

Peer vs. Pure Benchmarks in the Compensation of Mutual Fund Managers

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Motivation - Benchmarking and Incentives

Performance evaluation central to CEO compensation literature

- By benchmarking, noise can be reduced, and performance incentives sharpened
- There is also a debate about the **nature of the benchmark**:
 - Should it be based on a broad index, like the S& 500?
 - Or rather of a customized group of peers?

Many theoretical studies on benchmarking portfolio managers compensation

- Benchmarking negatively affects effort/risk-taking
- Fulcrum versus convex management fees
- Optimal benchmark composition & management contract
- **However, there is basically no discussion about the nature of the benchmark in the portfolio delegation literature**

Myth #1 – MF Managers Don't Have Incentive Compensation

- Theory models (and empirical work) often assume managers incentivized by maximizing TNA
- Elton, Gruber, Blake - 2003 JF Paper
 - “Incentive fees are not widely used by the mutual fund industry. In 1999, only 108 out of a total 6,716 [1.6%] bond and stock mutual funds used incentive fees.”
- **HOWEVER**
- Ma, Tang, and Gomez (2019) examine mutual fund manager compensation and find bonuses explicitly based on:
 - Fund performance - 79% of managers
 - Assets under management - 19.6% of managers

Myth #2 – Funds Only Have Market/Pure Benchmarks

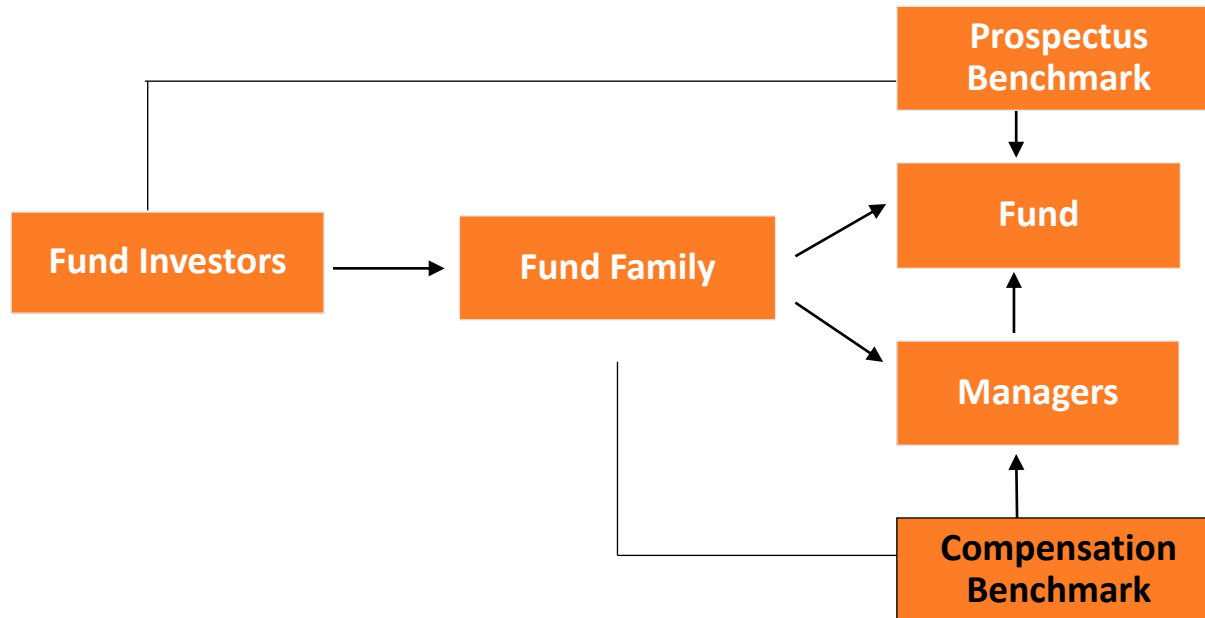
- Theory models with benchmarks assume a portfolio of securities in the economy ('market benchmark')
- SEC requires disclosing benchmark in prospectus since 1993
 - Help facilitate investors' evaluation of performance
 - "Broad-based securities market index" – 'pure' benchmark
 - Considered and rejected possible 'peer' benchmarks:

"The index comparison requirement is designed to show how much value the management of the fund added by showing whether the fund 'out-performed' or 'under-performed' the market, and not so much whether one fund 'out-performed' another. **A fund could underperform a relevant market, while nevertheless comparing favorably with its peers.**"
- **HOWEVER, WE FIND THAT:**
 - Peer benchmarks are used solely or in part by over 70% of funds to determine bonuses for their fund managers
 - Managers compensated relative to peers performance outperform

Manager Compensation Benchmarks

Starting in 2005, the SEC requires mutual funds to disclose the compensation structures of their managers in the Statement of Additional Information (SAI)

- “If compensation is based solely or in part on performance, a fund is required to identify any benchmark used to measure performance” (compensation benchmark)



Compensation Benchmark Examples

Goldman Sachs Mid-Cap Value

Portfolio managers are rewarded for their ability to outperform a benchmark while managing risk appropriately. The performance bonus is significantly influenced by 3 year period of investment performance.

The benchmarks for these Funds are:

Large Cap Value Fund: Russell 1000® Value Index
Mid Cap Value Fund: Russell Mid Cap® Value Index
Small Cap Value Fund: Russell 2000® Value Index

Marshall Mid-Cap Value Fund

A portfolio manager's performance bonus is determined primarily in relation to the pre-tax investment performance ...With respect to the portion of compensation received for managing the Fund, **each portfolio manager's performance is measured against the index set forth in the following table:**

Fund	Index
Marshall Large-Cap Value	Lipper Large Cap Value Funds Index
Marshall Large-Cap Growth	Lipper Large-Cap Growth Funds Index
Marshall Mid-Cap Value	Lipper Mid-Cap Value Funds Index
Marshall Mid-Cap Growth	Lipper Mid-Cap Growth Funds Index

Compensation Benchmark Examples (Continued)

Harris Capital Growth Fund

Bonus amounts are determined by many factors including: the **pre-tax investment performance of the portfolio manager compared to the performance of benchmarks ...set forth below**:

<u>Fund(s)</u>	<u>Benchmark</u>	<u>Peer Group</u>
Capital Growth Fund	Russell 1000® Growth Index	Lipper Large Cap Growth Funds
Mid-Cap Growth Fund	Russell Mid-Cap Growth Index	Lipper Mid-Cap Growth Funds

Nuveen Equity Income Fund

For managers of a Fund, the portion of the maximum potential annual cash incentive that is paid out is based upon **performance relative to the portfolio's benchmark and performance relative to an appropriate Lipper industry peer group.**

Research Questions

- We study, for the first time, the choice of peer vs. pure benchmarks in the compensation contracts of mutual fund managers.

- Theoretically and empirically, how does the use of peer vs. pure benchmarks for manager compensation affect
 - Manager effort / fund activeness
 - Incentive/advisory fees
 - Risk-adjusted performance

- What explains the choice of peer vs. pure benchmarks?
 - Heterogeneity in investor sophistication and family characteristics

Preview of Main Results

Both **peer** and **pure** benchmark are prevalent in the compensation contracts

- 21% (29%) of funds use peer (pure) benchmarks only, remaining 50% both
- Peer benchmark is harder to beat than Pure benchmark (gross comparison)

Compared to Pure counterparts, Peer-benchmark compensated funds

- Exhibit **greater portfolio activeness**
- **Pay more to their managers**
- Have **superior investment performance**

The use of **peer benchmark** is more likely among:

- Funds with **more sophisticated investors**
- **Direct-sold funds**
- Families **with greater incentives for competition** as opposed to cooperation

Potential Contributions

First to study the compensation benchmark choice and document that peer benchmarks are used extensively

- Model, for the first time, the difference between pure vs. peer benchmarks
- Uncover that peer benchmarks result in **an externality similar to a “Keeping up with the Joneses” preferences**

Provide empirical evidence that **supports other theory work**

- The optimal benchmark should reflect the manager’s investment style (e.g., Li and Tiwari (2009) and Gârleanu, Panageas and Yu (2020))
- Managers with a pure benchmark act more like closet indexers (e.g., Cuoco and Kaniel (2011), and Basak and Pavlova (2013))

Add to the nascent **literature on the compensation of portfolio managers**

- Ma, Tang, and Gomez (2019) on compensation structures of U.S. managers
- Ibert et al. (2018) analyze compensation data from Sweden
- Ours complements prior work as benchmark choices not studied before

Theory Model

- Extend the model of Kapur and Timmermann (2005)
- One period, two assets – risky stock and a risk-free asset
- Each risk-neutral investor invests in a single fund managed by a risk-averse manager
- At the beginning of the period, investors offers manager a contract:
 - Fixed salary (I)
 - Incentive fee (θ), where $1 \geq \theta \geq \underline{\theta}$
- Manager chooses whether to accept contract and expend effort (α) to learn a noisy signal s , partially correlated with the stock return
 - Greater effort translates to a more precise signal:
 - Effort is costly: $c(\alpha)$

$$E(\tilde{K}(\alpha, s)) = \bar{K} + \alpha s,$$

$$Var(\tilde{K}(\alpha)) = (1 - \alpha)\sigma_\epsilon^2.$$

Manager's Problem

- Peer and pure-compensated managers receive different signals
- If manager accepts contract (I, θ) :
 - Exerts effort α , and receives signal s
 - Chooses number of shares $\lambda(s)$ of risky stock to maximize expected utility
- The fund's NAV (end of period wealth) is:

$$\tilde{W}(\alpha, s) = \lambda \tilde{K}(\alpha, s) + r.$$

- Manager benchmark composition is exogenously given:
 - Pure benchmark holds λ^b units of the risky stock
 - Fraction (δ) evaluated relative to average manager performance (peers)
 - Fraction $(1 - \delta)$ evaluated relative to pure benchmark
- We use superscript e to denote **peer-compensated** managers and u to denote **pure-compensated** managers.

Theory Model's Predictions

- Peer-benchmarked managers (relative to pure-benchmarked) will:
 - Exhibit higher effort/active share
 - Outperform net of fees provided effort incentives are high enough

- Investors will offer peer managers a contract with higher incentive fee

- Intuition is similar to a “Keeping up with the Joneses” type-outcome
 - Pure benchmark return is exogenous.
 - Peer benchmark return embeds the effort choice of other managers
 - Peer managers care about their peers-adjusted fee and the (average) portfolio of pure-compensated managers. This:
 - Leverages incentives for outperforming
 - Limits managers ability to “undo” incentives
 - Increases active management

Sample for Empirical Analysis

Data Sources

- Morningstar Direct Mutual Fund database
- Thomson Reuters MF Holdings database
- SEC EDGAR: Prospectus, Statement of Additional Information, ADV filings

Sample: U.S. domestic equity funds from 2006 to 2012

- 1,043 unique mutual funds across 153 fund families
- 6,966 fund-year observations with compensation benchmark(s)

Key Variables: Peer & Pure compensation benchmark indicator

- Pure: market indices such as S&P 500 index
- Peer: Lipper indices use the 30 largest mutual funds (by AUM) in a specific investment category

Standard errors are adjusted for heteroscedasticity and clustered at the fund level

Table 1 – Peer vs. Pure Benchmarks Empirically

Distribution of Peer vs. Pure Compensation Benchmarks

		<i>Peer Benchmark</i>	
		0	1
<i>Pure Benchmark</i>	0	–	1,457 (20.9%)
	1	2,041 (29.3%)	3,468 (49.8%)

- Compensation benchmark: 70% contains a peer benchmark in the contract and 21% report only peer benchmark
- Prospectus benchmark: comply to the regulation and set a market index as primary benchmark, very few (0.1%) set Lipper as the secondary benchmark

Table 2 – Top 10 Pure/Peer Benchmarks

Panel A. Top 10 Pure Benchmarks						
Benchmark	# Rank	Funds	# Funds	% Funds	Assets (in bil- lions)	% As- sets
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	# Rank	Funds	# Funds	% Funds	Assets (in bil- lions)	% As- sets
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%

Prediction #1 – Higher Active Share/Effort (Table 3)

Variables	All Sample			Only Peer vs. Only Pure		
	(1) Active Share	(2) Track Error	(3) R-squared	(4) Active Share	(5) Track Error	(6) R-squared
<i>Peer Benchmark</i>	-1.338 (-1.07)	-0.099 (-0.70)	0.283 (0.81)	2.532** (2.23)	0.832*** (5.06)	-2.618*** (-5.04)
<i>Pure Benchmark</i>	-2.714** (-2.47)	-0.840*** (-5.70)	2.696*** (5.51)			
<i>Log(Fund Size)</i>	0.749* (1.72)	0.133*** (2.77)	-0.219 (-1.53)	0.691 (1.25)	0.220*** (3.30)	-0.266 (-1.31)
<i>Log(Fund Age)</i>	0.769 (1.01)	-0.064 (-0.69)	0.306 (1.01)	-1.427 (-1.44)	-0.358*** (-2.71)	1.124** (2.57)
<i>Expense</i>	20.583*** (10.25)	2.037*** (12.46)	-4.921*** (-10.48)	17.130*** (8.24)	1.944*** (8.62)	-4.633*** (-7.20)
<i>Log(Turnover)</i>	3.450*** (5.28)	0.181*** (2.95)	-0.104 (-0.61)	2.303** (2.44)	0.077 (0.79)	0.154 (0.58)
<i>Team</i>	0.728 (0.72)	-0.171 (-1.53)	0.708** (2.14)	2.845** (2.23)	-0.264 (-1.53)	0.976** (1.97)
<i>Log(Manager Tenure)</i>	2.635*** (4.57)	0.211*** (3.61)	-0.608*** (-3.45)	1.735** (2.57)	0.203** (2.33)	-0.742*** (-2.83)
<i>Log(Family Size)</i>	-1.033*** (-3.28)	-0.103*** (-2.80)	0.330*** (3.07)	-1.359*** (-3.87)	-0.179*** (-3.65)	0.471*** (3.24)
<i>Constant</i>	20.671* (1.91)	0.491 (0.50)	90.483*** (30.05)	53.711*** (3.94)	1.153 (0.84)	84.765*** (20.13)
<i>MS Category*Year FEs</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	5,107	5,761	5,629	2,562	2,876	2,815
<i>Adjusted R-squared</i>	0.572	0.427	0.396	0.580	0.418	0.396

Prediction #2 – Higher Incentive Fees (Table 4)

Variables	All Sample		Only Peer vs. Only Pure	
	(1)	(2)	(3)	(4)
	Advisory Fee Rate	Expense Ratio	Advisory Fee Rate	Expense Ratio
<i>Peer Benchmark</i>	0.008 (0.49)	0.004 (0.16)	0.063*** (3.32)	0.187*** (6.37)
<i>Pure Benchmark</i>	-0.048*** (-3.02)	-0.174*** (-6.94)		
<i>Log(Fund Size)</i>	-0.010* (-1.94)	-0.053*** (-6.47)	-0.004 (-0.53)	-0.049*** (-4.29)
<i>Log(Fund Age)</i>	-0.014 (-1.34)	0.064*** (4.29)	-0.026* (-1.81)	0.042* (1.92)
<i>Log(Turnover)</i>	0.079*** (11.42)	0.114*** (10.68)	0.076*** (7.30)	0.132*** (8.64)
<i>Team</i>	0.046*** (3.56)	0.056*** (2.90)	0.067*** (3.41)	0.056* (1.95)
<i>Log(Manager Tenure)</i>	0.038*** (5.39)	0.027*** (2.58)	0.040*** (3.85)	0.038** (2.43)
<i>Log(Family Size)</i>	-0.036*** (-7.84)	-0.028*** (-4.09)	-0.050*** (-8.56)	-0.036*** (-4.06)
Constant	1.225*** (10.40)	1.894*** (11.19)	1.452*** (8.56)	1.915*** (7.60)
<i>MS Category*Year FEs</i>	Yes	Yes	Yes	Yes
<i>Observations</i>	5,694	5,803	2,846	2,906
<i>Adjusted R-squared</i>	0.358	0.358	0.394	0.375

Prediction #3 – Outperformance (Table 6)

Variables	All Sample				Only Peer vs. Only Pure			
	(1) Prospectus Alpha	(2) Four Alpha	(3) DGTW Ret.	(4) MS Ratings	(5) Prospectus Alpha	(6) Four Alpha	(7) DGTW Ret.	(8) MS Ratings
<i>Peer Benchmark</i>	0.332** (2.02)	0.345** (2.01)	0.223* (1.70)	0.205*** (4.14)	0.850*** (3.82)	0.486** (2.02)	0.463** (2.51)	0.350*** (5.28)
<i>Pure Benchmark</i>	-0.412** (-2.24)	0.002 (0.01)	-0.197 (-1.27)	-0.117** (-1.98)				
<i>Log(Fund Size)</i>	-0.192*** (-3.24)	-0.264*** (-4.41)	-0.099** (-2.05)	0.135*** (8.05)	-0.257*** (-3.06)	-0.366*** (-4.20)	-0.123* (-1.69)	0.129*** (5.13)
<i>Log(Fund Age)</i>	0.153 (1.28)	0.236* (1.96)	0.128 (1.28)	-0.232*** (-6.38)	0.088 (0.51)	0.138 (0.82)	-0.020 (-0.14)	-0.271*** (-5.16)
<i>Expense</i>	-1.194*** (-4.98)	-1.464*** (-6.04)	-0.135 (-0.74)	-0.434*** (-6.52)	-1.830*** (-5.24)	-1.978*** (-5.69)	-0.339 (-1.22)	-0.498*** (-5.23)
<i>Log(Turnover)</i>	-0.168** (-1.98)	-0.224*** (-2.69)	-0.284*** (-4.18)	-0.083*** (-3.27)	-0.341** (-2.53)	-0.331** (-2.42)	-0.419*** (-3.78)	-0.144*** (-3.73)
<i>Team</i>	-0.265 (-1.63)	-0.021 (-0.12)	-0.084 (-0.62)	0.003 (0.06)	0.123 (0.50)	0.404 (1.60)	0.173 (0.79)	0.171*** (2.94)
<i>Log(Manager Tenure)</i>	0.139 (1.44)	0.034 (0.37)	0.072 (0.87)	0.112*** (4.47)	0.087 (0.60)	0.114 (0.82)	-0.093 (-0.78)	0.130*** (3.66)
<i>Active Share</i>	0.011*** (3.04)	0.000 (0.12)	0.009*** (2.92)	0.008*** (6.46)	0.015** (2.36)	-0.001 (-0.16)	0.011** (2.04)	0.006*** (3.18)
<i>Performance Adv. Fee</i>	-0.655 (-1.60)	-0.585 (-1.13)	-0.628 (-1.23)	0.037 (0.21)	-0.478 (-1.08)	-0.623 (-1.12)	-0.429 (-0.76)	0.070 (0.35)
<i>Log(Family Size)</i>	0.109** (2.23)	0.104** (2.17)	0.062 (1.60)	-0.026* (-1.78)	0.036 (0.56)	0.085 (1.33)	0.020 (0.41)	-0.038** (-2.01)
<i>Constant</i>	0.776 (0.60)	2.323* (1.77)	0.634 (0.62)	1.953*** (4.86)	4.857*** (2.62)	6.138*** (3.21)	3.618** (2.39)	2.667*** (4.89)
MS Category*Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,025	5,036	5,068	5,107	2,510	2,517	2,544	2,562
Adjusted R-squared	0.215	0.254	0.244	0.139	0.225	0.226	0.198	0.171

Compensation Benchmarking Equilibrium

- Model assumes an exogenous fraction of managers compensated relative peer and pure benchmarks.
- In equilibrium, how can we explain the existence of both types of benchmarks? Peer is clearly a superior choice for investors

- 1) Evidence consistent with market segmentation (investor heterogeneity)
- 2) Determinants of investment advisor usage of one type vs. another

Peer vs. Pure Fund Flows (Table 7)

	Only Peer	Only Pure	Only Peer & Only Pure
	(1)	(2)	(3)
	Performance=Prospectus Benchmark Adj. Alpha		
Performance Rank	3.114*** (9.89)	1.819*** (4.71)	1.842*** (4.82)
Peer Benchmark * Performance Rank			1.134** (2.43)
Peer Benchmark			-0.692** (-2.55)
Log(Fund Size)	-0.130* (-1.69)	-0.197* (-1.91)	-0.152** (-2.44)
Log(Fund Age)	-0.534*** (-3.09)	-1.057*** (-5.40)	-0.857*** (-6.45)
Expense	-0.187 (-0.58)	-0.601* (-1.92)	-0.406* (-1.82)
Log(Turnover)	-0.168 (-1.24)	0.531*** (2.62)	0.261* (1.85)
Team	-0.160 (-0.71)	0.00375 (0.02)	-0.0280 (-0.18)
Log(Manager Tenure)	0.129 (1.25)	0.310** (2.30)	0.211** (2.57)
Log(Family Size)	0.0543 (0.78)	0.0566 (0.97)	0.0377 (0.88)
Constant	2.226 (1.22)	5.502*** (3.22)	4.672*** (3.88)
MS Category * Year FEs	Yes	Yes	Yes
Observations	1,213	1,657	2,870
Adjusted R ²	0.155	0.119	0.104

Investors are heterogeneous in terms of flows-performance sensitivity, and funds with peer vs. pure compensation benchmarks cater to a different investor clientele.

Table 8: The Choice between Pure vs. Peer

	Only Peer VS. Only Pure				
	(1)	(2)	(3)	(4)	(5)
Pct. No Load	0.883*** (3.16)				1.311*** (2.59)
Hedge Fund Client		1.182*** (3.11)			1.715*** (3.68)
Avg. Account Size > \$1 mil.			1.412*** (3.29)		1.743** (2.04)
Net Cooperative Index				-2.711*** (-3.60)	-2.867*** (-3.00)
Log(Fund Size)	0.0626 (0.74)	0.0981 (0.94)	-0.0374 (-0.36)	-0.128 (-1.18)	-0.154 (-1.04)
Log(Fund Age)	0.427** (2.49)	0.176 (0.88)	0.381* (1.88)	0.530** (2.49)	0.453 (1.46)
Expense	2.188*** (6.56)	1.052*** (2.92)	1.178*** (3.23)	1.860*** (4.86)	2.179*** (3.76)
Log(Turnover)	-0.275*** (-2.62)	-0.412*** (-3.04)	-0.500*** (-3.81)	-0.378*** (-3.13)	-0.396** (-2.08)
Team	-0.0561 (-0.30)	-0.295 (-1.26)	-0.297 (-1.26)	0.241 (1.07)	0.109 (0.33)
Log(Manager Tenure)	-0.318*** (-2.98)	-0.0784 (-0.66)	-0.0828 (-0.67)	-0.244* (-1.96)	-0.286 (-1.60)
Log(Family Size)	0.156** (2.46)	-0.0173 (-0.23)	0.0912 (1.22)	0.212*** (2.69)	0.191* (1.67)
Category*Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2906	2000	1660	2011	1007
Pseudo R ²	0.103	0.077	0.080	0.113	0.201

- The design of pure vs peer benchmark is related to investor sophistication and family incentive structures.
- Direct-sold funds and % sophisticated investors are positively related to the use of peer benchmark.
- Families with high cooperative incentives index are less likely to use peer benchmarks.

Conclusions

- Managers are not indifferent to the benchmark against which they are compensated
 - Peer benchmarks induce greater effort (or attract better managers)
 - Our results are consistent with the predictions of a moral hazard model
- Greater effort or higher skill translates into more active management and (potentially) superior net fund performance
 - Partly extracted and shared by fund families and managers—higher fees
 - Partly passed on to investors—superior net performance
- The use of peer vs. pure is also related to investor sophistication and family incentive structures.
- SEC assessment indicated that disclosing peer-benchmarked performance would not be beneficial to investors
 - Our policy implications challenge the SEC's ad hoc restriction

Manager's optimal portfolio and effort

- The optimal portfolio:

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

Benchmark-adjusted incentive fee

- The optimal effort:

$$\alpha^u = \operatorname{argmax}_\alpha \left(\frac{\bar{K} + \alpha \sigma_\epsilon^2}{2\rho(1 - \alpha) \sigma_\epsilon^2} - c(\alpha) \right) \quad \alpha^e(\theta^e) = \operatorname{argmax}_\alpha \left(\frac{\bar{K} + \alpha \sigma_\epsilon^2}{2\rho(1 - \alpha) \sigma_\epsilon^2} + \theta^e(1 - \delta) \frac{\sqrt{1 - \alpha^u} \bar{\lambda}^u \bar{K}}{\sqrt{1 - \alpha}} - c(\alpha) \right)$$

Managers cannot undo the incentives of pure-benchmarked managers

Tracking Error Volatility

$$(TEV^u)^2 = \frac{\bar{K}^2 + \alpha^u \sigma_\epsilon^2}{\rho^2 \sigma_\epsilon^2 (1 - \alpha^u)}$$

$$(TEV^e(\theta^e))^2 = \frac{\bar{K}^2 + \alpha^e \sigma_\epsilon^2}{\rho^2 \sigma_\epsilon^2 (1 - \alpha^e)} + (\theta^e(1 - \delta))^2 \frac{\alpha^u}{\rho^2 (\theta^u)^2 (1 - \alpha^u)}$$

$TEV^e > TEV^u$

Optimal incentive fee and net performance

- Assuming the participation constraint is binding:

$$\theta^u = \operatorname{argmax}_{\theta \in [\underline{\theta}, 1]} \left(\frac{\bar{K}^2 + \alpha^u \sigma^2}{\theta \rho (1 - \alpha^u) \sigma_\epsilon^2} + \lambda^b \bar{K} - \frac{\rho}{2} (TEV^u)^2 \right)$$

$$\theta^u = \underline{\theta}$$

$$\theta^e = \operatorname{argmax}_{\theta \in [\underline{\theta}, 1]} \left(\frac{\bar{K}^2 + \alpha^e(\theta) \sigma^2}{\theta (1 - \delta) \rho (1 - \alpha^e(\theta)) \sigma_\epsilon^2} + \frac{\sqrt{1 - \alpha^u}}{\sqrt{1 - \alpha^e(\theta)}} \bar{\lambda}^u \bar{K} - \frac{\rho}{2} (TEV^e(\theta))^2 \right)$$

- $\alpha^e(\theta)$ and $(TEV^e(\theta))$ are both increasing functions of θ
- The optimal incentive fee is the outcome of **a tradeoff between effort incentives and higher TEV** which is costly for investors (risk-averse managers)
- If effort incentives are high enough, we should expect **peer-benchmarked managers to outperform net of fees**