THE PEER PERFORMANCE RATIOS OF HEDGE FUNDS

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PEER PERFORMANCE

- In general terms, peer performance is the performance of an entity (individual, firm, country, fund, forecasting rule) compared with the performance of a group of peer entities.
- Practitioner's approach: rank-based measure.
- Academic's approaches:
  - Comparison of fund returns with returns of peer funds*:*
    - *Relative alpha* (Jagannathan et al., 2010)*.*
    - *Peer alpha* (Hunter et al., 2014)*.*
  - Part of fund performance that cannot be explained by peers/factors:
    - *Distinctiveness* (Sun et al., 2012).
    - *Selectivity* (Amihud and Govenko, 2013).

DRAWBACKS OF RANK-BASED PEER PERFORMANCE

- If n funds have the same risk-adjusted performance, the rank based on the estimated performance is a random number between 1 and n.
- The distinction between top funds within the peer group and across peer groups may therefore be an unreliable signal of the fund's peer performance.

PEER PERFORMANCE RATIOS

– Ideally, we would like to measure **three** peer performance **ratios**:

  Equal-performance ratio π_i^0: percentage of funds in the peer universe with equal performance as the focal fund i.

  Outperformance ratio π_i^+: percentage of funds in the peer universe that are outperformed by the focal fund i.

  Underperformance ratio π_i^-: percentage of funds in the peer universe that outperform the focal fund i.

– But how to estimate those three parameters?

– What can we do with these parameters, from a practitioner & academic viewpoint?

OUR PAPER

Contribution **1**

We propose an approach for the estimation of these ratios.

Contribution **2**

We investigate the determinants of the peer performance of hedge funds.

- Life-cycle theory: Fund size reduces the peer performance (Berk and Green, 2004; Getmansky, 2012; Chen et al., 2004).
- Career hypothesis: Large funds with a short track record tend to underperform more than their peers with same fund size but longer track record (Graham, 1999; Boyson, 2010).

Contribution **3**

We analyze the informativeness of peer performance ratios when predicting future performance (economical & statistical viewpoints).

AGENDA

1. Constructing the ratios
2. Application to hedge funds
   a. How can we use it in practice?
   b. Are our hypotheses verified?
   c. Does it help forecasting performance?
3. Digest

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SETUP

– We have $n+1$ funds in the universe.

– $\widehat{\Delta}_{i-j}$ denotes estimate of the performance's difference Δ_{i-j} between the focal fund i and its peer j $(j = 1, \ldots, n; j \neq i)$.

– Typically:

$$\left(r_{i,t} - r_{j,t}\right) = \Delta_{i-j} + \boldsymbol{\beta}'_{i-j}\boldsymbol{f}_t + \epsilon_{i-j,t}$$

for $t = 1, \ldots, T$, where $r_{i,t}$ is the return of fund i at time t, $\boldsymbol{f}_t$ is the $(K \times 1)$ vector of risk factors at time t, $\boldsymbol{\beta}_{i-j}$ is $(K \times 1)$ vector of factor exposures and $\epsilon_{i-j,t}$ an error term.

– We use $\hat{\tau}_{i-j} \equiv \widehat{\Delta}_{i-j}/\widehat{se}_{i-j}$ as the test-statistic such that the higher the absolute value, the higher is the evidence against the H_0 of equal performance.

– Each test leads to a *p*-value, denoted by $\hat{p}_{i-j}$.

ESTIMATION STRATEGY

– Two-step estimator:
  1. Compute *p*-values of two sided tests of equal performance.
  2. Extrapolate π_i^0, π_i^+ and π_i^- from the obtained *p*-value distribution using FDR (Storey, 2002).

– Advantages:
  1. Parallel estimation possible:
     ➔ Computationally feasible.
  2. No need to have concurrent data for the whole universe:
     ➔ More power.

RATIOS

Built on the properties of the difference in distribution of *p*-values:

under H_0: *p*-values are uniformly distributed between 0 and 1.

under H_A: *p*-values are small.

– We can thus determine a threshold λ_i such that: *p*-values $\hat{p}_{i-j}$ corresponding to H_A are smaller than λ_i.

– The number of equal performing funds can be estimated as the number of *p*-values exceeding λ_i divided by $1 - \lambda_i$:

$$\hat{n}_i^0 \equiv min\left[\frac{\sum_{j \neq i} I\{\hat{p}_{i-j} \geq \lambda_i\}}{1-\lambda_i}, n\right].$$

– Then estimate $\hat{\pi}_i^0 \equiv \hat{n}_i^0 / n$.

– λ_i is obtained by bootstrap (Barras et al., 2010).

– Attribution rule “à la Barras” to determine $\hat{\pi}_i^+$ and $\hat{\pi}_i^-$.

AGENDA

1. Constructing the ratios
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   a. How can we use it in practice?
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DATA

- Dataset composed of hedge funds taken from the HFR database.
- Peer performance ratios and measures are computed on 39 samples of five years of net returns over the period 2000 to 2014.
- The peer group is defined as the set of hedge funds pursuing the same investment style (Equity Hedge, Event-Driven, Macro and Relative Value).
- Peer performance ratios are estimated using the alpha-differential in the 9-factor (Carhart, 1997 and Fung and Hsieh, 2004) model, using HAC standard errors.
- Research questions:

  How to use it in practice?

  Are our hypotheses verified?

  Can we use it to predict future performance?

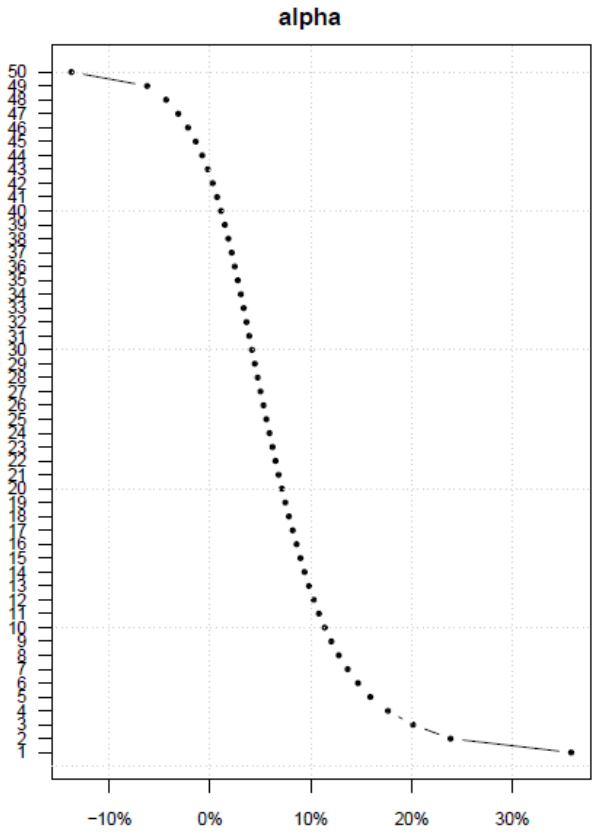
RANKING & PEER PERFORMANCE

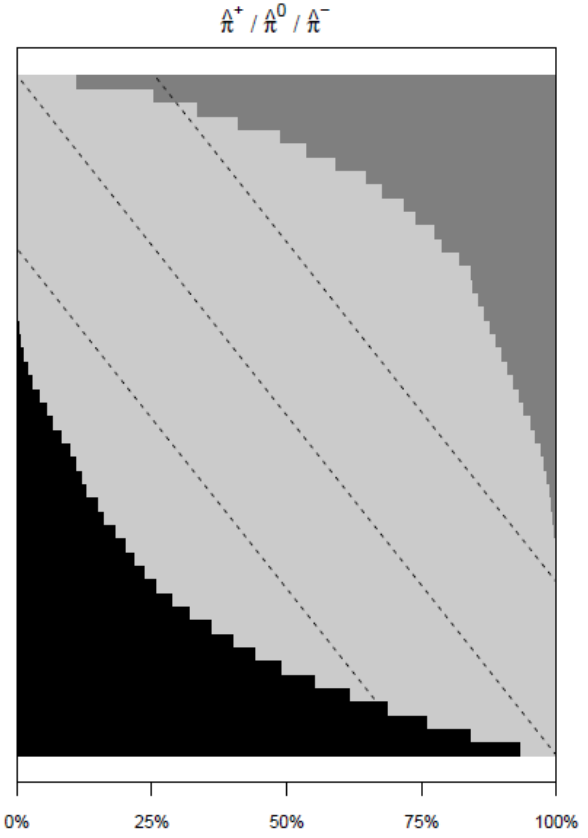
– Type a table a practitioners could use.

Fund	Strategy	Equity Hedge	Event-Driven	Macro	Relative Value
A	Relative Value	1[0.99;0.00]	1[1.00;0.00]	1[1.00;0.00]	1[1.00;0.00]
B	Equity Hedge	1[0.98;0.00]	1[1.00;0.00]	1[0.97;0.00]	2[0.94;0.00]
C	Macro	2[0.97;0.00]	1[1.00;0.00]	1[0.97;0.00]	2[0.93;0.00]
D	Relative Value	2[0.98;0.00]	1[1.00;0.00]	2[0.97;0.00]	2[0.95;0.00]
E	Equity Hedge	2[0.67;0.00]	1[0.09;0.00]	2[0.46;0.00]	3[0.00;0.00]
⋮	⋮	⋮	⋮	⋮	⋮
K	Equity Hedge	234[0.00;0.00]	94[0.00;0.00]	115[0.00;0.00]	158[0.00;0.00]
L	Equity Hedge	235[0.21;0.00]	94[0.00;0.26]	115[0.17;0.05]	158[0.00;0.38]
M	Equity Hedge	236[0.25;0.04]	94[0.00;0.26]	115[0.22;0.08]	158[0.00;0.37]
N	Equity Hedge	237[0.00;0.00]	94[0.00;0.00]	115[0.00;0.00]	158[0.00;0.08]
O	Event-Driven	238[0.30;0.06]	94[0.07;0.46]	115[0.24;0.13]	158[0.00;0.53]
⋮	⋮	⋮	⋮	⋮	⋮
V	Macro	616[0.00;0.98]	136[0.00;1.00]	254[0.00;0.99]	202[0.00;1.00]
W	Equity Hedge	616[0.00;0.99]	136[0.00;1.00]	255[0.00;0.98]	202[0.00;1.00]
X	Equity Hedge	617[0.00;0.99]	136[0.00;1.00]	255[0.00;0.99]	202[0.00;1.00]
Y	Equity Hedge	618[0.00;0.99]	136[0.00;1.00]	255[0.00;1.00]	202[0.00;1.00]
Z	Equity Hedge	619[0.00;0.99]	136[0.00;1.00]	255[0.00;1.00]	202[0.00;1.00]

DISTRIBUTION OF PEER PERFORMANCE

- Alpha and outperformance ratio are strongly positively dependent but the relationship is highly nonlinear.
- Middle performing funds out- or underperform a minority of their peers.

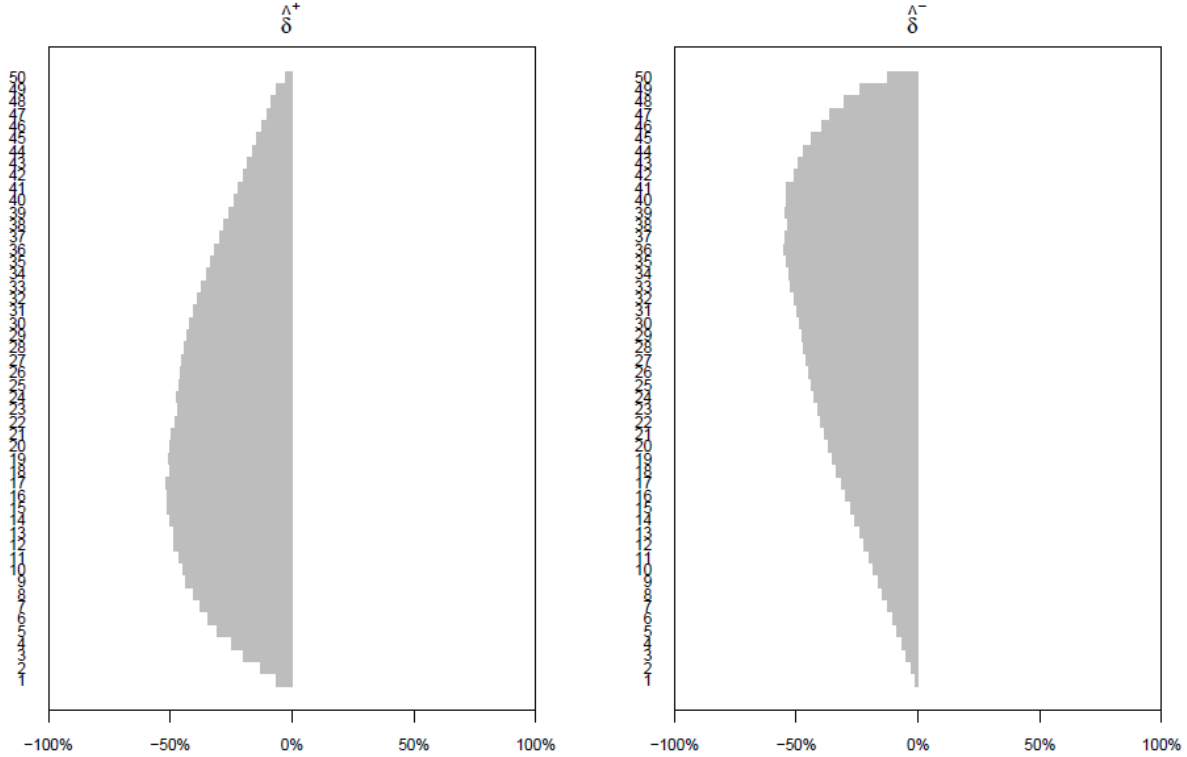




CORRECTION FOR LUCK

- Since equal-performance dominates, the usual ranking is thus too optimistic or pessimistic.
- Correction for luck should therefore be negative.

$$\hat{\delta}^{+} \equiv \hat{\pi}_i^{+} - \left(\frac{n-k+1}{n}\right) \qquad \hat{\delta}^{-} \equiv \hat{\pi}_i^{-} - \left(\frac{k-1}{n}\right)$$



EFFECTS OF FUND SIZE & AGE ON PEER PERFORMANCE

– We test our hypotheses in our longitudinal time series of quarterly updated peer performance ratios $\hat{\pi}^{+}_{i,q}$, $\hat{\pi}^{-}_{i,q}$ and $\hat{\pi}^{0}_{i,q}$, with $q = 1, \dots, 39$.
– The determinants of the peer performance ratios are analyzed through a nonlinear regression model.

$$\hat{\pi}_{i,q} = G\left(\beta_{0,q} + \beta_{1,q} LAUM_{i,q-1} + \beta_{2,q} AGE_{i,q-1} + \beta_{3,q} IT_{i,q-1} + \boldsymbol{\gamma}'_q \boldsymbol{CTRL}_i\right) + \epsilon_{i,q}$$

$G(\cdot)$ is the logistic function, $\boldsymbol{\gamma}_q$ is a (8×1) vector of parameter for the controls:

$$\boldsymbol{CTRL}_i \equiv (EH_i, MA_i, RV_i, MF_i, PF_i, LEV_i, HUR_i, HWM_i)'$$

FUND SIZE & AGE ON OUTPERFORMANCE

- In 79% of the samples the coefficient of fund size is significantly negative.
- Since the interaction effect between fund size and fund age is in 85% of the samples not significantly different from zero, we conclude that fund size leads to a deterioration in the outperformance ratio.

Panel A: Peer ratios computed with same strategy funds as peers

	$\widehat{\pi}^{+}$				$\widehat{\pi}^{-}$				$\widehat{\pi}^{0}$			
	$\overline{\beta}$	$\neq 0$	>0	<0	$\overline{\beta}$	$\neq 0$	>0	<0	$\overline{\beta}$	$\neq 0$	>0	<0
Constant	−1.93	100	0	100	−0.77	79	0	82	0.12	21	23	15
$LAUM_{q-1}$	−0.10	72	0	79	0.08	46	62	5	0.04	36	49	0
AGE_{q-1}	−0.04	28	0	36	0.07	92	97	0	−0.01	8	3	13
IT_{q-1}	0.00	15	15	0	−0.01	46	0	69	0.00	5	5	3
EH	−0.25	56	5	62	−0.44	85	0	85	0.48	82	85	0
MA	−0.65	54	0	59	−0.54	56	0	64	0.65	72	69	8
RV	0.08	31	23	18	−0.13	23	10	38	0.01	54	31	26
MF	38.37	79	87	0	−31.77	69	0	69	−3.71	13	3	28
PF	1.67	49	46	10	−1.69	41	0	51	0.03	8	8	8
LEV	−0.07	33	10	33	−0.01	5	0	10	0.05	23	21	3
HUR	0.11	33	31	10	0.11	3	13	0	−0.11	31	3	31
HWM	0.32	26	31	0	−0.21	26	0	38	0.02	0	0	0
Pseudo R^2		96.65				97.11				96.33		

FUND SIZE & AGE ON EQUAL-PERFORMANCE

– Fund size has a positive impact.

– Interaction is almost never significant.

➔ Empirical support to life-cycle theory: Because of decreasing returns of scale in active investment strategies, larger funds have less opportunities to outperform their smaller peers.

Panel A: Peer ratios computed with same strategy funds as peers

	$\widehat{\pi}^{+}$				$\widehat{\pi}^{-}$				$\widehat{\pi}^{0}$			
	$\overline{\beta}$	$\neq 0$	>0	<0	$\overline{\beta}$	$\neq 0$	>0	<0	$\overline{\beta}$	$\neq 0$	>0	<0
Constant	−1.93	100	0	100	−0.77	79	0	82	0.12	21	23	15
$LAUM_{q-1}$	−0.10	72	0	79	0.08	46	62	5	0.04	36	49	0
AGE_{q-1}	−0.04	28	0	36	0.07	92	97	0	−0.01	8	3	13
IT_{q-1}	0.00	15	15	0	−0.01	46	0	69	0.00	5	5	3
EH	−0.25	56	5	62	−0.44	85	0	85	0.48	82	85	0
MA	−0.65	54	0	59	−0.54	56	0	64	0.65	72	69	8
RV	0.08	31	23	18	−0.13	23	10	38	0.01	54	31	26
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LEV	−0.07	33	10	33	−0.01	5	0	10	0.05	23	21	3
HUR	0.11	33	31	10	0.11	3	13	0	−0.11	31	3	31
HWM	0.32	26	31	0	−0.21	26	0	38	0.02	0	0	0
Pseudo R^2		96.65				97.11				96.33		

FUND SIZE & AGE ON UNDERPERFORMANCE

– Effects of fund size and fund age are both significantly positive.

– Moreover, they interact negatively.

➔ Empirical support to carrier hypothesis: Large funds with a long track tend to underperform less than their younger peers with same fund size.

Panel A: Peer ratios computed with same strategy funds as peers

	$\widehat{\pi}^{+}$				$\widehat{\pi}^{-}$				$\widehat{\pi}^{0}$			
	$\overline{\beta}$	$\neq 0$	>0	<0	$\overline{\beta}$	$\neq 0$	>0	<0	$\overline{\beta}$	$\neq 0$	>0	<0
Constant	−1.93	100	0	100	−0.77	79	0	82	0.12	21	23	15
$LAUM_{q-1}$	−0.10	72	0	79	0.08	46	62	5	0.04	36	49	0
AGE_{q-1}	−0.04	28	0	36	0.07	92	97	0	−0.01	8	3	13
IT_{q-1}	0.00	15	15	0	−0.01	46	0	69	0.00	5	5	3
EH	−0.25	56	5	62	−0.44	85	0	85	0.48	82	85	0
MA	−0.65	54	0	59	−0.54	56	0	64	0.65	72	69	8
RV	0.08	31	23	18	−0.13	23	10	38	0.01	54	31	26
MF	38.37	79	87	0	−31.77	69	0	69	−3.71	13	3	28
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HUR	0.11	33	31	10	0.11	3	13	0	−0.11	31	3	31
HWM	0.32	26	31	0	−0.21	26	0	38	0.02	0	0	0
Pseudo R^2		96.65				97.11				96.33		

FUND SIZE & AGE ON PEER PERFORMANCE

- Effects are still observed but less strong with full universe of funds as peer group.
- Consistent with the view that controlling for investment style leads to more accurate proxies for the hedge fund managers' skill (Hunter et al., 2014).

PEER PERFORMANCE MEASURES

- We assess the economic gains of selecting funds based on the peer performance ratios compared with alternative (peer) performance measures.
- We measure the performance of quarterly rebalanced strategies which invest in the top quintile funds in terms of the various measures.
- We consider:
  1. Alpha of the nine-factor model.
  - Comparison of fund returns with returns of peer funds*:*
    2. Relative alpha (Jagannathan et al., 2010)*.*
    3. Peer alpha (Hunter et al., 2014)*.*
  - Part of fund performance that cannot be explained by peers/factors:
    4. Distinctiveness (Sun et al., 2012).
    5. Selectivity (Amihud and Govenko, 2013).
  6. Outperformance ratio.

CAPTURING THE SAME THING?

– Even thought the different measures claim a commonality in what they proxy (fund's talent), they are complementary in terms of what exactly is captured.

	$\widehat{\alpha}$	$\widehat{\alpha}^{\text{rel}}$	$\widehat{\alpha}^{\text{peer}}$	$\widehat{D}$	$\widehat{S}$	$\widehat{\pi}^{+}$	$\widehat{\pi}^{*+}$
$\widehat{\alpha}$		43.4	74.5	11.9	25.0	76.7	79.1
$\widehat{\alpha}^{\text{rel}}$	62.2		61.5	20.6	13.2	34.3	33.1
$\widehat{\alpha}^{\text{peer}}$	70.9	87.8		34.4	22.2	58.5	56.9
$\widehat{D}$	17.2	37.9	41.8		53.7	8.6	9.9
$\widehat{S}$	28.5	24.8	27.3	68.3		20.2	23.0
$\widehat{\pi}^{+}$	75.6	55.7	63.1	11.8	19.8		96.0
$\widehat{\pi}^{*+}$	77.4	54.7	62.1	14.6	22.5	87.1	

QUINTILE PORTFOLIOS PERFORMANCE

– The outperformance ratio is a valuable metric for fund selection.

		Equally-weighted portfolios				Value-weighted portfolios			
Criterion	Quintile	Mean	Std	Sharpe	Alpha	Mean	Std	Sharpe	Alpha
Panel A: Portfolio sorts using the outperformance ratio computed with same strategy funds as peers									
$\widehat{\pi}^{+}$	Bottom	5.30	11.63	0.46	0.16	3.22	9.20	0.35	−0.03
	Top	9.88	8.47	1.17	6.00***	7.29	7.97	0.91	4.10**

QUINTILE PORTFOLIOS PERFORMANCE

- Top quintile portfolio based on outperformance ratio has the best risk-adjusted performance of all portfolios considered.
- Distinctiveness and selectivity fail (maybe due to absolute nature of the measures).

		Equally-weighted portfolios				Value-weighted portfolios			
Criterion	Quintile	Mean	Std	Sharpe	Alpha	Mean	Std	Sharpe	Alpha
Panel A: Portfolio sorts using the outperformance ratio computed with same strategy funds as peers									
$\widehat{\pi}^{+}$	Bottom	5.30	11.63	0.46	0.16	3.22	9.20	0.35	−0.03
	Top	9.88	8.47	1.17	6.00^{***}	7.29	7.97	0.91	4.10^{**}
Panel B: Portfolio sorts using alternative indicators									
$\widehat{\alpha}$	Bottom	6.57	12.96	0.51	0.25	5.03	11.06	0.45	0.75
	Top	9.51	9.13	1.04	5.25^{**}	6.43	8.47	0.76	2.72
$\widehat{\alpha}^{rel}$	Bottom	6.68	12.67	0.53	0.57	6.09	10.52	0.58	1.70
	Top	8.95	8.66	1.03	5.25^{***}	6.91	8.45	0.82	4.08^{**}
$\widehat{\alpha}^{peer}$	Bottom	6.89	13.13	0.52	0.35	6.45	10.93	0.59	1.02
	Top	9.03	7.60	1.19	5.76^{***}	6.87	7.46	0.92	4.41^{**}
$\widehat{D}$	Bottom	9.00	14.34	0.63	2.29	8.68	11.53	0.75	3.65^{**}
	Top	4.53	2.47	1.84	3.85^{***}	2.45	3.53	0.69	1.29^{**}
$\widehat{S}$	Bottom	8.62	14.11	0.61	1.42	8.74	12.37	0.71	2.78^{**}
	Top	5.42	4.08	1.33	3.86^{***}	3.53	4.89	0.72	1.99^{*}

QUINTILE PORTFOLIOS PERFORMANCE

– What if we correct alternative measures for luck, using a two-pass ranking with the outperformance ratio?
– Leads to a significant increase in risk-adjusted performance.

Panel B: Portfolio sorts using alternative indicators									
$\widehat{\alpha}$	Bottom	6.57	12.96	0.51	0.25	5.03	11.06	0.45	0.75
	Top	9.51	9.13	1.04	5.25^{**}	6.43	8.47	0.76	2.72
$\widehat{\alpha}^{rel}$	Bottom	6.68	12.67	0.53	0.57	6.09	10.52	0.58	1.70
	Top	8.95	8.66	1.03	5.25^{***}	6.91	8.45	0.82	4.08^{**}
$\widehat{\alpha}^{peer}$	Bottom	6.89	13.13	0.52	0.35	6.45	10.93	0.59	1.02
	Top	9.03	7.60	1.19	5.76^{***}	6.87	7.46	0.92	4.41^{**}
$\widehat{D}$	Bottom	9.00	14.34	0.63	2.29	8.68	11.53	0.75	3.65^{**}
	Top	4.53	2.47	1.84	3.85^{***}	2.45	3.53	0.69	1.29^{**}
$\widehat{S}$	Bottom	8.62	14.11	0.61	1.42	8.74	12.37	0.71	2.78^{**}
	Top	5.42	4.08	1.33	3.86^{***}	3.53	4.89	0.72	1.99^{*}
Panel C: Portfolio sorts using the outperformance ratio, after sorting on the alternative indicators									
$\widehat{\pi}^{+} \mid \widehat{\alpha}$	Top	9.89	8.52	1.16	5.99^{***}	7.28	7.98	0.91	4.09^{**}
$\widehat{\pi}^{+} \mid \widehat{\alpha}^{rel}$	Top	9.54	7.85	1.22	5.79^{***}	6.57	7.78	0.84	3.45^{**}
$\widehat{\pi}^{+} \mid \widehat{\alpha}^{peer}$	Top	9.71	8.02	1.21	6.09^{***}	6.88	7.57	0.91	3.94^{**}
$\widehat{\pi}^{+} \mid \widehat{D}$	Top	6.84	3.89	1.76	5.21^{***}	5.09	5.53	0.92	3.50^{**}
$\widehat{\pi}^{+} \mid \widehat{S}$	Top	6.56	5.47	1.20	4.49^{***}	4.97	6.13	0.81	2.82^{**}

QUINTILE PORTFOLIOS PERFORMANCE

– Using the outperformance ratio computed with all funds as peers leads to a significant performance, but less pronounced.

Criterion	Quintile	Equally-weighted portfolios Mean	Std	Sharpe	Alpha	Value-weighted portfolios Mean	Std	Sharpe	Alpha
Panel A: Portfolio sorts using the outperformance ratio computed with same strategy funds as peers									
$\widehat{\pi}^{+}$	Bottom	5.30	11.63	0.46	0.16	3.22	9.20	0.35	−0.03
	Top	9.88	8.47	1.17	6.00***	7.29	7.97	0.91	4.10**
Panel D: Portfolio sorts using the outperformance ratio computed with all funds as peers									
$\widehat{\pi}^{*+}$	Bottom	6.15	11.84	0.52	0.60	4.78	9.37	0.51	1.18
	Top	9.25	8.21	1.13	5.43***	6.33	7.69	0.82	3.13*

MULTIVARIATE REGRESSION

– We control for other influences in the analysis of predictive power of the outperformance ratio for forecasting fund performance one quarter in the future.

$$R_{i,q} = \zeta_q + \beta_1 \hat{\pi}^{+}_{i,q-1} + \beta_2 \hat{\alpha}^{\text{rel}}_{i,q-1} + \beta_3 \hat{\alpha}^{\text{peer}}_{i,q-1} + \beta_4 IT^{\text{rel}}_{i,q-1} + \beta_5 IT^{\text{peer}}_{i,q-1} \quad + \boldsymbol{\gamma}' \boldsymbol{CTRL}_{i,q-1} + \epsilon_{i,q}$$

$$IT^{\text{rel/peer}}_{i,q-1} \equiv \hat{\alpha}^{\text{rel/peer}}_{i,q-1} \times \hat{\pi}^{+}_{i,q-1}$$

$$\boldsymbol{CTRL}_i \equiv (R_{i,q-1}, LAU_{i,q-1}, AGE_{i,q-1}, F_{i,q-1}, VOL_{i,q-1}, \ldots)'$$

MULTIVARIATE REGRESSION

- For all specifications, the outperformance ratio has a positive and significant predictive power.
- Forecasting performance is improved when including an interaction.
- Positive and significant effect of past returns and past volatility.
- Older and larger funds tend to have smaller returns.

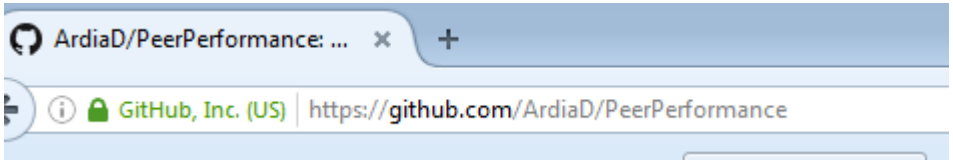
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\widehat{\pi}^{+}_{i,q-1}$		0.0075^{***}	0.0071^{***}	0.0056^{***}	0.0056^{***}	0.0061^{***}	0.0061^{***}
		(0.0015)	(0.0016)	(0.0018)	(0.0018)	(0.0017)	(0.0017)
$\widehat{\alpha}^{\text{rel}}_{i,q-1}$			0.0327		0	−0.0096	
			(0.0388)		(0.0464)	(0.0456)	
$\widehat{\alpha}^{\text{peer}}_{i,q-1}$				0.1259^{*}	0.1259		−0.0096
				(0.0694)	(0.0834)		(0.0456)
$IT^{\text{rel}}_{i,q-1}$						0.0021^{*}	
						(0.0011)	
$IT^{\text{peer}}_{i,q-1}$							0.0021^{*}
							(0.0011)
$R_{i,q-1}$	0.1102^{***}	0.1073^{***}	0.1069^{***}	0.1062^{***}	0.1062^{***}	0.1071^{***}	0.1071^{***}
	(0.0047)	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0048)

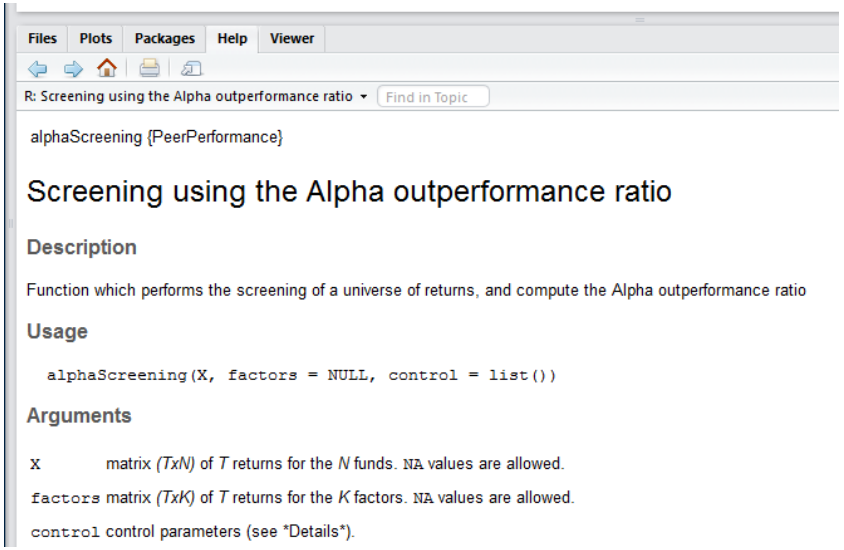
AGENDA

1. Constructing the ratios
2. Application to hedge funds
   a. How can we use it in practice?
   b. Are our hypotheses verified?
   c. Does it help forecasting performance?
3. Digest

DIGEST

- We define the peer performance ratios that characterizes for each fund the peer performance in three numbers: $\hat{\pi}_i^+$, $\hat{\pi}_i^-$ and $\hat{\pi}_i^0$.
- Find support for the life-cycle theory and the career hypothesis.
- Better out-of-sample performance of quintile portfolios constructed from the peer performance ratios.
- The R package PeerPerformance is available online.





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