_SIZE) | 10.842***<br>(4.99) | | | | | | 6.529*<br>(1.67) |
| log(FAMILY_SIZE) | | 2.212**<br>(2.22) | | | | | −2.107<br>(−1.08) |
| FAMILY_HHI | | | −20.298***<br>(−3.77) | | | | −1.221<br>(−0.12) |
| NET_COOPERATIVE_ INDEX | | | | −16.783*<br>(−1.82) | | | −23.568**<br>(−2.02) |
| PCT._NO_LOAD | | | | | 7.956**<br>(2.00) | | 16.991***<br>(2.75) |
| PCT._HEDGE_FUND_ CLIENT | | | | | | 41.940*<br>(1.68) | 70.474**<br>(2.35) |
| AVG._FAMILY_EXPENSE_ RATIO | 25.161***<br>(5.24) | 26.697***<br>(5.38) | 25.277***<br>(5.19) | 26.742***<br>(4.76) | 26.981***<br>(5.34) | 18.083***<br>(2.85) | 24.479***<br>(3.10) |
| log(FAMILY_AVG._ TURNOVER) | −4.424**<br>(−2.18) | −3.565*<br>(−1.71) | −4.979**<br>(−2.39) | −5.959***<br>(−2.67) | −3.770*<br>(−1.84) | −1.945<br>(−0.69) | −4.831<br>(−1.52) |
| FAMILY_AVG._ TEAM_SIZE | 10.436**<br>(2.41) | 9.424**<br>(2.14) | 10.604**<br>(2.51) | 19.260***<br>(4.19) | 8.551*<br>(1.91) | 5.680<br>(0.94) | 19.302***<br>(3.02) |
| log(FAMILY_AVG._ MANAGER_TENURE) | 1.118<br>(0.41) | 2.459<br>(0.89) | 4.246<br>(1.58) | 7.403**<br>(2.50) | 2.480<br>(0.90) | 1.445<br>(0.42) | 0.121<br>(0.03) |
| Year FEs | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| No. of obs. | 740 | 740 | 740 | 579 | 740 | 516 | 409 |
| Adj. $R^2$ | 0.059 | 0.034 | 0.046 | 0.064 | 0.032 | 0.006 | 0.059 |

include all of the variables and find that family age, cooperative incentives, distribution channel, client sophistication, average expense ratio, and average team size remain as statistically significant predictors of peer benchmarking. These results complement the fund-level analysis of Panel A, but add additional insight about the nature of the family-level determinants of peer benchmark usage.

## V. Conclusion

While the empirical and theoretical literature on asset management has long conflated the incentives of fund managers and the investment advisors they work for, a small but growing literature correctly separates the two and examines the importance of portfolio manager compensation and incentives. In addition to identifying the determinants of fund manager compensation, these articles have begun to explore the implications for fund and advisor outcomes from these different compensation schemes. In this article, we first model theoretically and then explore empirically the use of peer and pure benchmarks as determinants of fund manager compensation.

The overall picture that emerges after our study provides four important new insights. First, the impact of using pure versus peer benchmarks in compensation contracts is fundamentally different. Peer benchmarks induce a wedge in the manager's optimal portfolio since she must beat the performance of peers evaluated with respect to a pure benchmark whose portfolio is based on a private signal that she does not observe. Second, this wedge exposes the manager to a relative performance fee that, otherwise, she can fully undo (i.e., fees become irrelevant for effort inducement when the benchmark is pure). Consequently, to beat their peers, managers compensated relative to them must increase the fund's TEV and their effort expenditure. Third, as they are risk averse, they demand higher pay than pure-evaluated managers to compensate them for their funds' higher TEV. Fourth, one plausible explanation for the existence of both types of benchmarks in equilibrium is that the markets of fund investors are segmented. Fund investors differ in their level of sophistication and the distribution channel they use. These differences and the associated differences in the underlying business models across advisory firms play an important role in the choice of peer versus pure benchmarks.

Our study adds to the literature by documenting new evidence on the actual benchmarks used to compensate portfolio managers, and its implications for portfolio decisions and fund performance. Our results also shed light on the determinants underlying the choice of a given benchmark. Investor sophistication and the segmented markets of fund investors may explain the existence of both choices in equilibrium. We believe these findings should guide the modeling of optimal benchmarking in the future.

This article also has important policy implications. In seeking comment on the original 1993 regulation requiring funds to disclose their prospectus benchmark, some commenters urged the SEC to allow peer group comparisons reported in the prospectus, arguing that such a comparison would be an appropriate performance measure for investors since it would represent the "true" opportunity cost of the investor (i.e., the performance of the funds they could have selected, but did not). The SEC rejected this idea by suggesting that peer benchmarks could be used to suggest superior performance of the fund when, in fact, the fund had underperformed a market or pure-benchmark. In making this assessment, the SEC clearly indicated their belief that disclosing peer-benchmark relative performance would not be beneficial to investors. Given our evidence on the outperformance of peer-benchmarked managers, it is hard to justify a policy that only allows pure benchmark comparison. Our results, therefore, challenge the SEC's ad hoc restriction on providing only pure-benchmark performance comparisons in fund prospectuses, but not peer-benchmark performance comparisons.

## Appendix A. Variable Definitions

### *Key Variables*

PURE_BENCHMARK: = 1 if the portfolio manager has a market index benchmark in her compensation contract based on a fund's Statement of Additional Information (SAI), and 0 otherwise.

PEER_BENCHMARK: = 1 if the portfolio manager has a peer benchmark in her compensation contract based on a fund's SAI, and 0 otherwise.

PROSPECTUS_BENCHMARK_ADJ._ALPHA: Alpha estimated as in model 1 with prospectus benchmark returns as the factor.

4_FACTOR_ALPHA: Alpha estimated as in Carhart (1997).

MORNINGSTAR_RATING: The Morningstar rating is a measure of a fund's risk-adjusted return, relative to similar funds. Funds are rated from 1 to 5 stars, with the best performers receiving 5 stars and the worst performers receiving a single star.

ACTIVE_SHARE: Active share is a measure of the percentage of stock holdings in a manager's portfolio that differs from the benchmark index.

R2: It is constructed as the R2 of Carhart's (1997) 4-factor model regressions following Amihud and Goyenko (2013).

TRACKING_ERROR: It is a measure of the volatility of excess fund returns relative to either the pure or peer benchmarks.

EXPENSE_RATIO: Ratio of the fund's annual operating expenses by the average dollar value of its assets under management.

EXPENSE_RATIO_INCOME: The natural logarithm of the product of the fund's expense ratio and monthly fund assets under management.

ADVISORY_FEE: The fee fund managers charge to make investment decisions for managing the mutual fund.

ADVISORY_FEE_INCOME: The natural logarithm of the product of the fund's advisory fee and monthly fund assets under management.

NET_FLOW: Net flows is the annual average of monthly net growth in fund assets beyond reinvested dividends (Sirri and Tufano (1998)).

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### *Determinant Variables*

NET_COOPERATIVE_INDEX: A standardized index that measures the fund family net cooperative (cooperative–competitive) incentives as defined in Evans et al. (2020).

PCT._NO_LOAD: Percentage of total assets in no-load funds managed by a fund family.

AVG._ACCOUNT_SIZE: The average account size at an investment advisor is calculated using the total number of accounts and the total assets managed by an investment advisor taken from Form ADV.

PCT._HEDGE_FUND_CLIENT: The percentage of total assets managed by an investment advisor from hedge fund is estimated from Form ADV.

### *Control Variables*

FUND_SIZE: Sum of assets under management across all share classes of the fund.

FUND_AGE: Age of the oldest share class in the fund.

EXPENSE: Ratio of the fund's annual operating expenses by the average dollar value of its assets under management.

TURNOVER: Fund turnover ratio, computed by taking the lesser of purchases or sales and dividing by average monthly net assets.

TEAM: = 1 if a fund is managed by multiple managers, and 0 otherwise.

MANAGER_TENURE: Average managerial tenure of the portfolio managers of a fund in months.

FAMILY_SIZE: Sum of assets under management across all funds in the family, excluding the fund itself.

## Appendix B. Proofs

### *Proof of Proposition 1*

After putting effort $\alpha$, for each signal $s$, managers solve the problem $\max_\lambda V(\lambda)$, where $V(\lambda)$ is the manager's conditional indirect expected utility function given by equation (7) before averaging across all possible signals.

In the case of managers compensated with a relative incentive fee defined against an exogenous benchmark $\lambda^b$, the fund's absolute NAV is $\tilde{W}^u$ and the relative NAV is defined in (4). Then, $V(\lambda)$ becomes

(B-1)
$$\begin{aligned} V^u(\lambda) = {} & I^u + \beta^u\left(\lambda^b E\left(\tilde{K}^u\right) + W_0 r\right) + (\beta^u + \theta^u)\left(\lambda - \lambda^b\right) E\left(\tilde{K}^u\right) \\ & - \frac{\rho}{2}\Big((\beta^u)^2\left(\lambda^b\right)^2 \operatorname{var}\left(\tilde{K}^u\right) + (\beta^u + \theta^u)^2\left(\lambda - \lambda^b\right)^2 \operatorname{var}\left(\tilde{K}^u\right) \\ & + 2\beta^u \lambda^b (\beta^u + \theta^u)\left(\lambda - \lambda^b\right) \operatorname{cov}\left(\tilde{K}^u, \tilde{K}^u\right)\Big) \end{aligned}$$

with $\tilde{K}^u \equiv \tilde{K}(\alpha^u, s^u)$. In the case of managers compensated with a relative incentive fee defined against peers' performance, the fund's absolute NAV is $\tilde{W}^e$ and the relative NAV is defined in (5). Then, $V(\lambda)$ becomes

(B-2) $$V^e(\lambda) = I^e + \int_{-\infty}^{\infty} \Big(\beta^e\big(\lambda E(\tilde{K}^e) + W_0 r\big) + \theta^e(1-\delta)\big(\lambda E(\tilde{K}^e) - \lambda^u(s^u)E(\tilde{K}^u)\big) - \frac{\rho}{2}\Big((\beta^e)^2\lambda^2 \mathrm{var}(\tilde{K}^e) + (\theta^e)^2(1-\delta)^2 \mathrm{var}(\lambda\tilde{K}^e - \lambda^u\tilde{K}^u) + 2\beta^e\theta^e(1-\delta)\mathrm{cov}(\lambda\tilde{K}^e, \lambda\tilde{K}^e - \lambda^u\tilde{K}^u)\Big)\Big) df^e(s^u)$$

with $\tilde{K}^e \equiv \tilde{K}(\alpha^e, s^e)$. After receiving her own signal $s^e$, managers compensated relative to their peers average their expected utility function across all possible, unobservable signals $s^u$ received by managers compensated relative to a pure benchmark. $f^e(s^u)$ denotes the density function of the signal $\tilde{s}^u$ conditional of the signal $s^e$ observed by the peer-benchmarked manager. Given (1), $\tilde{s}^u | s^e \sim N\left(\alpha^e s^e, \frac{(1-\alpha^u\alpha^e)\sigma_\varepsilon^2}{\alpha^u}\right)$. Notice that, when $\alpha^e = 0$, $\tilde{s}^u | s^e \sim N\left(0, \frac{\sigma_\varepsilon^2}{\alpha^u}\right)$, the unconditional distribution of $\tilde{s}^u$. In that case, the signal $s^e$ is totally uninformative about the stock return and the signal received by pure-benchmarked managers.

The optimal portfolios $\lambda^u(\alpha^u, s^u)$ in (8) and $\lambda^e(\alpha^e, s^e)$ in (9) follow, respectively, from the first-order conditions of each problem. The average portfolio $\bar{\lambda}^u$ is obtained as follows:

$$\bar{\lambda}^u(\alpha^u, \alpha^e, s^e) = \int_{-\infty}^{\infty} \lambda^u(\alpha^u, s^u) df^e(s^u). \qquad \square$$

### *Proof of Proposition 2*

The optimal effort solves the problem $\max_\alpha(V(\alpha) - c(\alpha))$. Replacing (8) into (B-1) and averaging across signals $s^u$ results into the unconditional expected utility function:

(B-3) $$V^u(\alpha) = I^u + \beta^u W_0 r + \frac{\bar{K}^2 + \alpha\sigma_\varepsilon^2}{\rho(1-\alpha)\sigma_\varepsilon^2} - \frac{\rho}{2}\frac{\bar{K}^2 + \alpha\sigma_\varepsilon^2}{\rho^2(1-\alpha)\sigma_\varepsilon^2}.$$

Likewise, replacing (8) and (9) into (B-2) and averaging across signals $s^e$ results into the unconditional expected utility function:

(B-4) $$V^e(\alpha) = I^e + \beta^e W_0 r + \frac{\bar{K}^2 + \alpha\sigma_\epsilon^2}{\rho(1-\alpha)\sigma_\epsilon^2} + \theta^e(1-\delta)\left(\frac{\sqrt{1-\alpha^u}}{\sqrt{1-\alpha}}\left(\frac{\bar{K}^2 + \alpha^u\alpha\sigma_\epsilon^2}{(\beta^u+\theta^u)\rho(1-\alpha^u)\sigma_\epsilon^2} + \frac{\theta^u}{\beta^u+\theta^u}\lambda^b\bar{K}\right) - \frac{\bar{K}^2 + \alpha^u\sigma_\epsilon^2}{(\beta^u+\theta^u)\rho(1-\alpha^u)\sigma_\epsilon^2} - \frac{\theta^u}{\beta^u+\theta^u}\lambda^b\bar{K}\right) - \frac{\rho}{2}\left(\frac{\bar{K}^2 + \alpha\sigma_\epsilon^2}{\rho^2(1-\alpha)\sigma_\epsilon^2} + (\theta^e(1-\delta))^2\frac{(1-\alpha)\alpha^u}{\left((\beta^u+\theta^u)^2\rho^2(1-\alpha^u)\right)}\right).$$

Rearranging terms and simplifying (B-3) and (B-4) to eliminate terms independent of $\alpha$, we arrive, respectively, at conditions (12) and (13). $\square$

*Proof of Proposition 3*

The manager's expected compensation if she is evaluated relative to a pure benchmark $\lambda^b$ is given by

$$I^u + \beta^u W_0 r + \frac{\bar{K}^2 + \alpha\sigma_\epsilon^2}{\rho(1-\alpha)\sigma_\epsilon^2}.$$

On the other side, if the manager is compensated relative to her peers' performance, her expected compensation is given by

$$I^e + \beta^e W_0 r + \frac{\bar{K}^2 + \alpha\sigma_\epsilon^2}{\rho(1-\alpha)\sigma_\epsilon^2} + \theta^e(1-\delta)\left(\frac{\sqrt{1-\alpha^u}}{\sqrt{1-\alpha}}\left(\frac{\bar{K}^2 + \alpha^u\alpha\sigma_\epsilon^2}{(\beta^u+\theta^u)\rho(1-\alpha^u)\sigma_\epsilon^2} + \frac{\theta^u}{\beta^u+\theta^u}\lambda^b\bar{K}\right)\right.$$
$$\left. - \frac{\bar{K}^2 + \alpha^u\sigma_\epsilon^2}{(\beta^u+\theta^u)\rho(1-\alpha^u)\sigma_\epsilon^2} - \frac{\theta^u}{\beta^u+\theta^u}\lambda^b\bar{K}\right).$$

If the participation constraint is binding at the optimal contract, $V(I,\beta,\theta) = U_0$. Given (B-3) and (B-4), respectively, equations (16) and (17) follow immediately. □

## Supplementary Material

To view supplementary material for this article, please visit http://doi.org/10.1017/S0022109023001230.

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