Herding Behaviors and Mutual Fund Returns

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What is Herding?

- Herding is commonly defined as the similarities in trading of a group of market participants in Finance.

- Herding can be divided into three types:
  - caused by the similar information obtained(Herding like)
  - **caused by incomplete information**
  - **caused by lack of skills**

- The mainstream herding theory is mainly concentrated in two research areas:
  - Incomplete information(e.g. Banerjee, 1992)
  - Payment externalities(e.g. Scharfstein and Stein, 1992)

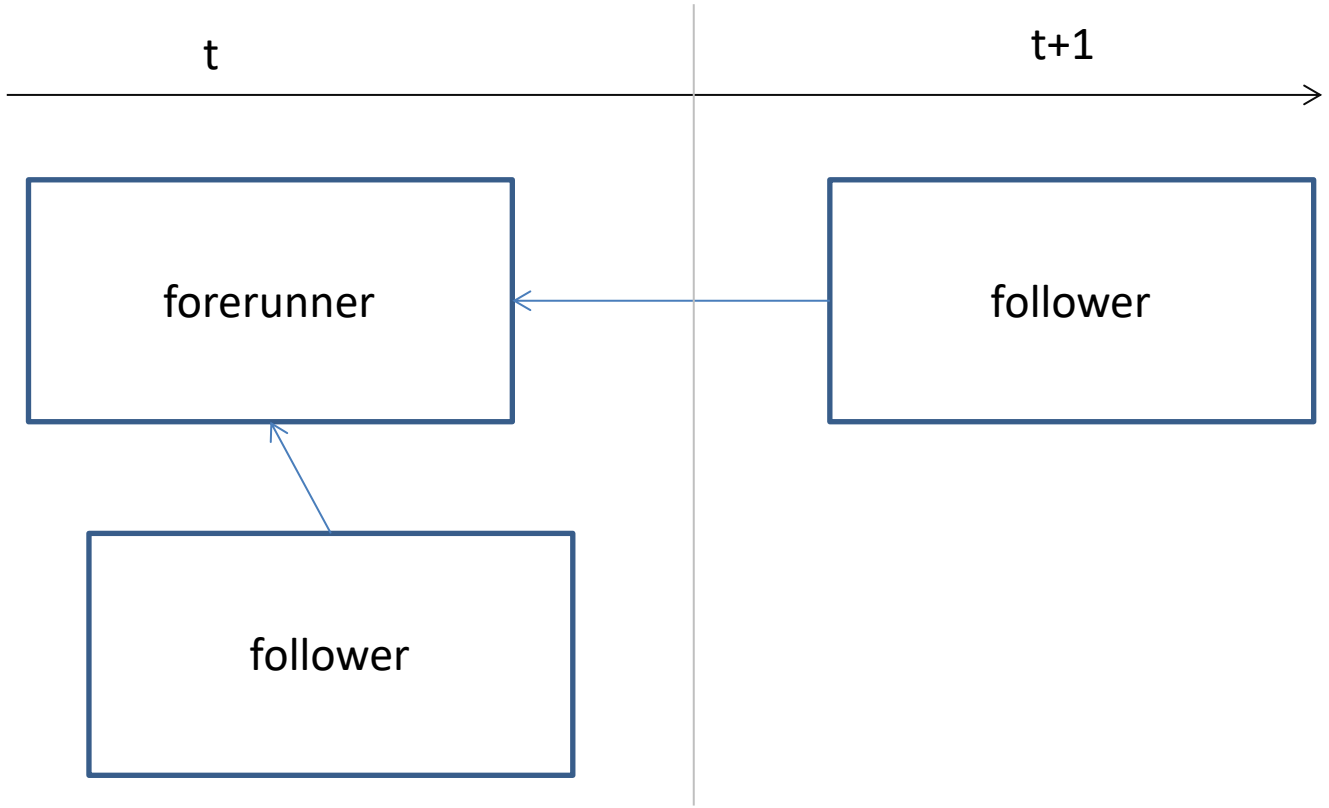
Why Herding?

- Mutual funds and other institutional investors tend to herd in their decisions(e.g. Lakonishok et al., 1992; Grinblatt et al.,1995)

- There are roughly six explanations for mutual funds herding (Choi and Sias , 2009)
  - positive-feedback trading
  - underlying investors' flows,
  - fads,
  - reputation,
  - Investigation,
  - information cascades.

The characteristics of herding

- Herding mainly includes two prominent characteristics:
  - the decision of the forerunner must be observed;
  - the decision-making behavior must occur in sequence



Previous measurement of herding

- LSV(Lakonishok, Andrei Shleifer, and Robert W. Vishny, 1992)
  - measures the average tendency of pension funds either to buy or to sell particular stocks at the same time

$$\mathrm{UHM}_{i,t} = |p_{i,t} - \bar{p}_t| - E|p_{i,t} - \bar{p}_t|$$

  - $p_{i,t}$ equals the proportion of funds trading in stock i during quarter t that are buyers

- FHM(Grinblatt et al., 1995)

$$\mathrm{SHM}_{i,t} = I_{i,t} \times \mathrm{UHM}_{i,t} - E[I_{i,t} \times \mathrm{UHM}_{i,t}]$$

$$\mathrm{FHM} = \frac{1}{120} \sum_{t=1}^{40} \sum_{i=1}^{3} \sum_{j=1}^{N} (\tilde{w}_{j,3t} - \tilde{w}_{j,3t-3}) \mathrm{SHM}_{j,3t-3+i}.$$

  - I = 1 if the fund trades "with the herd" in stock i during quarter t

Previous measurement of herding

- Quality(Cohen et al., 2005)
  - uses a covariance between funds' portfolio weight changes.

$$\bar{\delta}_n = \sum_{m=1}^{M} v_{m,n}\alpha_m, \qquad v_{m,n} = \frac{w_{m,n}}{\sum_{m=1}^{M} w_{m,n}}.$$

  - Alpha denotes the reference measure of skill for manager.

$$\hat{\delta}^{**} = C\hat{\alpha}, \qquad \mathrm{Cov}(\hat{\delta}^{**}, \hat{\delta}^{**\prime}) = C\Omega C',$$

Does Herding Behavior Reveal Skill? An Analysis of Mutual Fund Performance

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Background

- Herding caused by lack of skills, **underexplored feature of models**:
  - less skilled individuals may herd on the decisions of their predecessors,
  - those with superior ability may be more likely to deviate from past actions(exhibiting **antiherding** behavior).

- Mutual fund skills and returns.
  - Previous literature analyzes the returns and investment decisions of mutual fund managers to measure unobservable skill.(e.g. Kacperczyk and Seru (2007), Cremers and Petajisto (2009), Cohen, Polk, and Silli (2010))
  - How to measure skills?(return, **holdings**, fund manager, fund characteristics)

Motivation

- Ample evidence shows that mutual funds and other institutional investors tend to herd in their buying and selling decisions.

- Herding/ Antiherding can be reflected in mutual fund holdings, whlie holdings is a measure of mutual fund skills.

- **whether investors can identify skilled and unskilled mutual fund managers by observing their tendency to herd?**

Research Questions

- Whether differences in herding behavior across funds predict mutual fund performance?
- Whether skill drives the link between herding and future performance?
  - Whether antiherding funds consistently make better investment decisions than herding funds?
  - Is there time-series variation in the performance gap between herding and antiherding funds?
  - Is the performance gap between herding and antiherding funds persistent?
  - sequential information acquisition framework

- How do differences in skill lead to differences in herding behavior?
  - how skill interacts with career concerns to shape the response of mutual fund managers to reputational incentives.

Contributions

- Contribute to the literature on mutual fund performance.
  - the predictability of mutual fund performance uncovers herding behavior as a tool to capture mutual fund managers' skills.

- Contribute to the empirical literature on herding behavior.
  - create **a dynamic measure** of fund-level herding behavior
  - Previous studies estimate institutional herding using stock-level measures with a focus on their impact on stock prices.
  - shed new light on the dynamics of herding behavior over a manager's career cycle.

Data

- Sample: **actively managed U.S. equity funds** having at least 10 stock holdings from **1990 to 2009**, exclude index funds.

- eliminate balanced, bond, money market, sector, and international funds, as well as funds that do not primarily invest in U.S. common equity(Kacperczyk et al., 2008).

- eliminate observations prior to the reported fund inception date and funds whose net assets fall below $5 million(incubation bias).

- **2,255** distinct mutual funds; **56,116 fund-quarters** left.

Data

- Monthly fund returns and other fund characteristics from the CRSP Mutual Fund database.
- Fund stock holdings from the Thomson Reuters Mutual Fund Holdings database.

- Institutional investors' 13F filings from Thomson Reuters Institutional Holdings database.

- Stock price and return from the CRSP.
- Monthly stock files and accounting information from Compustat.

Variables: Fund Herding Measure

- Estimated at the fund level and captures the dynamic link between the decisions of a fund and the decisions made by the crowd in the past.

$$Trade_{i,j,t} = \alpha_{j,t} + \beta_{j,t}\Delta IO_{i,t-1} + \gamma_{1j,t}Mom_{i,t-1} + \gamma_{2j,t}MC_{i,t-1} + \gamma_{3j,t}BM_{i,t-1} + \varepsilon_{i,j,t}.$$

$$Trade_{i,j,t} = (N_{i,j,t} - N_{i,j,t-1})/\bar{N}_{i,j,t-1}.$$

$$\Delta IO_{i,t-1} = N_{i,t-1}/N^{out}_{i,t-1} - N_{i,t-2}/N^{out}_{i,t-2}.$$

- Trade: the percentage change in the number of split-adjusted shares of stock i in the portfolio of mutual fund j during quarter t
- IO: the change in the aggregate institutional ownership of stock i during quarter t − 1.

Variables: Fund Herding Measure

$$Trade_{i,j,t} = \alpha_{j,t} + \beta_{j,t}\Delta IO_{i,t-1} + \gamma_{1j,t}Mom_{i,t-1} + \gamma_{2j,t}MC_{i,t-1} + \gamma_{3j,t}BM_{i,t-1} + \varepsilon_{i,j,t}.$$

- The slope forms the building block of our measure of fund herding.
- **Novel**: control for commonalities in investment styles and institutional preferences.
- Fund-level herding, FH, captures the average tendency of a fund to follow past institutional trades.

$$FH_{j,t} = \frac{\sum_{h=1}^{t} \frac{1}{h}\beta_{j,t-h+1}}{\sum_{h=1}^{t} \frac{1}{h}}.$$

	Mean	Std. Dev.	5th Pctl	25th Pctl	Median	75th Pctl	95th Pctl
β	2.30	18.73	–27.84	–7.83	2.15	12.62	32.63
Fund Herding	2.42	7.12	–8.81	–1.51	2.35	6.39	13.86

Fund Herding and Future Performance

- Portfolio sort.
- Testing whether fund herding has predictive power for the cross section of mutual fund performance.
- Cross-sectional differences in fund herding can predict differences in mutual fund performance
- Fund herding is related to mutual fund skill.

FH rank	1	10	D10 – D1
FH	−0.104	0.152	0.256
Average	0.84	0.65	−0.19***
	(2.91)	(2.18)	(−3.37)
CAPM α	0.07	−0.14	−0.21***
	(1.07)	(−2.58)	(−3.71)
FF α	0.02	−0.15	−0.17***
	(0.31)	(−3.06)	(−3.26)
Carhart α	0.01	−0.14	−0.16***
	(0.20)	(−2.59)	(−2.93)
PS α	0.00	−0.14	−0.14***
	(0.02)	(−2.58)	(−2.67)
FS α	−0.02	−0.19	−0.17***
	(−0.34)	(−4.18)	(−3.18)

Fund Herding and Future Performance

- Predictive Regressions
- Fund herding reliably predicts mutual fund performance.
- the fund characteristics relate to future fund performance in a way that is consistent with previous findings.

	Four-Factor Net α $(t+1)$				Four-Factor Gross α $(t+1)$			
FH	−0.466***	−0.438***	−0.543***	−0.439***	−0.469***	−0.437***	−0.541***	−0.438***
	(−5.16)	(−4.83)	(−4.36)	(−4.84)	(−5.18)	(−4.82)	(−4.35)	(−4.82)
Size		−0.007**	−0.011**	−0.006*		−0.008**	−0.012***	−0.007**
		(−2.01)	(−2.37)	(−1.78)		(−2.41)	(−2.63)	(−2.17)
Age		0.015*	0.005	0.016*		0.016*	0.006	0.016*
AS			0.177***				0.180***	
			(3.89)				(3.97)	
RPI			0.061				0.063	
			(0.49)				(0.51)	
Similarity			0.087***				0.087***	
			(2.74)				(2.74)	
TE				1.577				1.646*
				(1.60)				(1.68)
Adj. R^2	0.060	0.062	0.092	0.062	0.060	0.061	0.092	0.061
N	167,854	160,067	81,759	159,588	167,854	160,067	81,759	159,588

Does Herding Behavior Reveal Skill?

- Revealing Skill through **Investment Choices.**
  - Differences in skill across funds should be reflected in different investment choices.
- Antiherding funds should consistently make better investment decisions.
- Test the future returns of the stocks held in the portfolios of funds characterized by different herding tendencies.
- Stock-level measure of fund herding:

$$S_{i,t}^{FH} = \sum_{j=1}^{J} w_{i,t}^{j} \left(- \frac{rank(FH_t^j) - \overline{rank(FH_t^j)}}{10} \right).$$

Does Herding Behavior Reveal Skill?

- Stocks that represent large bets by antiherding funds outperform stocks that are mostly held by herding funds.
- The performance differential between herding and antiherding funds is MORE likely to be driven by investment decisions related to unobservable skill.

S^{FH}	Low	2	3	4	High	High − Low
Average	0.93**	1.07***	0.92***	1.21***	1.42***	0.49***
	(2.48)	(3.30)	(2.80)	(3.56)	(3.95)	(3.03)
CAPM α	0.08	0.29**	0.15	0.42**	0.62***	0.54***
	(0.49)	(2.09)	(0.91)	(2.52)	(3.11)	(3.36)
FF α	–0.06	0.14	–0.01	0.20	0.39**	0.45***
	(–0.40)	(1.25)	(–0.05)	(1.53)	(2.36)	(2.83)
Carhart α	0.11	0.24**	0.10	0.31**	0.49***	0.38**
	(0.71)	(2.19)	(0.65)	(2.38)	(3.07)	(2.36)
PS α	–0.17	0.20	–0.05	0.16	0.30	0.47**
	(–0.98)	(1.43)	(–0.32)	(1.11)	(1.56)	(2.43)

Does Herding Behavior Reveal Skill?

- Time-Varying Opportunities and the Value of Skill.
  - the performance gap should increase in times of greater investment.
- Using 3 variables: average idiosyncratic volatility (IV), investor sentiment index (Sent), $CrossVol_t = \sqrt{\sum_{i=1}^{N} w_{i,t-1}(R_{i,t} - R_{m,t})^2}$,
- the performance gap is greater during and after periods of high investment opportunities.

	Dependent Variable: Four-Factor Net α					
Fund Herding	−0.529***	−0.535***	−0.480***	−0.459***	−0.416***	−0.419***
	(−4.76)	(−4.92)	(−4.67)	(−4.41)	(−4.70)	(−4.73)
FH × $CrossVol_t$	−0.322**					
	(−2.14)					
FH × $CrossVol_{t-1}$		−0.324**				
		(−2.51)				
FH × IV_t			−0.165*			
			(−1.88)			
FH × IV_{t-1}				−0.102		
				(−1.10)		
FH × $Sent_t$					−0.358***	
					(−2.64)	
FH × $Sent_{t-1}$						−0.276**
						(−2.15)

Does Herding Behavior Reveal Skill?

- Performance Persistence
  - if herding funds underperform due to bad luck, while antiherding funds are simply lucky
- Sort into 10 groups, L-S group's return.
- the performance gap related to herding is remarkably persistent.

	$K=6$	$K=9$	$K=12$	$K=15$	$K=18$	$K=21$	$K=24$
				Net Return			
Average	-0.15^{***}	-0.15^{***}	-0.15^{***}	-0.13^{**}	-0.13^{**}	-0.12^{*}	-0.10^{*}
	(–2.83)	(–3.04)	(–2.62)	(–2.14)	(–1.98)	(–1.88)	(–1.71)
CAPM α	-0.17^{***}	-0.17^{***}	-0.17^{***}	-0.15^{**}	-0.15^{**}	-0.13^{**}	-0.11^{**}
	(–3.15)	(–3.42)	(–2.99)	(–2.46)	(–2.29)	(–2.24)	(–2.14)
FF α	-0.13^{***}	-0.14^{***}	-0.13^{***}	-0.12^{***}	-0.12^{**}	-0.10^{**}	-0.09^{**}
	(–3.07)	(–3.59)	(–3.21)	(–2.60)	(–2.53)	(–2.56)	(–2.50)
Carhart α	-0.11^{***}	-0.12^{***}	-0.11^{***}	-0.09^{**}	-0.09^{**}	-0.08^{**}	-0.06^{**}
	(–2.67)	(–3.41)	(–3.00)	(–2.38)	(–2.35)	(–2.43)	(–2.36)
PS α	-0.10^{**}	-0.11^{***}	-0.10^{***}	-0.08^{**}	-0.08^{**}	-0.06^{**}	-0.05^{*}
	(–2.38)	(–2.98)	(–2.63)	(–2.04)	(–2.01)	(–2.02)	(–1.88)

Does Herding Behavior Reveal Skill?

- Anticipating the Actions of the Crowd
  - consider a gradual information acquisition framework
- investors who acquire information earlier than others are more likely to display antiherding behavior.
- antiherding funds can significantly predict aggregate institutional trades.

	Dependent Variable: $\Delta IO\ (t+1)$			Dependent Variable: $\Delta IO\ (t+1:t+4)$		
Trades of Antiherding Funds	1.120**	1.297**	1.140**	1.747*	2.257**	2.420**
	(2.07)	(2.38)	(2.15)	(1.83)	(2.54)	(2.38)
Trades of Herding Funds	0.177	0.033	0.068	−0.565	−0.899	−0.655
	(0.39)	(0.07)	(0.17)	(−0.71)	(−1.12)	(−0.83)
Lagged ΔIO			−0.300***			−0.289***
			(−11.95)			(−9.13)

Skill and Reputational Herding

- Building on Chevalier and Ellison (1999),
  - whether there is evidence of career concerns among the mutual fund,
  - whether herding might provide an incentive to attenuate such concerns.

- whether managers with stronger career concerns respond to these potential incentives to herd.

- the degree to which herding and antiherding choices reveal skill for managers experiencing different levels of career concerns.

- two measures of managerial experience:
  - general **experience**, defined as the number of years on the CRSP database;
  - fund-specific **tenure**, defined as the number of years during which a manager is employed in a given fund.

Skill and Reputational Herding

- less experienced managers face a higher probability of termination.
- managers have incentives to follow the crowd in order to decrease the probability of negative career outcomes.

	Dependent Variable: Termination			
Fund Herding	−0.075**	−0.080***	−0.074**	−0.079***
	(−2.49)	(−2.61)	(−2.46)	(−2.58)
	[−0.0035]	[−0.0037]	[−0.0034]	[−0.0037]
Experience	−0.183***	−0.187***		
	(−5.51)	(−5.57)		
	[−0.0081]	[−0.0086]		
Tenure			−0.144***	−0.145***
			(−4.41)	(−4.41)
			[−0.0066]	[−0.0067]
TE		−0.054*		−0.052*
		(−1.78)		(−1.70)
		[−0.0025]		[−0.0024]
Adj R^2	0.129	0.128	0.127	0.126
N	17,593	17,417	17,593	17,387

Skill and Reputational Herding

- the impact of herding is large among low-experience managers, whereas it is insignificant for high-experience managers.
- herding behavior might constitute a rational response to reputational incentives that vary over a manager's career.

Dependent Variable: Termination								
	Experience				Tenure			
	Low		High		Low		High	
FH	−0.106***	−0.106***	−0.028	−0.041	−0.105***	−0.104***	−0.049	−0.061
	(−2.92)	(−2.89)	(−0.56)	(−0.78)	(−2.65)	(−2.61)	(−1.03)	(−1.25)
	[−0.0062]	[−0.0061]	[−0.0011]	[−0.0017]	[−0.0057]	[−0.0056]	[−0.0022]	[−0.0028]
Experience	−0.230**	−0.239**	−0.122**	−0.119**				
	(−2.08)	(−2.14)	(−2.07)	(−1.99)				
	[−0.0133]	[−0.0138]	[−0.0049]	[−0.0048]				
Tenure					0.130	0.127	−0.159***	−0.147**
					(0.93)	(0.90)	(−2.78)	(−2.54)
					[0.0071]	[0.0069]	[−0.0071]	[−0.0067]
TE		−0.006		−0.141***		0.000		−0.109**
		(−0.15)		(−2.94)		(−0.01)		(−2.43)
		[−0.0004]		[−0.0058]		[0.0000]		[−0.0050]
Adj R^2	0.125	0.124	0.128	0.128	0.132	0.132	0.117	0.117
N	8,583	8,543	8,251	8,095	7,927	7,897	8,887	8,719

Skill and Reputational Herding

- less experienced managers are more likely to herd.
- models of reputational herding that predict stronger herding incentives for more career-concerned managers.

Dependent Variable: Fund Herding						
	Experience			Tenure		
Experience	−0.144**	−0.160**	−0.148**			
	(−2.29)	(−2.23)	(−2.21)			
Tenure				−0.158**	−0.135*	−0.163**
				(−2.43)	(−1.78)	(−2.22)
AS		−0.411***			−0.405***	
		(−4.11)			(−3.72)	
RPI		0.546***			0.559***	
		(7.67)			(7.51)	
Similarity		−0.137			−0.136	
		(−1.42)			(−1.46)	
TE			−0.199			−0.193
			(−1.59)			(−1.49)
Adj R^2	0.009	0.026	0.013	0.009	0.026	0.013
N	22,389	12,227	22,325	22,343	12,227	22,279

Skill and Reputational Herding

- differences in herding behavior predict large and significant differences in performance for funds with less experienced managers.
- differences in herding behavior reveal skill more strongly for inexperienced, career-concerned managers.

Panel A: General Experience

	Net Return					Four-Factor Net α				
FH	Low	2	3	High	High – Low	Low	2	3	High	High – Low
Experience										
Low	0.80	0.75	0.77	0.64	–0.16**	0.02	–0.06	–0.02	–0.16	–0.18**
	(2.46)	(2.27)	(2.35)	(1.92)	(–2.41)	(0.21)	(–0.89)	(–0.23)	(–2.29)	(–2.60)
Med	0.79	0.73	0.71	0.65	–0.14**	0.00	–0.07	–0.05	–0.11	–0.11*
	(2.50)	(2.28)	(2.16)	(1.96)	(–2.27)	(–0.02)	(–1.02)	(–0.70)	(–1.31)	(–1.90)
High	0.78	0.73	0.68	0.66	–0.12	–0.01	–0.06	–0.08	–0.12	–0.10
	(2.53)	(2.42)	(2.12)	(2.03)	(–1.47)	(–0.15)	(–0.90)	(–1.00)	(–1.50)	(–1.37)
High – Low	–0.02	–0.02	–0.10	0.02	0.05	–0.03	0.00	–0.06	0.05	0.08
	(–0.36)	(–0.32)	(–1.31)	(0.37)	(0.53)	(–0.47)	(–0.02)	(–0.86)	(0.72)	(0.83)

Robustness test

$$\begin{aligned}\Delta IO_{i,t} = {} & \gamma_{0t} + \gamma_{1t} Mom_{i,t} + \gamma_{2t} MC_{i,t} + \gamma_{3t} BM_{i,t} + \gamma_{4t} Turn_{i,t} + \gamma_{5t} IVol_{i,t} \\ & + \gamma_{6t} FRev_{i,t} + \gamma_{7t} Issue_{i,t} + \gamma_{8t} Spread_{i,t} + \gamma_{9t} Amihud_{i,t} \\ & + \sum_{k=1}^{9} \gamma_{9+k,t} IND_{i,t}^{k} + \varepsilon_{i,t},\end{aligned}$$

$$\begin{aligned}Trade_{i,j,t} = {} & \alpha_{j,t} + \beta_{j,t} \Delta IO_{i,t-1} + \gamma_{1j,t} Mom_{i,t-1} + \gamma_{2j,t} MC_{i,t-1} + \gamma_{3j,t} BM_{i,t-1} \\ & + \gamma_{4j,t} Trade_{i,j,t-1} + \varepsilon_{i,j,t}.\end{aligned}$$

$$CS_{t+1} = \sum_{i=1}^{N} w_{i,t} \left(R_{i,t+1} - R_{i,t+1}^{b} \right),$$

Do Investors Respond to Fund Herding?

- mutual fund investors do not respond aggressively to the information about future performance that is captured by our measure of fund herding.

Dependent Variable: Fund Flows		
Fund Herding	–0.033**	–0.019
	(–2.34)	(–1.58)
Size		–0.003***
		(–5.85)
Age		–0.009***
		(–7.58)
Expense		0.131
		(0.60)
Turnover		0.002
		(0.99)
Flow		0.192***
		(11.13)
Alpha		5.758***
		(19.67)
Adj R^2	0.010	0.084
N	55,595	53,002

Conclusion

- herding behavior strongly and negatively predicts the cross section of mutual fund returns.

- the negative association between fund herding and future performance is related to managerial skill.

- the performance gap between herding and antiherding funds is especially strong among inexperienced managers,
- herding and antiherding choices might be used to signal skill by managers with stronger career concerns.

Herd Behavior and Mutual Fund Performance

Andrew Koch

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Motivation

- Prior literature has distinguished informational from non-informational drivers of herding by examining the relation between herd behavior and subsequent returns.

- **Prior findings are mixed, and depend to some extent on methodology.**
  - some studies measure contemporaneous correlations, whereas others focus on cross-autocorrelations
  - studies of similarity in trading are generally conducted at the stock-level, whereas similarity in holdings is often measured at the fund-level

Research Questions

- A new method of herding **based on Euclidean geometry,** measuring herding by **correlated trading.**
  - Persistence.
  - how the cross sectional distributions of these measures relate to subsequent fund performance

- the relation between correlated trading and correlated holdings.
  - leaders, contemporaneous traders, and followers
  - how these measures of similarity in trading relate to measures of similarity in holdings.
  - understanding the interaction between similarity in trading with similarity in holdings may be informative regarding the motives generating herd behavior

Contributions

- Contributes by developing simple, novel, fund-level measures of similarities in portfolio decisions.
  - use a **novel framework based on Euclidean geometry** to measure multiple aspects of portfolio decisions at the fund-level.

- Analyse the managers' portfolio changing for each Adjacent period.
  - This is a type of correlated trading behavior that has received little attention in prior literature.

- Contributes to the literature of fund skills
  - the extent to which a fund's trades predict the trades of the aggregate mutual fund industry can be informative regarding the skill of the fund manager.

Data

- Sample: **1989-2009**, all funds having at least 10 stocks that are not identified as index funds per the index fund flag variable from CRSP.

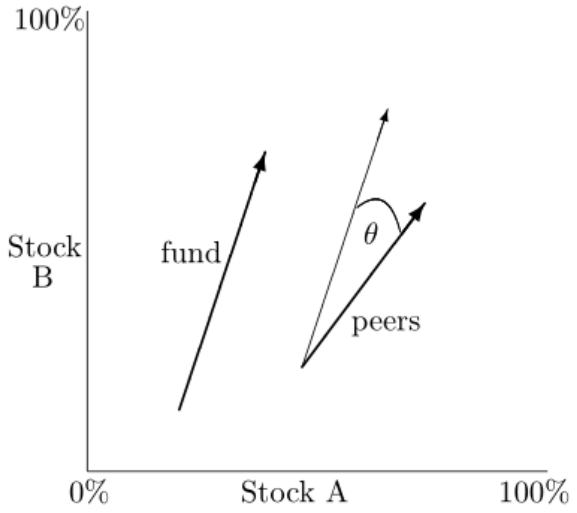
- exclude funds that do not report holdings in March, June, September, or December.

- quarterly mutual fund holdings data from Thomson Reuters
  - match with stock and mutual fund data from CRSP using MFLinks.
- fund characteristic, fund returns are obtained from CRSP.

- 2,694 funds left.

Methodology

- Each portfolio can be thought of as having a location in stock-space that is determined by its weights on stocks.
- A 3-security example of one fund and its peer portfolio.
  - The angle, θ, between the vector representing the change in the location of the fund and the vector representing the change in the location of peers, is the measure of similarity in trades



Methodology

- The vector of portfolio weights for fund f at quarter t is denoted **wf,t**
- the peer portfolio has portfolio weights denoted by the vector **hf,t** where each element equals the average portfolio weight among funds with non-zero weights (excluding fund f).

- Wf,t changes: $\Delta w_{f,t,i} = w_{f,t,i} - w_{f,t-1,i} * \frac{Ret_{t,i}}{\sum_i w_{f,t-1,i} * Ret_{i,t}}$,

- leaders, contemporaneous traders, and followers

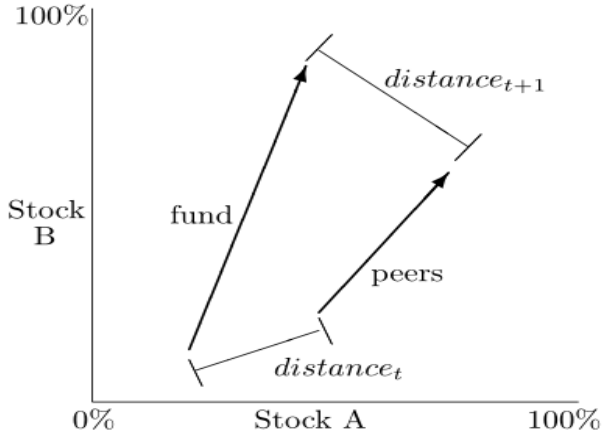
$$contemporaneous_{f,t} = \cos(\theta) = \frac{\Delta \mathbf{w}_{f,t} \bullet \Delta \mathbf{h}_{f,t}}{||\Delta \mathbf{w}_{f,t}|| \ ||\Delta \mathbf{h}_{f,t}||}.$$

$$, leading_{f,t} = \frac{\Delta \mathbf{w}_{f,t} \bullet \Delta \mathbf{h}_{f,t+1}}{||\Delta \mathbf{w}_{f,t}|| \ ||\Delta \mathbf{h}_{f,t+1}||}, \quad following_{f,t} = \frac{\Delta \mathbf{w}_{f,t} \bullet \Delta \mathbf{h}_{f,t-1}}{||\Delta \mathbf{w}_{f,t}|| \ ||\Delta \mathbf{h}_{f,t-1}||}.$$

the similarity in holdings

- The similarity in holdings levels is reflected in the distance between the location of the fund and the location of peers.
- The shorter the distance, the higher is the similarity portfolio weights. $distance_{f,t} = ||\mathbf{w}_{f,t} - \mathbf{h}_{f,t}||.$
- the extent to which the manager's portfolio changes cause the holdings to become more similar to peers.

$$convergence_{f,t} = 1 - \frac{||\mathbf{w}_{f,t} - \mathbf{h}_{f,t}||}{||\mathbf{w}'_{f,t} - \mathbf{h}_{f,t}||}.$$



The performance of leading, contemporaneous, and following funds

- There is no evidence of an association between following behavior and fund performance.
- The performance of leading is strong.

Panel A: $leading_{t-3,t}$	raw return	CAPM	Carhart	CPZ	CS
Quintile 1 (lowest)	0.22	-0.16***	-0.16***	-0.20***	-0.34***
	(0.74)	(-3.18)	(-3.39)	(-4.80)	(-7.90)
Quintile 5 (highest)	0.41	0.02	-0.02	-0.02	-0.23***
	(1.33)	(0.28)	(-0.40)	(-0.39)	(-4.49)
Quintile 5 - Quintile 1	0.18***	0.18***	0.14***	0.19***	0.11***
	(2.98)	(2.96)	(2.58)	(3.45)	(2.90)

Panel B: $contemp\text{-}oraneous_{t-3,t}$	raw return	CAPM	Carhart	CPZ	CS
Quintile 1 (lowest)	0.38	0.00	-0.04	-0.02	-0.26***
	(1.25)	(-0.06)	(-0.77)	(-0.49)	(-5.37)
Quintile 5 (highest)	0.27	-0.13*	-0.15**	-0.14**	-0.34***
	(0.85)	(-1.76)	(-2.31)	(-2.38)	(-5.49)
Quintile 5 - Quintile 1	-0.11	-0.12*	-0.11*	-0.12*	-0.08
	(-1.51)	(-1.66)	(-1.74)	(-1.77)	(-1.33)

Panel C: $following_{t-3,t}$	return	CAPM	Carhart	CPZ	CS
Quintile 1 (lowest)	0.34	-0.04	-0.06	-0.06	-0.28***
	(1.11)	(-0.64)	(-1.33)	(-1.58)	(-6.10)
Quintile 5 (highest)	0.33	-0.05	-0.09	-0.08	-0.27***
	(1.07)	(-0.68)	(-1.43)	(-1.59)	(-4.63)
Quintile 5 - Quintile 1	-0.01	-0.01	-0.03	-0.02	0.01
	(-0.10)	(-0.21)	(-0.57)	(-0.38)	(0.11)

The performance of leading, contemporaneous, and following funds

- leading behavior remains strongly statistically related to all four performance measures
- There is some evidence of significant underperformance of both contemporaneous and following funds, although this evidence is mixed.

	(1) CAPM_{t+2}	(2) Carhart_{t+2}	(3) CPZ_{t+2}	(4) CS_{t+2}	(5) CAPM_{t+1}	(6) Carhart_{t+1}	(7) CPZ_{t+1}	(8) CS_{t+1}	(9) CAPM_{t+1}	(10) Carhart_{t+1}	(11) CPZ_{t+1}	(12) CS_{t+1}
$leading_{t-3,t}$	0.0162***	0.0043***	0.0059***	0.0620***								
	(3.26)	(3.38)	(6.60)	(6.99)								
$contemporaneous_{t-3,t}$					-0.0085***	-0.0016	-0.0027	-0.0182				
					(-3.27)	(-0.70)	(-1.25)	(-0.58)				
$following_{t-3,t}$									0.0063*	-0.0057**	-0.0051**	0.0382
									(1.70)	(-2.14)	(-2.61)	(0.62)

Is leading distinct?

- leading behavior is distinct from fund-level measures of correlated trading in prior literature.

	(1) $CAPM_{t+2}$	(2) $Carhart_{t+2}$	(3) CPZ_{t+2}	(4) CS_{t+2}
$leading_{t-3,t}$	0.0191***	0.0065***	0.0080***	0.0710***
	(3.79)	(4.19)	(7.87)	(8.62)
$FHM_{t-3,t}$	-0.0635	-0.1410***	-0.1649***	-0.6060
	(-1.07)	(-2.77)	(-3.95)	(-1.20)
$\hat{\delta}^{**}_{m\ t-3,t}$	0.0944***	0.0837**	0.1089***	0.5123***
	(3.69)	(2.25)	(3.77)	(3.45)

	(1) $CAPM_{t+1}$	(2) $Carhart_{t+1}$	(3) CPZ_{t+1}	(4) CS_{t+1}
$distance_t$	0.0261***	0.0288***	0.0306***	0.2199***
	(5.05)	(5.67)	(5.42)	(3.22)
$activeshare_t$	0.0114	0.0052***	0.0143***	0.0342*
	(1.40)	(2.94)	(6.23)	(1.94)
ICI_t	-0.0344*	-0.0162**	-0.0177***	-0.0478
	(-1.75)	(-2.42)	(-3.86)	(-0.51)
$\hat{\delta}^{*}_{m,t}$	-0.3415***	-0.1091***	-0.0567*	-0.8061
	(-5.21)	(-3.04)	(-1.96)	(-0.90)

Similarity in trades and similarity in holdings levels

- contemporaneous and following managers are motivated by the incentive to maintain similar portfolio holdings levels.
- the evidence regarding leaders suggests these managers are informed, either directly about the future trades of peers, or about the signals on which peers ultimately rely.

	(1)	(2)	(3)	(4)	(5)	(6)
	$leading_{t+1,t+4}$		$contemporaneous_{t+1,t+4}$		$following_{t+1,t+4}$	
$distance_t$		-0.00		-0.17***		-0.03*
		(-0.05)		(-11.94)		(-1.75)
$convergence_t$		-0.01		0.09***		0.05***
		(-1.35)		(10.56)		(6.59)

Conclusion

- Managers whose trades lead the aggregate trades of mutual funds perform well multiple periods in the future.
- Contemporaneous traders and followers do not outperform, and if anything, they exhibit poor performance.

- Contemporaneous and following managers are motivated by the incentive to maintain similar portfolio holdings levels.
- In contrast, the evidence regarding leaders suggests these managers are informed, either directly about the future trades of peers, or about the signals on which peers ultimately rely.