Heterogeneity and Persistence in Performance of Mutual Fund Managers

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Abstract

We document a significant effect of unobservable fund manager specific heterogeneity on fund performance using a comprehensive data set of U.S. active mutual fund managers from 1979 to 2014. We design a new fixed-effect estimation method to accommodate the particular features of mutual fund managers data set. We find that manager fixed effects explain a larger part of the variation in fund performance than fund fixed effects. Though performance persistence at the fund level is found weak, it is significant at the manager level. The strong persistence seems due to the lack of investors' tendency or ability to chase better-performing managers as fund flows are not sensitive to managers' past performance.

Motivation

- Mutual funds are managed by individual portfolio managers.
  - Human capital is a critical input.
  - But many studies and media equate “funds = managers”.

- Several studies examine managerial characteristics.
  - Since Chevalier and Ellison (1999), studies examine education, network, wealth, gender, and so on.

- However, many of individual characteristics are not readily observable.

- Examples include:

  - Cognitive ability (Grinblatt, Keloharju, and Linnainmaa, 2012)
  - Psychological attributes (Kamya, Kim, and Park, 2018)
  - Family background (Aghion, Akcigit, Hyytinen, and Toivanen, 2017; Bell, Chetty, Jaravel, Petkova, and Van Reenen, 2017; Chuprinin and Sosyura, 2017)
  - Early-life experience (Malmendier and Nagel, 2011; Benmelech and Frydman, 2015)

Research questions

1. How are unobservable manager-specific heterogeneity associated with fund performance?
   - Instead of trying to identify hard-to-observe characteristics

2. Whether and how are these related to some observable characteristics?

3. Relative importance of individual managers vs. fund organizations.

4. Performance persistence at the manager level.

Data

- Focus on active equity U.S. funds
  - MorningStar + CRSP for fund data.
  - Follow Pastor, Stambaugh and Taylor (2015, JFE)
  - 3,311 funds from 1979 to 2014.

- Portfolio managers
  - MorningStar Direct + Principia + Capital IQ + Internet search (company websites, LinkedIn, Bloomberg, etc.)
  - 3,224 funds with manager data.
  - Cover 90% (in numbers) and 93% (in assets) of the entire fund-months.

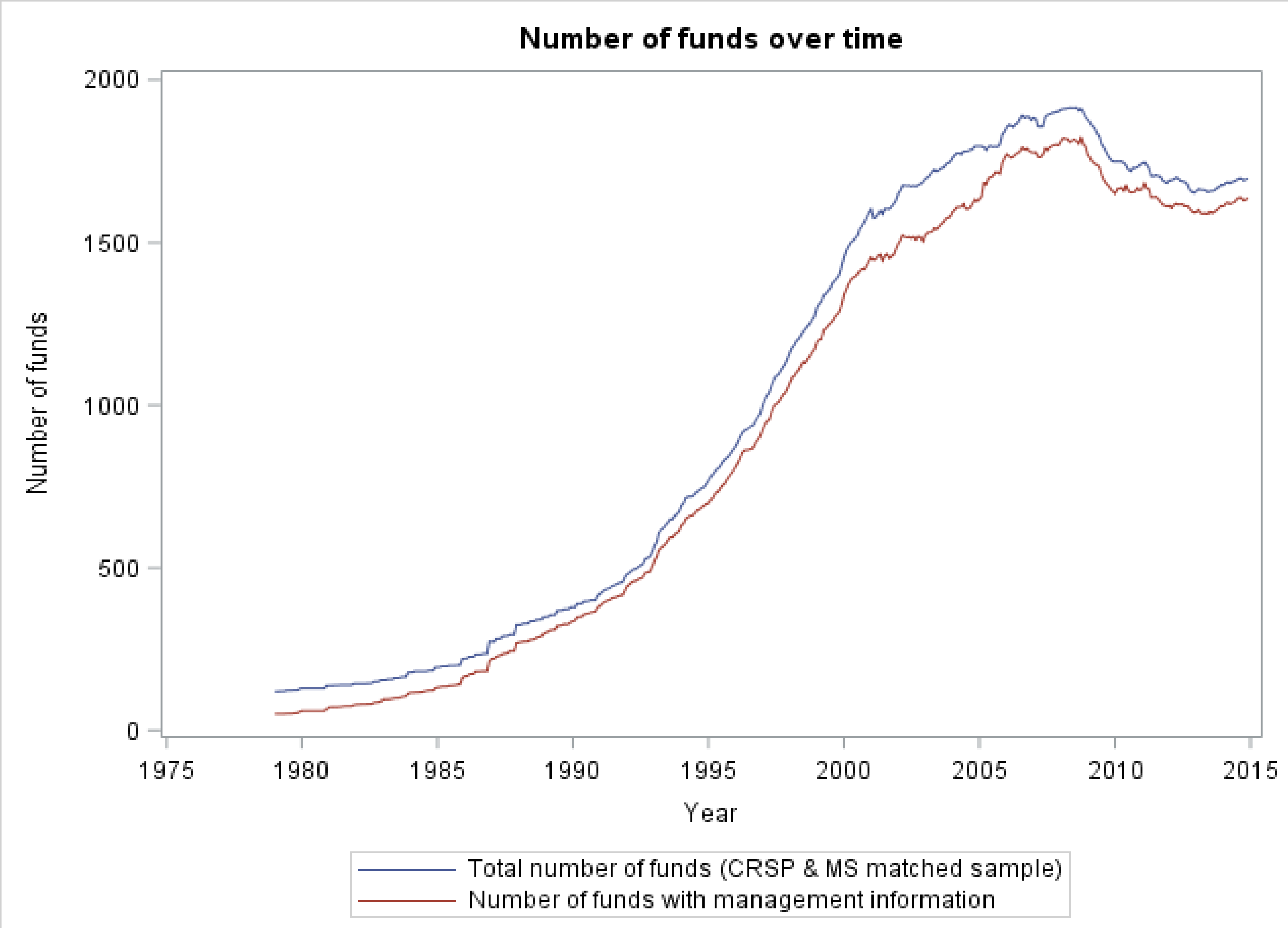
Summary statistics: Funds

- From 1979 to 2014

	Total	w/ manager	%
# fund-months	442,646	402,358	90.9%
# funds	3,311	3,224	97.4%
		w/ bio data	
# managers	6,107	5,044	82.6%

	w/ managers		w/o managers	
Variable	N	Mean	N	Mean
Net return	400,012	0.008	39,693	0.008
Benchmark-adjusted gross return	378,146	0.000	30,729	0.000
Benchmark-adjusted net return	399,174	-0.001	33,566	-0.001
Fund Size (in 2014 $mm)	370,955	1209.4	32,626	1044.6
Family Size (in 2014 $mm)	383,506	31378.1	34,477	26944.6
Fund Age (in years)	402,358	13.346	40,288	13.145

#Managers/Fund	402,358	2.206
Mean tenure (in years)	402,358	6.744


Number of funds over time
2000
1500
1000
500
0
Number of funds
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year
Total number of funds (CRSP & MS matched sample)
Number of funds with management information

Summary statistics: Managers

- Bio data: 5,044 managers (at least BA info.)

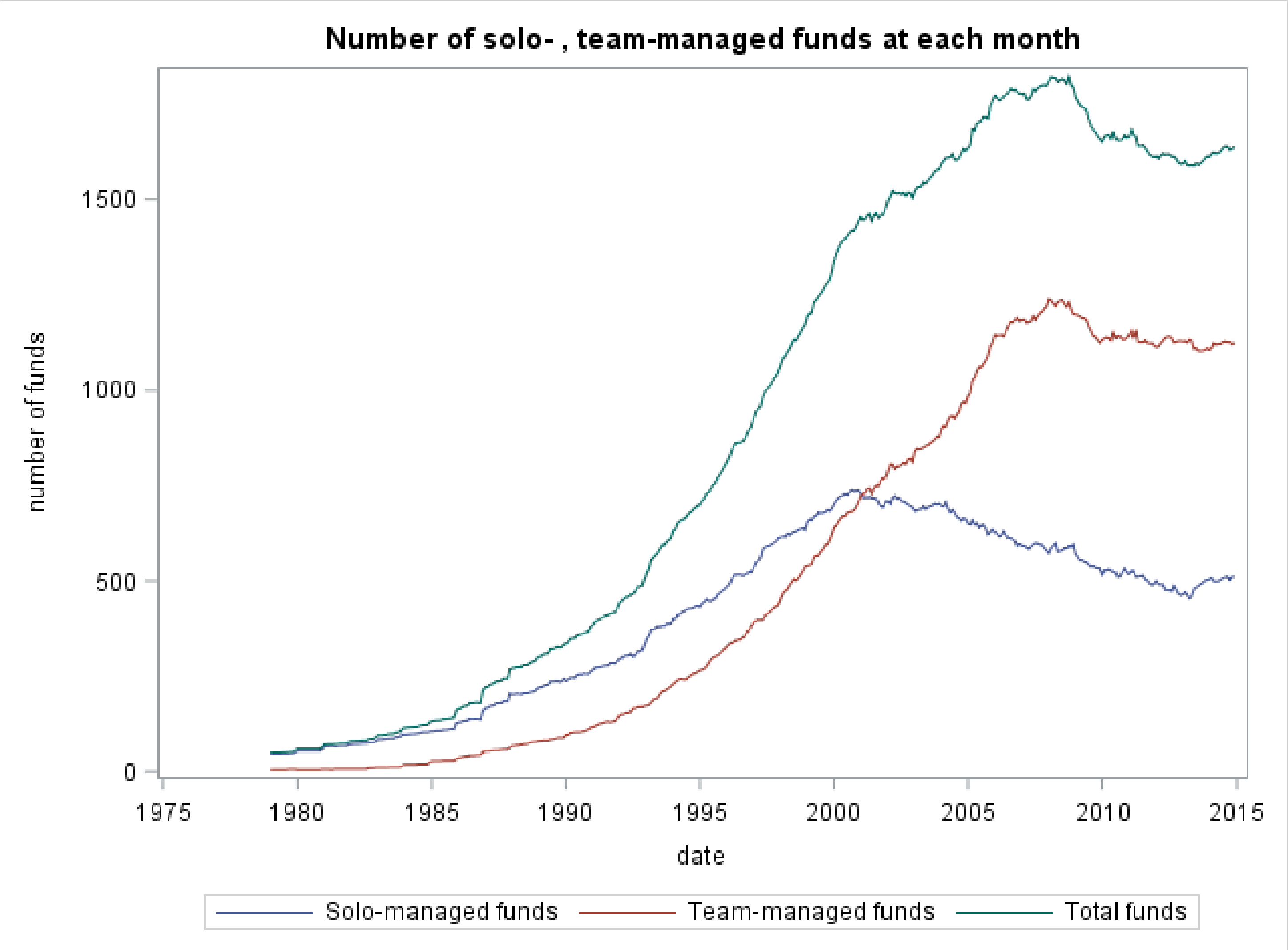
Variable	N	Mean	Std Dev	25th	Median	75th
Female	5,044	0.11	0.31	0	0	0
MBA	5,044	0.58	0.49	0	1	1
Master's	5,044	0.14	0.35	0	0	0
Ph.D.	5,044	0.04	0.20	0	0	0
CFA	5,033	0.58	0.49	0	1	1
YOB	3,503	1960.17	11.47	1954	1962	1969

Major	Mean	Std Dev
Finance_Accounting	33.3%	47.1%
Management	45.0%	49.8%
Economics	30.9%	46.2%
Engineering	6.3%	24.3%
Mathematics_Statistics	5.5%	22.9%
Physics	1.0%	9.7%
Computer science	2.4%	15.4%

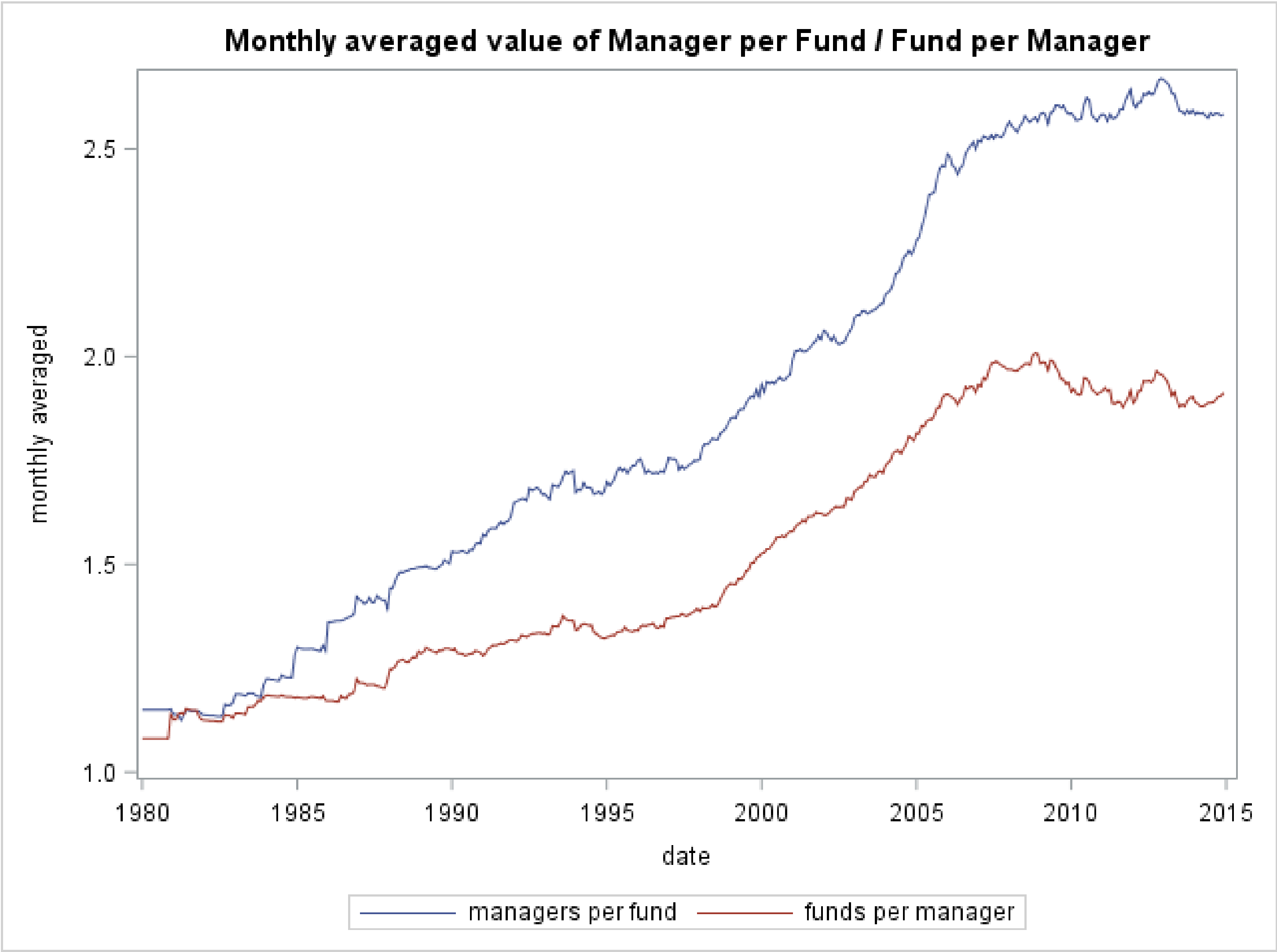
Top 10 Institutions

BA Inst.	#	%	MBA Inst.	#	%
U of Pennsylvania	140	2.78	Harvard U	231	7.92
U of Wisconsin-Madison	121	2.40	U of Chicago	231	7.92
Harvard U	102	2.02	U of Pennsylvania	220	7.55
Yale U	96	1.90	New York U	192	6.59
Princeton U	81	1.61	Columbia U	163	5.59
Stanford U	78	1.55	Stanford U	83	2.85
U of Virginia	72	1.43	Northwestern U	80	2.74
Dartmouth C	71	1.41	Dartmouth C	63	2.16
Boston C	61	1.21	U of Michigan	51	1.75
Brown U	59	1.17	UCLA	50	1.72
Total	5044			2915	

MA Inst.	#	%	PhD Inst.	#	%
U of Wisconsin-Madison	47	6.44	Harvard U	13	6.44
MIT	34	4.66	Stanford U	12	5.94
Columbia U	22	3.01	U of Chicago	10	4.95
New York U	22	3.01	U of Pennsylvania	8	3.96
Stanford U	21	2.88	Columbia U	7	3.47
Boston C	18	2.47	U of Virginia	7	3.47
Harvard U	17	2.33	MIT	6	2.97
U of Pennsylvania	16	2.19	Cornell U	5	2.48
U of Chicago	15	2.05	New York U	5	2.48
Johns Hopkins U	14	1.92	Princeton U	5	2.48
Total	730			202	



Number of solo- , team-managed funds at each month
number of funds
0
500
1000
1500
1975
1980
1985
1990
1995
2000
2005
2010
2015
date
Solo-managed funds
Team-managed funds
Total funds


Monthly averaged value of Manager per Fund / Fund per Manager
monthly averaged
2.5
2.0
1.5
1.0
1980
1985
1990
1995
2000
2005
2010
2015
date
managers per fund
funds per manager

Empirical method

- Test the significance of manager fixed effects in explaining fund performance.

  - Bertrand and Schoar (2003), Graham, Li, and Qiu (2012), Golubov, Yawson, and Zhang (2015), Bao and Edmans (2011), Cronqvist and Fahlenbrach (2009), Ewens and Rhodes-Kropf (2015) etc.

  - But only capture the time-invariant dimension of unobserved heterogeneity, not time-variant unobserved heterogeneity.

Fixed effect estimations

1. The spell fixed effects method
   - Create dummy for each unique combination of fund-manager.
   - Cannot separate fund vs. manager effects.
2. The mover dummy variable method
   - Moving managers only.
   - Endogenous movers; small sample.
3. The Abowd, Kramarz, and Margolis method
   - Estimate fixed effects for non-movers as well using connected sample.
   - Graham, Li, and Qiu (2012), Ewens and Rhodes-Kropf(2015), Huang and Wang (2015), Chemmanur, Ertugrul, and Krishnan (2017)

Issue: co-management

- However, the estimation is not straightforward in the context of mutual fund managers.

  - In previous studies, individuals have distinct outcome values.
    - Employees ↔ wages
    - Managers ↔ compensation

- However, individuals in our study have the same outcome values when managing the same fund.
  - Some studies do not consider the many-to-one matching seriously.
    - M&A advisors ↔ announcement returns
    - Large shareholders ↔ corporate policies

Attribution of funds' returns to managers

- How to attribute a fund's (common) performance to multiple managers?

- We cannot observe the actual contribution of individual managers' to fund performance.

- Different FE estimation methods make different assumptions about the underlying "attribution process."

The manager-month data (traditional)

- For manager i and fund j

$$y_{it} = \theta_i + \psi_{j=\mathbf{J}(i,t)} + \lambda_t + \varepsilon_{it}$$

$$Y = D\Theta + F\Psi + Z\Lambda + \epsilon$$

- θ_i, ψ_j, and λ_t are individual, firm, and time fixed effects
- $\mathbf{J}(i,t)$ indicates the firm of individual i at time t
- Y: $(N^* \times 1)$ vector of individuals' outcome values
  - $N^* = \sum_{i=1}^{N} T_i$, where T_i is # of periods of manager i.
- D: $(N^* \times N)$ matrix of indicators for N individuals
- F: $(N^* \times J)$ matrix of indicators for J firms
- Z: $(N^* \times T)$ matrix of indicators for T periods
  - T the total number of periods in the data.
- Each matrix (D, F, and Z) is full (column) rank

- We have a manager-month dataset.
- $y_{i_1 t} = y_{i_2 t} = \cdots = y_{i_m t}$ if managers $i_1, i_2, \ldots, i_m$ run the same fund during the same period.
- In later analyses, the standard errors of “fund” fixed effects will be underestimated for team-managed funds since these funds will have repeated values of performance.
- A manager fixed effect is simply the average of returns of all funds that the manager has run.

Assumptions about performance attribution

- Suppose the fund's performance (r_{jt}) is the weighted average of manager 1 & 2 performance:
$$r_{jt} = r_{1t}q_{1t} + r_{2t}(1 - q_{1t})$$
  - r_{kt} is the performance of manager k managing q_{kt} fraction of the fund's AUM $(k = 1, 2)$.
    - We assume that two managers run their own AUM or pick their stocks independently (i.e. $AUM_{1t} + AUM_{2t} = AUM_{jt}$).

  - If we assume that $r_{jt} = r_{1t} = r_{2t}$, we can employ the traditional FE estimation method, where two managers have their own outcome values (r_{jt}).

The fund-month data (new)

$$y_{jt} = \theta' + \psi_j + \lambda_t + \varepsilon_{jt}$$

$$Y^* = D^*\Theta^* + F^*\Psi^* + Z^*\Lambda^* + \epsilon^*$$

- θ': a vector of manager fixed effects for (potentially) multiple managers who operates fund j at time t
- Y^*: $(\widetilde{N} \times 1)$ vector of outcome values
    - $\widetilde{N} = \sum_{j=1}^{J} T'_j$, where T'_j is # of periods of fund j.
- D^*: $(\widetilde{N} \times N)$ matrix of indicators for N individuals
- F^*: $(\widetilde{N} \times J)$ matrix of indicators for J firms
- Z^*: $(\widetilde{N} \times T)$ matrix of indicators for T periods
- D^* is not necessarily of full rank

Assumptions about performance attribution

- Now we have a fund-month dataset.
- We do not assume $r_{jt} = r_{i_1 t} = \cdots = r_{i_m t}$, instead we split r_{jt} across i_m managers.
- When we do so, managers with longer tenure and/or stronger performance (when working alone) have greater fixed effects by being attributed with a bigger fraction of the fund performance.

An illustration: manager-months

$$
\begin{array}{cc}
\begin{array}{cccccccc} f1 & f2 & f3 & m1 & m2 & m3 & m4 & m5 \end{array} & t \\
\begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1
\end{pmatrix} &
\begin{array}{c} 1 \\ 2 \\ 1 \\ 2 \\ 3 \\ 3 \\ 1 \\ 2 \end{array}
\end{array}
$$

Transformation

$$
\begin{array}{cc}
\begin{matrix} f1 & f2 & f3 & m1 & m2 & m3 & m4 & m5 \end{matrix} & t \\
\begin{pmatrix}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
\cancel{1} & \cancel{0} & \cancel{0} & \cancel{0} & \cancel{0} & \cancel{1} & \cancel{0} & \cancel{0} \\
\cancel{1} & \cancel{0} & \cancel{0} & \cancel{0} & \cancel{1} & \cancel{0} & \cancel{0} & \cancel{0} \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
\cancel{0} & \cancel{1} & \cancel{0} & \cancel{0} & \cancel{1} & \cancel{0} & \cancel{0} & \cancel{0} \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1
\end{pmatrix} &
\begin{matrix} 1 \\ 2 \\ 1 \\ 2 \\ 3 \\ 3 \\ 1 \\ 2 \end{matrix}
\end{array}
$$

Fund-months data

$$
\begin{array}{cccccccc}
f1 & f2 & f3 & m1 & m2 & m3 & m4 & m5 \\
\end{array}
$$

$$
\left(\begin{array}{ccc|ccccc}
1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 \\
\hline
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
\hline
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 1
\end{array}\right)
$$

FE estimates

- Consider manager fixed effects only for brevity.
  - $\hat{\theta} = P^{-1}D^{*\prime}Y^{*}$, where $P \equiv D^{*\prime}D^{*}$ is assumed to be invertible.

$$P = \begin{bmatrix} p_{11} & \cdots & p_{1N} \\ \vdots & \ddots & \vdots \\ p_{N1} & \cdots & p_{NN} \end{bmatrix}$$ is symmetric & all entries are >0.

  - p_{lm} $(l \neq m)$ is the number of periods that manager l and m work at the same fund, and p_{ll} is the number of periods that manager l run funds during the entire sample period. Also, $\min(p_{ll}, p_{mm}) \geq p_{lm} \Rightarrow p_{ll}p_{mm} \geq p_{lm}^2$.

- Note that p_{lm} is not the number of calendar months. It is the number of event months, meaning, e.g., if l simultaneously manages two funds during 3 calendar months, then $p_{ll} = 6$.

Let $P^{-1} = \frac{adj(P)}{\det(P)} \equiv \begin{bmatrix} w_{11} & \cdots & w_{1N} \\ \vdots & \ddots & \vdots \\ w_{N1} & \cdots & w_{NN} \end{bmatrix}$

- Adjoint of P is symmetric and the diagonals are positive.
- The determinant of P is positive.

$$\hat{\theta} = P^{-1}D^{*\prime}Y^{*} = P^{-1}\begin{bmatrix} \sum_{j=1}^{J}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(1,t)\}}\right) \\ \vdots \\ \sum_{j=1}^{J}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(N,t)\}}\right) \end{bmatrix}$$

$$= \begin{bmatrix} \sum_{k=1}^{N}\left\{w_{1k}\sum_{j=1}^{J}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(k,t)\}}\right)\right\} \\ \vdots \\ \sum_{k=1}^{N}\left\{w_{Nk}\sum_{j=1}^{J}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(k,t)\}}\right)\right\} \end{bmatrix}$$

$$\hat{\theta}_i = \sum_{k=1}^{N}\left\{w_{ik}\sum_{j=1}^{J}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(k,t)\}}\right)\right\}$$

- $I_{\{j=\mathbf{J}(i,t)\}} = 1$ if manager i runs fund j in month t; 0 otherwise.

- If no manager shares the co-management period, the off-diagonal entries in matrix P is zeros. P is also invertible since the diagonal entries are positive.
  - $\hat{\theta}_i = \frac{1}{P_{ii}}\left(\sum_{j=1}^{J}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(k,t)\}}\right)\right)$, which is the average of performance of all funds that manager i managed during the entire sample period.

Example

Managers	Duration	Performance
1	T'_1	$\bar{r}_1 = \frac{1}{T'_1}\sum_{t=1}^{T_1} r_{1t}$
2	T'_2	$\bar{r}_2 = \frac{1}{T'_2}\sum_{t=1}^{T_2} r_{2t}$
1 & 2	T'_3	$\bar{r}_3 = \frac{1}{T'_3}\sum_{t=1}^{T_2} r_{3t}$

- Note that r_{jt} $(j = 1,2,3)$ is fund $j's$ performance in month t.
- $P = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} = \begin{bmatrix} T_1' + T_3' & T_3' \\ T_3' & T_2' + T_3' \end{bmatrix}$

$$\hat{\theta}^N = \begin{bmatrix} \sum_{k=1}^{N=2} \left\{ w_{1k} \sum_{j=1}^{J=3} \left(\sum_{t=1}^{T_j'} r_{jt} I_{\{j=\mathbf{J}(k,t)\}} \right) \right\} \\ \sum_{k=1}^{N=2} \left\{ w_{2k} \sum_{j=1}^{J=3} \left(\sum_{t=1}^{T_j'} r_{jt} I_{\{j=\mathbf{J}(k,t)\}} \right) \right\} \end{bmatrix}$$

$$= \begin{bmatrix} w_{11}(\bar{r}_1 + \bar{r}_3) + w_{12}(\bar{r}_2 + \bar{r}_3) \\ w_{21}(\bar{r}_1 + \bar{r}_3) + w_{22}(\bar{r}_2 + \bar{r}_3) \end{bmatrix}$$

$$= \begin{bmatrix} (1 - \lambda_2)\bar{r}_1 + \lambda_2(\bar{r}_3 - \bar{r}_2) \\ (1 - \lambda_1)\bar{r}_2 + \lambda_1(\bar{r}_3 - \bar{r}_1) \end{bmatrix}$$

- $P^{-1} = \begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \end{bmatrix} = \frac{1}{p_{11}p_{22} - p_{12}^2} \begin{bmatrix} p_{22} & -p_{12} \\ -p_{21} & p_{11} \end{bmatrix}$
- $\lambda_2 = \frac{T_2' T_3'}{T_1' T_2' + T_2' T_3' + T_1' T_3'}$ and $\lambda_1 = \frac{T_1' T_3'}{T_1' T_2' + T_2' T_3' + T_1' T_3'}$

- Compare these with the traditional FE estimates.

$$\hat{\theta}^T = \begin{bmatrix} \frac{1}{P_{11}}\left(\sum_{j=1}^{J=3}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(k,t)\}}\right)\right) \\ \frac{1}{P_{22}}\left(\sum_{j=1}^{J=3}\left(\sum_{t=1}^{T_j'} y_{jt} I_{\{j=\mathbf{J}(k,t)\}}\right)\right) \end{bmatrix}$$

$$= \begin{bmatrix} v_1\bar{r}_1 + (1-v_1)\bar{r}_3 \\ v_2\bar{r}_2 + (1-v_2)\bar{r}_3 \end{bmatrix}$$

- $P^{-1} = \begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \end{bmatrix} = \begin{bmatrix} 1/p_{11} & 0 \\ 0 & 1/p_{22} \end{bmatrix}$

- $v_1 = \frac{T_1'}{T_1'+T_3'}$ and $v_2 = \frac{T_2}{T_2+T_3}$

Traditional vs. New estimates

- The new estimates takes into account the presence of co-managers while the traditional estimates do not.
- The new estimates have the following properties: Ceteris paribus,
  - $T_i' \nearrow \Longrightarrow$ the weight on $\bar{r}_i \nearrow$
    - Her fixed effect puts greater weight on the returns of the fund she manages by herself.
  - $\bar{r}_i \nearrow \Longrightarrow \ \hat{\theta}_i \nearrow$ and $\hat{\theta}_{-i} \searrow$
    - The greater the return of the fund she manages alone, the greater is her fixed effect all other things equal.

$$\hat{\theta}^N = \begin{bmatrix} (1-\lambda_2)\bar{r}_1 + \lambda_2(\bar{r}_3 - \bar{r}_2) \\ (1-\lambda_1)\bar{r}_2 + \lambda_1(\bar{r}_3 - \bar{r}_1) \end{bmatrix}$$

Synergy

- In the two-manager example:

  - If $\bar{r}_3 > \max(\bar{r}_1, \bar{r}_2)$, then the co-managed return ($\bar{r}_3$) improves individual managers' fixed effects, i.e. $\hat{\theta}_i > \bar{r}_i$.
    - The two managers create synergy.
    - If $\bar{r}_3 < \min(\bar{r}_1, \bar{r}_2)$, $\hat{\theta}_i < \bar{r}_i$.

  - If $\bar{r}_3 = \rho\bar{r}_1 + (1-\rho)\bar{r}_2$ where $\rho \in [0,1]$, then

$$\hat{\theta}^N = \begin{bmatrix} (1-\lambda_2)\bar{r}_1 + \lambda_2\rho(\bar{r}_1 - \bar{r}_2) \\ (1-\lambda_1)\bar{r}_2 - \lambda_1(1-\rho)(\bar{r}_1 - \bar{r}_2) \end{bmatrix}$$

Multi-collinearity

- One issue with the new estimation approach is multicollinearity.

- We have to make sure the normal equation is solvable, i.e. $[D^* \; F^* \; Z^*]$ is full rank.

- We eliminate all columns and rows with multi-collinearity and create a matrix of independent vectors.

An algorithm for creating a matrix of independent vectors

- Let $\underset{\sim}{C} = [C_l]_{\widetilde{N}\times M} = [R_k]_{\widetilde{N}\times M} = [\ D^* \quad F^*\ ]_{\widetilde{N}\times M}$, where C_l is a $\widetilde{N} \times 1$ column vector, R_k is a $1 \times M$ row vector, and $M = N + J$.

- For $l = 1, \ldots,$ repeat until no column vector remains:
  1. Find a set of column vectors together with C_l create perfect collinearity, i.e. $C_l = \sum_{p \in L_l, p \neq l} C_p$, where L_l is a set of indices of column vectors correlated with C_l, including l itself.
  2. Drop row vectors, R_k ($k \in K_l$), where K_l is a set of indices of row vectors which have a value of one in column $p \in L_l$.
  3. Drop C_p's ($p \in L_l$).
- End for.

Estimation steps

1. Using fund and manager vectors, find (groups of) matrices of independent vectors.
2. Combine with a matrix of time vectors.
3. The matrix of fund vectors is perfectly collinear with the matrix of time vectors: drop one vector (use it as a reference vector)
4. Estimate fixed effects by including all dummy variables.
5. Perform *F*-test for dummy variables in the independent-vector matrix only.

FE estimation

- We present estimation results using both traditional and new approaches.

- Alternatively, we can estimate FE for solo-managed funds only.
  - However, this will reduce and distort information

FE estimates

Benchmark-adjusted gross return										
Model	Controls	F-test of	N	F Value	Pr > F	#Managers	#Funds	Obs	R2	Adj. R2
1	Time FE	Manager FE	5,624	1.98	<.0001	6,107	3,224	833,904	0.064	0.057
2	Time FE, Fund FE	Manager FE	4,623	1.31	<.0001	6,107	3,224	693,352	0.075	0.065
		Fund FE	2,453	2.23	<.0001	6,107	3,224	693,352	0.075	0.065
3	Time FE, Fund FE, Fund Char.	Manager FE	4,172	1.22	<.0001	6,107	3,224	556,096	0.080	0.068
		Fund FE	2,173	3.17	<.0001	6,107	3,224	556,096	0.080	0.068
Net return										
1	Time FE	Manager FE	5,670	2.10	<.0001	6,107	3,224	833,904	0.823	0.822
2	Time FE, Fund FE	Manager FE	4,624	1.41	<.0001	6,107	3,224	693,753	0.831	0.829
		Fund FE	2,456	2.20	<.0001	6,107	3,224	693,753	0.831	0.829
3	Time FE, Fund FE, Fund Char.	Manager FE	4,172	1.43	<.0001	6,107	3,224	556,096	0.844	0.842
		Fund FE	2,173	3.52	<.0001	6,107	3,224	556,096	0.844	0.842

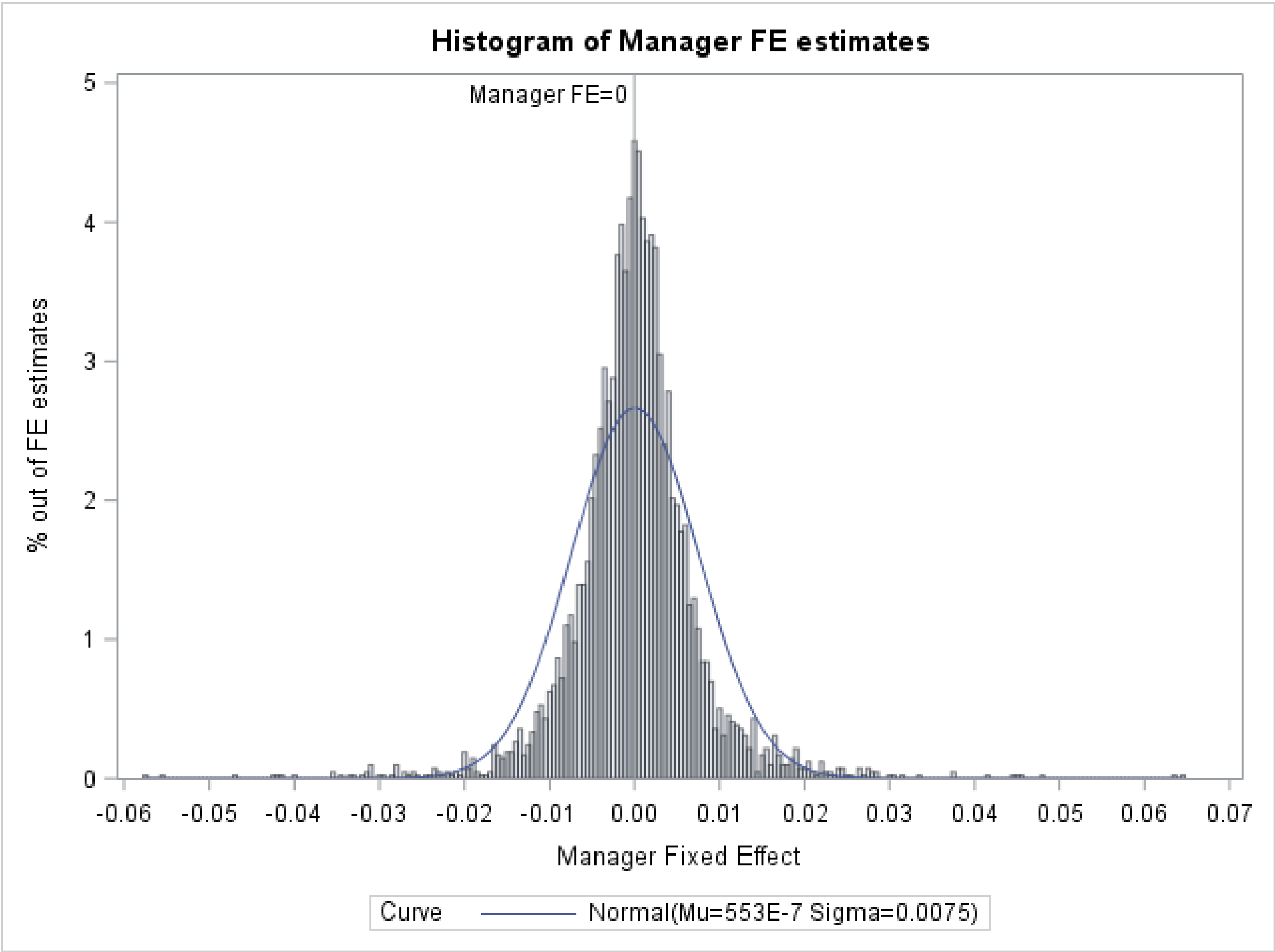
Benchmark-adjusted gross return							
Model (2)				Model (3)			
Group	#Funds	#Managers	Obs	Group	#Funds	#Managers	Obs
1	2,527	4,624	693,352	1	2,278	4,173	556,096
2	13	15	3,289	2	13	14	2,679
Net return							
1	2,529	4,683	693,753	1	2,278	4,173	556,096
2	13	15	3,289	2	13	14	2,679

- Characteristics: lags (expense ratio, log fund age, turnover ratio, log asset, log family asset, small cap dummy, monthly flow ratio, 24m return vol, fund level manager tenure)

Distribution of FE

Benchmark-adjusted gross return									
Model	FE	N	Range	Mean	Std	p25	p50	p75	Skewness
1	Manager	5,624	0.003	-0.001	0.003	-0.002	0.000	0.001	-0.779
2	Manager	4,623	0.004	-0.001	0.004	-0.003	-0.001	0.001	-0.358
	Fund	2,406	0.004	0.005	0.004	0.003	0.005	0.007	-0.136
3	Manager	4,172	0.004	-0.002	0.004	-0.004	-0.002	0.000	-0.368
	Fund	2,124	0.007	0.005	0.006	0.002	0.006	0.009	-0.262
Net return									
1	Manager	5,670	0.004	0.001	0.004	0.000	0.002	0.003	-0.613
2	Manager	4,624	0.005	0.002	0.006	-0.001	0.002	0.004	-0.954
	Fund	2,409	0.005	0.002	0.006	0.000	0.002	0.005	0.271
3	Manager	4,172	0.005	0.002	0.006	-0.001	0.002	0.004	-0.021
	Fund	2,124	0.009	0.003	0.008	-0.001	0.004	0.008	-0.456

Histogram of manager FEs



Robustness checks

1. Passively managed funds
2. Scrambled sample
3. Exclude twin funds/Combine twin funds
4. Include family fixed effects
5. Solo- and team-managed funds
6. Other performance measures (DGTW)

Passively managed funds

Benchmark-adjusted gross return										
Model	Controls	F-test of	N	F Value	Pr > F	#Managers	#Funds	Obs	R2	Adj. R2
1	Time FE	Manager FE	278	1.16	0.037	312	207	24,935	0.086	0.060
2	Time FE, Fund FE	Manager FE	238	0.85	0.950	312	207	24,935	0.092	0.060
		Fund FE	148	0.83	0.935	312	207	24,935	0.092	0.060
3	Time FE, Fund FE, Fund Char.	Manager FE	224	1.00	0.478	312	207	21,389	0.107	0.073
		Fund FE	147	1.40	0.001	312	207	21,389	0.107	0.073
Net return										
1	Time FE	Manager FE	280	1.14	0.052	315	213	26,834	0.915	0.913
2	Time FE, Fund FE	Manager FE	239	1.09	0.156	315	213	26,834	0.916	0.913
		Fund FE	154	1.43	0.000	315	213	26,834	0.916	0.913
3	Time FE, Fund FE, Fund Char.	Manager FE	224	1.00	0.506	315	213	21,389	0.925	0.922
		Fund FE	147	1.45	0.000	315	213	21,389	0.925	0.922

Scrambled sample - bootstrapping

- Following Fee, Hadlock, and Pierce (2013)
  - Random matches between managers and funds
  - Estimate manager fixed effects
  - Repeat 1,000 times and record F statistics
  - Compare the original F statistics against the simulated F statistics.

Model	Controls	0.10%	1%	10%	50%
1	Time FE	0.929	0.996	1.000	1.000
2	Time FE, Fund FE	0.931	0.988	1.000	1.000
3	Time FE, Fund FE, Fund Char.	0.582	0.893	0.987	1.000

  - Our result is unlikely to be a random outcome.
  - Endogenous matching between funds and managers (Jovanovic, 1979).

Managers vs. funds

- $R^2 = \dfrac{cov(y_{it}, X_{it}\widehat{\beta} + \widehat{\theta}_i + \widehat{\Psi}_j + \widehat{\lambda}_t)}{var(y_{it})}$

Benchmark-adjusted gross return						
Model	R2	Manager FE	Time FE	Fund FE	Fund Char.	N
1	0.074	0.024	0.050			378,146
2	0.081	0.019	0.050	0.012		378,146
3	0.087	0.021	0.049	0.017	0.000	294,009
1		31.9%	68.1%			
2		22.9%	62.0%	15.1%		
3		24.2%	55.5%	19.8%	0.4%	
Net return						
Model	R2	Manager FE	Time FE	Fund FE	Fund Char.	N
1	0.805	0.006	0.799			400,012
2	0.806	0.005	0.799	0.002		400,012
3	0.822	0.005	0.825	0.005	-0.012	294,052
1		0.7%	99.3%			
2		0.6%	99.1%	0.3%		
3		0.6%	100.4%	0.6%	-1.5%	

Manager characteristics and fixed effects

- Most variables (CFA, MA, Ph.D., sex, institution, majors, age etc.) are not robustly associated with manager fixed effects.
  - Quantitative science and MBA degree are marginally significantly related to manager FEs.
  - Important but unobservable time-invariant manager characteristics that cannot be explained by some observable characteristics exist.
  - The models in the previous studies may suffer from omitted variable bias.

Performance persistence

- Every year end, estimate manager fixed effect using the past t years.
- Form decile portfolios based on the estimated FEs.
- Keep track of the performance of each manager.

Benchmark-adjusted gross return				
Manager - Persistence				
Estimation		1 year	2 year	3 year
3 years	Spread	0.002	0.002	0.001
	T	3.300	3.710	3.420
4 years	Spread	0.002	0.002	0.002
	T	3.290	3.110	3.490
5 years	Spread	0.002	0.002	0.002
	T	3.180	3.530	3.630
Fund - Persistence				
Estimation		1 year	2 year	3 year
3 years	Spread	0.001	0.000	0.000
	T	1.370	0.810	0.500
4 years	Spread	0.001	0.000	0.000
	T	1.090	0.530	0.300
5 years	Spread	0.000	0.000	0.000
	T	0.640	0.120	0.260

Performance-flow relationship

- Estimate manager FE using the past 2 year data.
- Regress future flows on past manager FEs.
- Focus on departing and arriving managers. Otherwise, difficult to distinguish fund effects from manager effects on flows.

Departing managers						
Flow	Control	estimate	tvalue	probt	Nobs	R2
1m	All	0.43	0.40	0.69	1653.00	0.03
3m	All	2.43	1.60	0.11	1652.00	0.07
6m	All	3.30	1.24	0.22	1599.00	0.09
12m	All	-11.86	-0.41	0.68	1496.00	0.02

Arriving managers						
Flow	Control	estimate	tvalue	probt	Nobs	R2
1m	All	0.48	0.99	0.32	601.00	0.09
3m	All	1.12	1.33	0.18	596.00	0.13
6m	All	1.30	0.70	0.48	577.00	0.10
12m	All	0.08	0.02	0.98	532.00	0.15

Summary

- Document a significant effect of unobservable fund manager specific heterogeneity on fund performance
  - Design a new fixed-effect estimation method to accommodate team management practices.
- Manager fixed effects are more important than fund fixed effects in explaining the variation in fund performance.
- Performance persistence is significant at the manager level.
  - The strong persistence is due to investors' inability or reluctance to chase better-performing managers
  - Fund flows are not sensitive to managers' past performance.