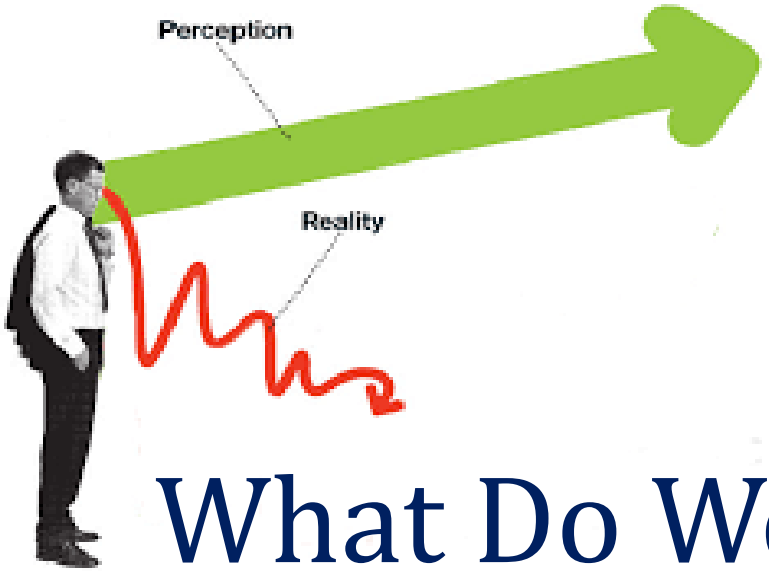


Università Commerciale
Luigi Bocconi

What Do We Know About Hedge Funds?

Prof. Massimo Guidolin

Fall 2018

Are Hedge Funds a Distinct Asset Class?

Figure 1: Mean of Portfolios of Stocks, Bonds and 20 Hedge Funds (A).

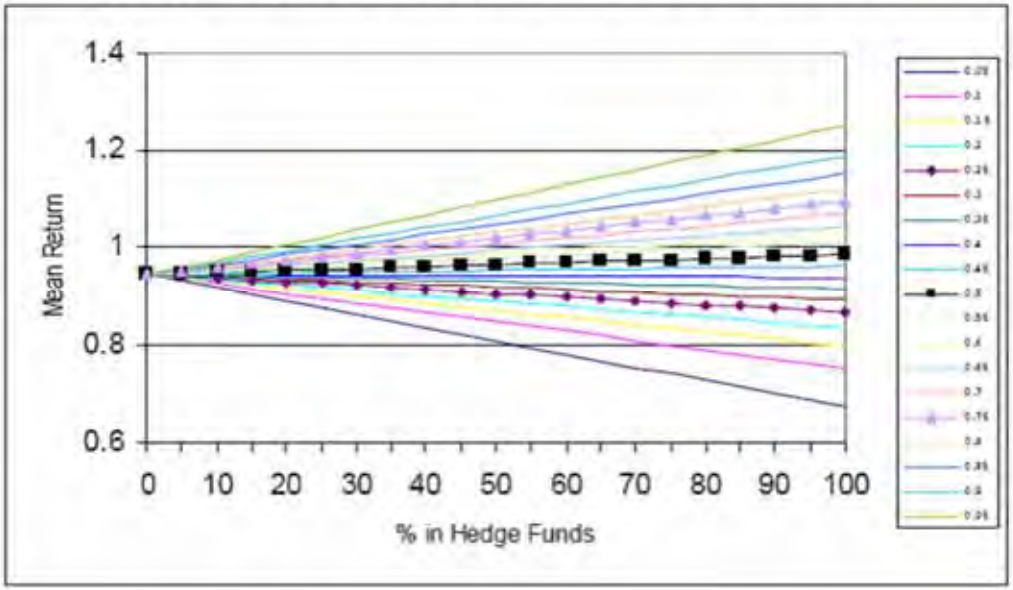


Figure 2: Standard Dev. of Portfolios of Stocks, Bonds and 20 Hedge Funds (A).

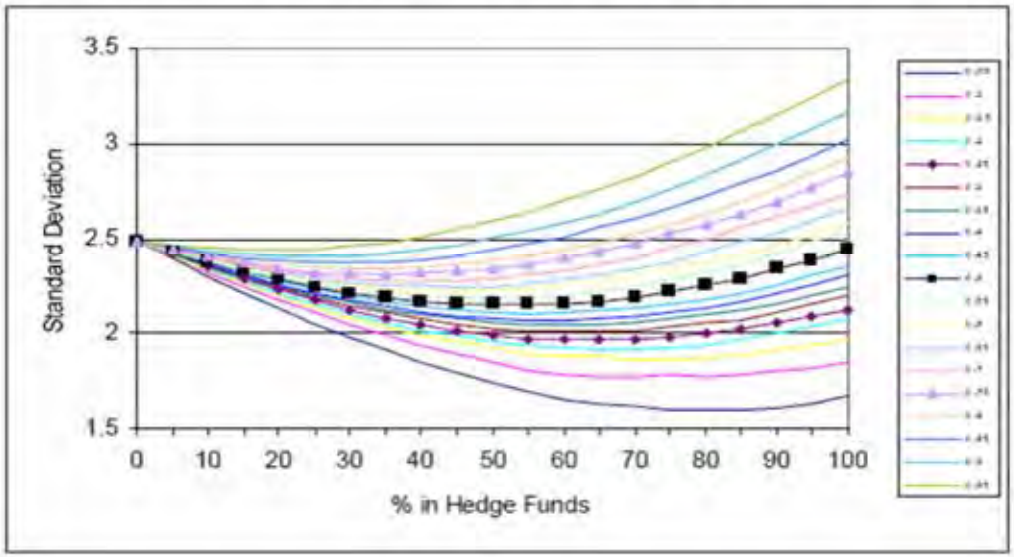


Figure 3: Skewness of Portfolios of Stocks, Bonds and 20 Hedge Funds (A).

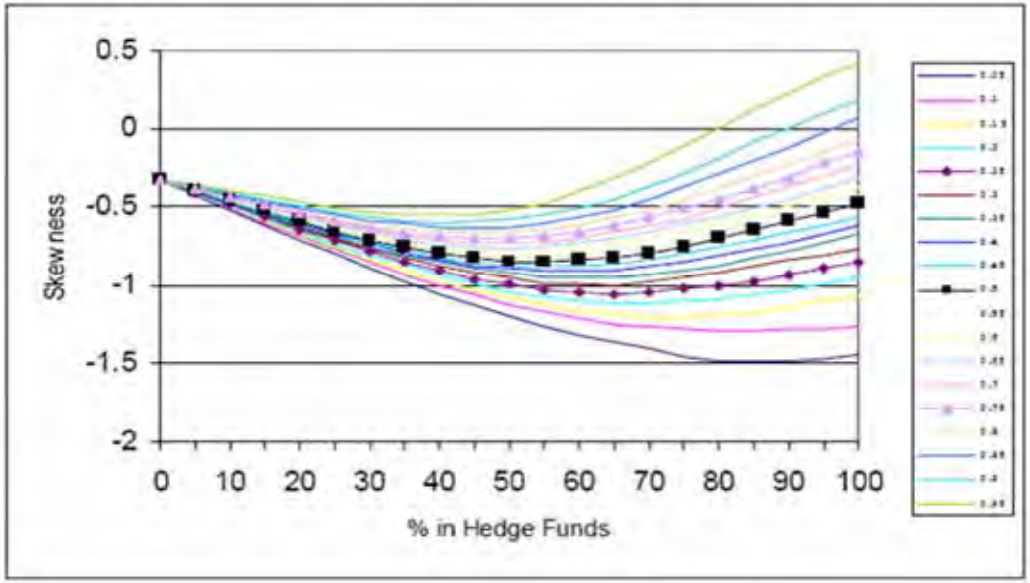
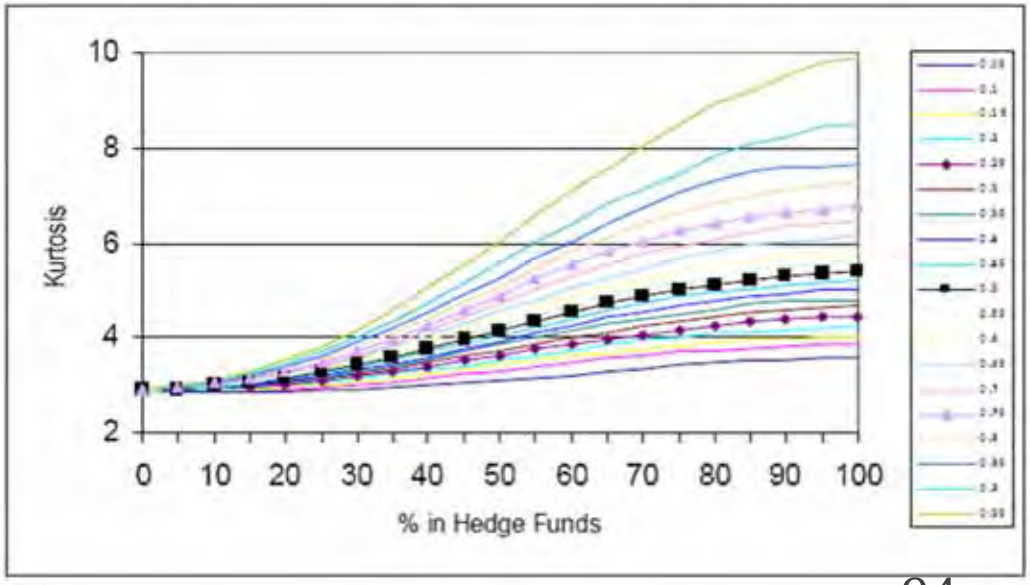


Figure 4: Kurtosis of Portfolios of Stocks, Bonds and 20 Hedge Funds (A).



Performance Measurement Issues

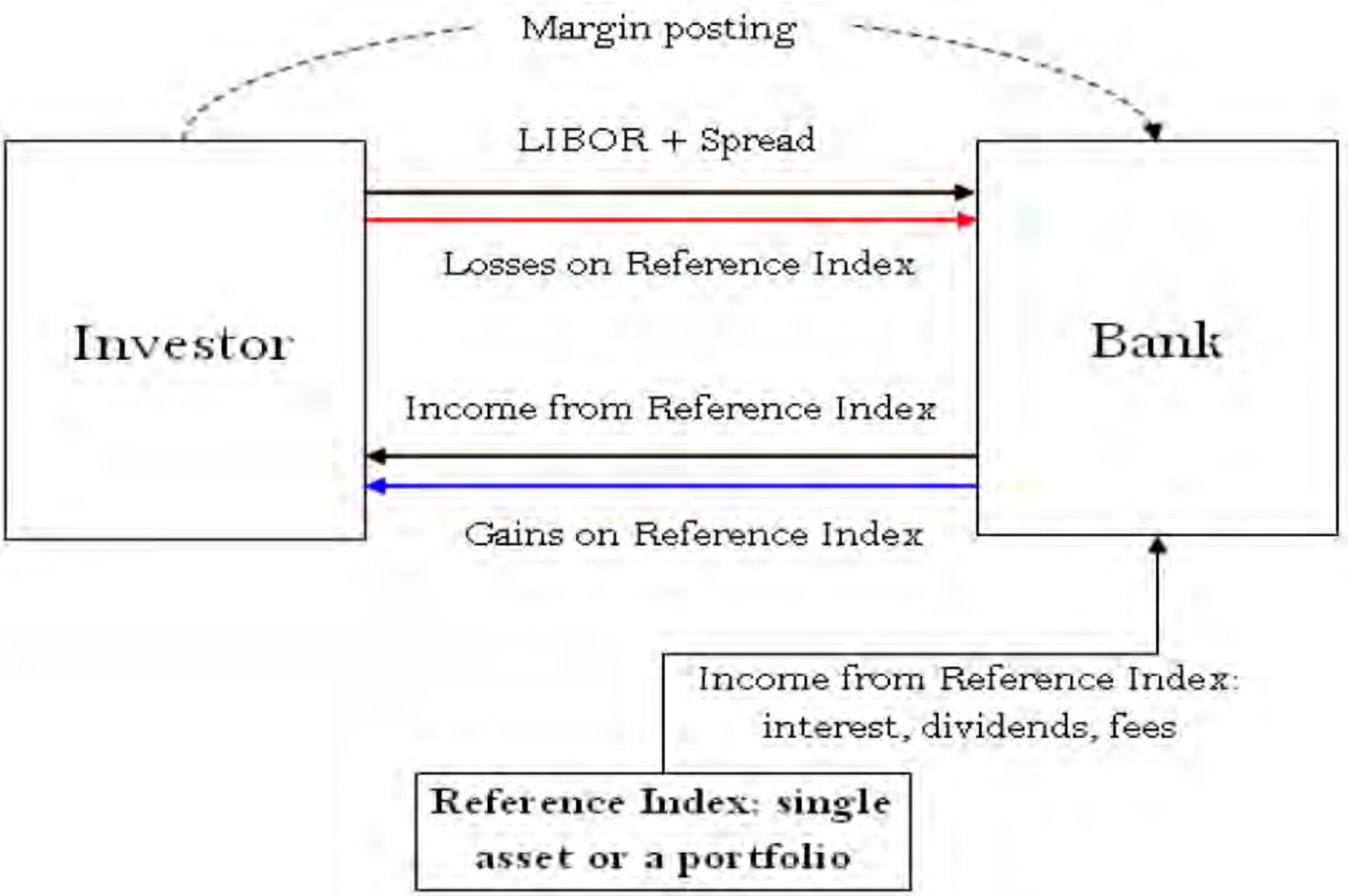
- The Sharpe ratio has a number of limitations however:
  - Time dependence, increases proportionally with square root of time
  - Not an appropriate measure of risk-adjusted performance when the investment has an asymmetrical return distribution, with either negative or positive skewness
  - Illiquid holdings bias the Sharpe ratio upward.
  - Overestimated when returns are serially correlated, which causes a lower estimate of the standard deviation; this occurs with certain HF strategies that may have a problem with stale pricing or illiquidity
  - Primarily a risk-adjusted performance measure for stand-alone investments and does not take into consideration the correlations with other assets in a portfolio.
  - Has not been found to have predictive ability for HFs: being a "winner" according to the Sharpe ratio over a past period cannot be relied on to predict future success
- The Sharpe ratio can be gamed, that is, increased without the investment really delivering higher risk-adjusted returns
- Spurgin (2001) shows the following ways to game the Sharpe ratio:

Performance Measurement Issues

1. Lengthening the measurement interval as this will result in a lower estimate of volatility
2. Compounding the monthly returns but calculating the standard deviation from the (not compounded) monthly returns
3. Writing out-of-the-money puts and calls on a portfolio as this strategy can potentially increase the return by collecting the option premium without paying off for several years
   - TASS reports that more than 50% of its 4,000 HFs use derivatives
- Similar to trading negative skewness for a greater Sharpe ratio

4. Smoothing of returns, as using certain derivative structures, infrequent marking to market of illiquid assets, and pricing models that understate monthly gains or losses can reduce volatility
5. Getting rid of extreme returns (best and worst monthly returns each year) that increase the standard deviation through a total-return swap: One pays the best and worst returns for one's benchmark index each year, and the counterparty pays a fixed cash flow and hedges the risk in the open market

Total Return Swap



Performance Measurement Issues

- Both the Sharpe ratio and the Jensen's alpha require that the ICAPM is valid or even a Gaussian distribution for HF returns
- Estimating alpha requires correct specification of a linear factor model—one way to extend the span of one or more factors from linear to non linear is to include put or call options on the factors
  - First problem, unclear which options, strikes, etc, should be included
  - Second, since a small number of calls and puts can be included, there is a limit to the range and type of non linearities that can be captured
- Amin and Kat (2003, JFQA) offer a method equivalent to constructing an option for every HF evaluated, with a payoff distribution fully determined by the empirically return distribution
  - When buying a HF, an investor buys a claim to a payoff distribution
  - We can re-create the payoff distribution that a HF offers his investors by means of a dynamic trading strategy of some sort and compare the cost of that strategy with the price of a fund participation
- If the manager in question indeed had superior skills, the strategy should be more expensive than the HF participation share

Performance Measurement Issues

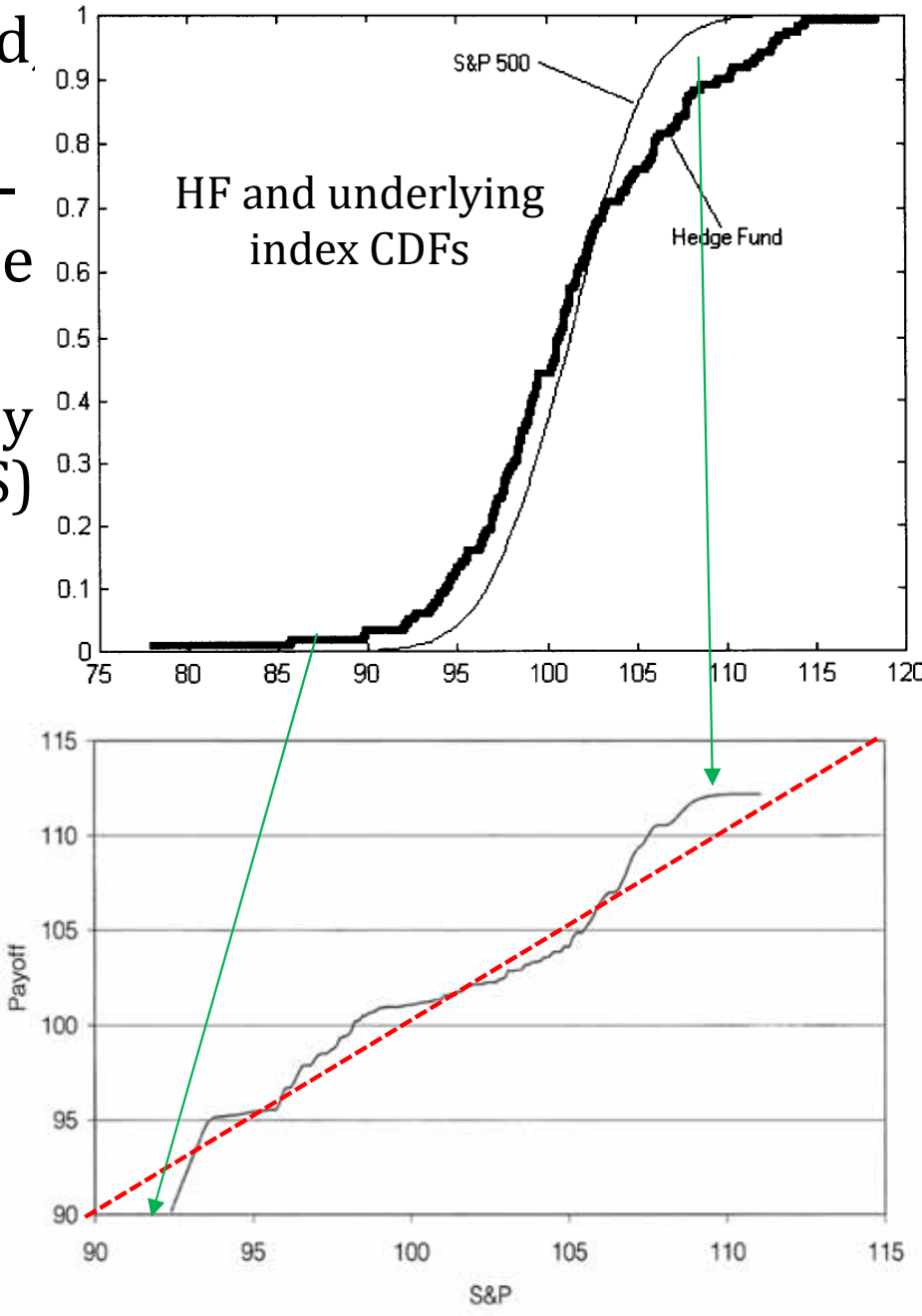
- Illiquidity can bias the statistical properties of HF returns
  - Using a MA model for illiquid HF returns, Getmansky, Lo, and Makarov (2004, JFE) show that standard estimators of volatility are biased downward, Sharpe ratios are biased upward, and the betas of regressions on lagged market factors are non-zero.
  - After correcting for the effects of smoothed returns, some of the most successful types of funds tend to have considerably less attractive
  - Lo (2001, FAJ) provides the appropriate correction for computing vols and Sharpe ratios, and shows that corrected ratios based on monthly data can differ from the standard SR
- Asness, Krail, and Liew (2001, JPM) show that HFs have small mkt beta when only contemporaneous returns are used as regressors

Fund	Start Date	T	$\hat{\mu}$ (%)	$\hat{\sigma}$ (%)	$\hat{\rho}_1$ (%)	$\hat{\rho}_2$ (%)	$\hat{\rho}_3$ (%)	p-Value of Q_{11} (%)	Monthly $\widehat{SR}$	Monthly SE_3	Annual $\sqrt{12}\widehat{SR}$	Annual $\widehat{SR}(12)$	Annual $SE_3(12)$	Annual $SE_6(12)$
Mutual funds														
Vanguard 500 Index	10/76	286	1.30	4.27	–4.0	–6.6	–4.9	64.5	0.21	0.06	**0.72**	**0.85**	0.26	0.25
Fidelity Magellan	1/67	402	1.73	6.23	12.4	–2.3	–0.4	28.6	0.21	0.06	**0.73**	**0.66**	0.20	0.21
Investment Company of America	1/63	450	1.17	4.01	1.8	–3.2	–4.5	80.2	0.19	0.05	**0.65**	**0.71**	0.22	0.22
Janus	3/70	364	1.52	4.75	10.5	–0.0	–3.7	58.1	0.23	0.06	**0.81**	**0.80**	0.17	0.17
Fidelity Contrafund	5/67	397	1.29	4.97	7.4	–2.5	–6.8	58.2	0.18	0.05	**0.61**	**0.67**	0.23	0.23
Washington Mutual Investors	1/63	450	1.13	4.09	–0.1	–7.2	–2.6	22.8	0.17	0.05	**0.60**	**0.65**	0.20	0.20
Janus Worldwide	1/92	102	1.81	4.36	11.4	3.4	–3.8	13.2	0.32	0.11	**1.12**	**1.29**	0.46	0.37
Fidelity Growth and Income	1/86	174	1.54	4.13	5.1	–1.6	–8.2	60.9	0.27	0.09	**0.95**	**1.18**	0.47	0.40
American Century Ultra	12/81	223	1.72	7.11	2.3	3.4	1.4	54.5	0.18	0.07	**0.64**	**0.71**	0.27	0.25
Growth Fund of America	7/64	431	1.18	5.35	8.5	–2.7	–4.1	45.4	0.14	0.05	**0.50**	**0.49**	0.19	0.20
Hedge funds														
Convertible/option arbitrage	5/92	104	1.63	0.97	42.6	29.0	21.4	0.0	1.26	0.28	**4.35**	**2.99**	1.04	1.11
Relative value	12/92	97	0.66	0.21	25.9	19.2	–2.1	4.5	1.17	0.17	**4.06**	**3.38**	1.16	1.07
Mortgage-backed securities	1/93	96	1.33	0.79	42.0	22.1	16.7	0.1	1.16	0.24	**4.03**	**2.44**	0.53	0.54
High-yield debt	6/94	79	1.30	0.87	33.7	21.8	13.1	5.2	1.02	0.27	**3.54**	**2.25**	0.74	0.72
Risk arbitrage A	7/93	90	1.06	0.69	–4.9	–10.8	6.9	30.6	0.94	0.20	**3.25**	**3.83**	0.87	0.85
Long–short equities	7/89	138	1.18	0.83	–20.2	24.6	8.7	0.1	0.92	0.06	**3.19**	**2.32**	0.35	0.37
Multistrategy A	1/95	72	1.08	0.75	48.9	23.4	3.3	0.3	0.89	0.40	**3.09**	**2.18**	1.14	1.19
Risk arbitrage B	11/94	74	0.90	0.77	–4.9	2.5	–8.3	96.1	0.63	0.14	**2.17**	**2.47**	0.79	0.77
Convertible arbitrage A	9/92	100	1.38	1.60	33.8	30.8	7.9	0.8	0.60	0.18	**2.08**	**1.43**	0.44	0.45
Convertible arbitrage B	7/94	78	0.78	0.62	32.4	9.7	–4.5	23.4	0.60	0.18	**2.06**	**1.67**	0.68	0.62
Multistrategy B	6/89	139	1.34	1.63	49.0	24.6	10.6	0.0	0.57	0.16	**1.96**	**1.17**	0.25	0.25
Fund of funds	10/94	75	1.68	2.29	29.7	21.1	0.9	23.4	0.56	0.19	**1.93**	**1.39**	0.67	0.70

Note: For the mutual fund sample, monthly total returns from various start dates through June 2000; for the hedge fund sample, various start dates through December 2000. The term $\hat{\rho}_k$ denotes the kth autocorrelation coefficient, and Q_{11} denotes the Ljung–Box Q-statistic, which is asymptotically χ^2_{11} under the null hypothesis of no serial correlation. $\widehat{SR}$ denotes the usual Sharpe ratio estimator, $(\hat{\mu} - R_f)/\hat{\sigma}$, which is based on monthly data; R_f is assumed to be 5/12 percent per month; and $\widehat{SR}(12)$ denotes the annual Sharpe ratio estimator that takes into account serial correlation in monthly returns. All standard errors are based on GMM estimators using the Newey–West (1982) procedure with truncation lag $m = 3$ for entries in the SE_3 and $SE_3(12)$ columns and $m = 6$ for entries in the $SE_6(12)$ column.

Performance Measurement Issues

- Assuming a Black and Scholes' world determine the cost of the cheapest dynamic strategy, trading some reference index and cash, generating the same payoff distribution as the HF
  - Existence guaranteed in BS world by results in Dybvig (1988a,b, JoB, RFS)
- This method eliminates the normality restriction since by dynamically trading the index and cash, we are not only able to replicate the HF st. dev. but also its higher moments
- If fund returns are normally distributed, the efficiency test collapses the Sharpe ratio as, in that case, given a normally distributed index, no dynamic trading is required



Performance Measurement Issues

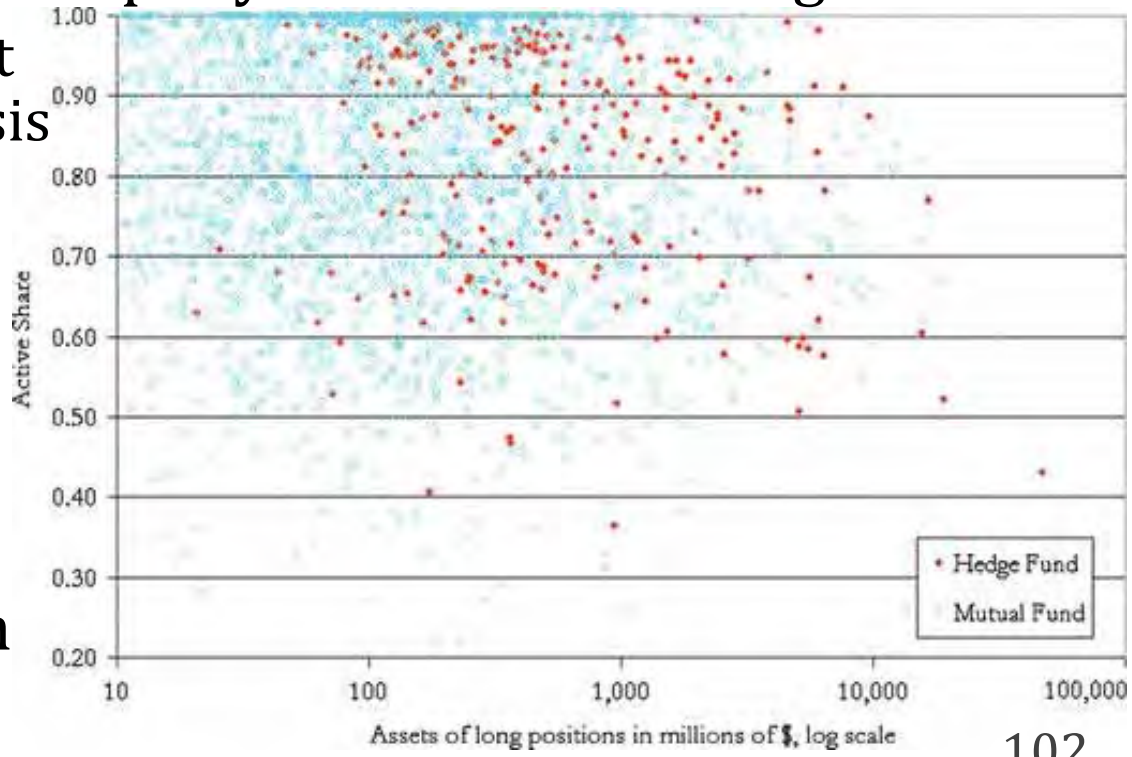
	Overall		Efficient		Inefficient	
	No.	Avg. Yearly	No.	Avg. Yearly	No.	Avg. Yearly
Indices	13	−2.7579	1	0.1380	12	−2.9992
FOF Indices	3	−4.1532	0	—	3	−4.1532
Non-FOF Indices	10	−2.3393	1	0.1380	9	−2.6146
Individual Funds	77	−6.4171	5	1.4871	72	−6.9660
FOF	23	−7.5137	0	—	23	−7.5137
Non-FOF	54	−5.9501	5	1.4871	49	−6.7088
Global	28	−7.0848	4	1.4700	24	−8.5106
Market Neutral	11	−6.0427	1	1.5556	10	−6.8025
Event Driven	15	−3.7641	0	—	15	−3.7641
Offshore	28	−7.7523	1	1.2936	27	−8.0874
U.S. Based	49	−5.6542	4	1.5354	45	−6.2932

Table 4 summarizes the efficiency test results on hedge fund indices and individual hedge funds. With regard to the latter, we distinguish between the following categories: Fund of Funds (FOF), Non-Fund of Funds (Non-FOF), Global, Market Neutral, Event Driven, Offshore, and U.S. Based.

- FoF are particularly bad, -1.81% below others, quite a waste
- With an efficiency loss of 6.42%, the average HF is inefficient
- The 2.76% lower average efficiency loss observed on HF indices suggests that a major part of the inefficiency costs of individual funds can diversified away by investing in a portfolio of HFs
- HFs score much better as part of an investment ptf

Are Hedge Fund Managers Skilled?

- Early literature typically concluded that HF managers generate positive, statistically significant risk-adjusted performance (Ackermann, McEnally and Ravenscraft, 1999, JF; Liang, 1999, FAJ)
- However Fung and Hsieh (2001, RFS) expressed doubts as, though compared to MFs, HFs prefer smaller, opaque value securities, and have higher turnover and more active share bets, decomposing returns into three components, HFs are better than mutual funds at stock picking by only 1.32% per year on a value-weighted basis
  - This result is insignificant on an equal-weighted basis or with price-to-sales benchmarks
- HFs exhibit no ability to time sectors or pick better stock styles and there is only weak evidence of differential ability between hedge funds



Are Hedge Fund Managers Skilled?

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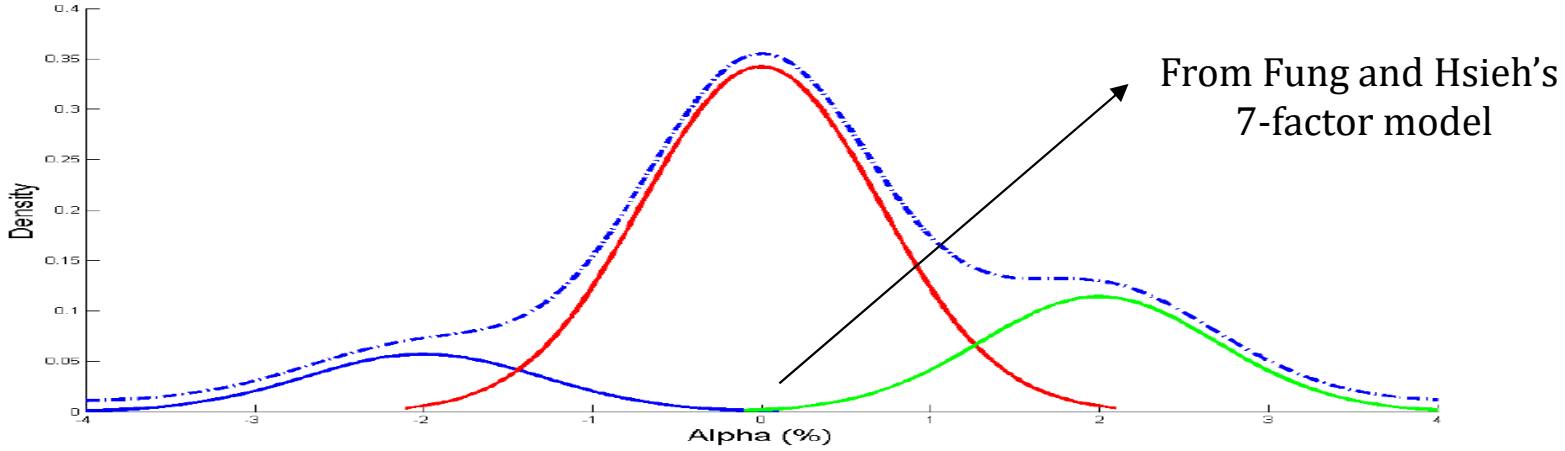
- Kosowski, Naik and Teo (2007, JFE) apply a seven-factor model to examine HF performance using a robust bootstrap methodology, to test whether hedge fund alpha can be explained by luck
- The performance of the top hedge funds (ranked by the t-statistic of the alpha) cannot be attributed to chance alone
  - Their findings are robust to adjusting for backfill bias, serial correlation in returns, and structural breaks

Portfolio	Mean Ret. (pct/ year)	Std. dev.	Alpha (pct/ year)	*t*-stat of alpha	One-tailed parametric *p*-value of alpha	IR	TE	SR	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSFX	PTFSCOM	Adj. - R^2	*p*-value (normality test)
Panel A: Ranking funds on two-year OLS alphas (one-year holding period)																	
1%ile	0.89	15.13	−0.95	−0.19	0.43	−0.08	12.35	0.06	0.31	0.31	0.49	0.49	−0.01	0.04	0.10	0.27	0.01
5%ile	6.37	11.77	4.32	1.29	0.10	0.52	8.33	0.54	0.29	0.35	0.48	0.78	−0.02	0.03	0.06	0.45	0.00
Decile 1	7.21	10.27	5.32	1.97	0.03	0.80	6.69	0.70	0.30	0.36	0.42	0.51	−0.02	0.02	0.06	0.54	0.21
Decile 2	7.25	7.74	5.76	3.04	0.00	1.23	4.70	0.94	0.28	0.26	0.26	0.35	−0.02	0.02	0.02	0.60	0.22
Decile 3	5.71	5.87	4.78	4.00	0.00	1.61	2.97	0.97	0.25	0.21	0.08	0.12	−0.01	0.02	0.01	0.72	0.78
Decile 4	6.40	4.87	5.57	5.11	0.00	2.06	2.71	1.32	0.20	0.16	0.09	0.13	−0.01	0.00	0.00	0.66	0.39
Decile 5	6.51	4.53	5.77	5.82	0.00	2.34	2.46	1.44	0.19	0.13	0.06	0.14	−0.01	0.01	0.00	0.68	0.42
Decile 6	5.22	4.66	4.42	3.95	0.00	1.59	2.78	1.12	0.19	0.12	0.08	0.14	−0.01	0.01	0.01	0.61	0.82
Decile 7	5.15	5.67	4.07	2.96	0.00	1.19	3.41	0.91	0.25	0.15	0.11	0.04	0.00	0.01	0.01	0.61	0.45
Decile 8	5.87	6.78	4.44	2.71	0.00	1.09	4.06	0.87	0.30	0.19	0.16	0.06	−0.01	0.01	0.00	0.61	0.60
Decile 9	5.54	6.46	4.24	2.56	0.01	1.03	4.12	0.86	0.27	0.15	0.11	0.13	0.01	0.02	0.02	0.56	0.66
Decile 10	6.22	10.84	4.99	1.46	0.08	0.59	8.51	0.57	0.37	0.17	0.02	0.09	−0.01	0.02	0.00	0.33	0.15
95%ile	7.14	13.72	5.67	1.35	0.09	0.55	10.41	0.52	0.49	0.19	−0.03	0.01	−0.02	0.01	−0.01	0.37	0.30
99%ile	9.53	19.74	8.24	1.33	0.10	0.53	15.43	0.48	0.70	0.06	−0.33	−0.49	−0.01	0.04	−0.04	0.33	0.01
Spread 10%	0.99	10.90	0.33	0.08	0.47	0.03	9.71	0.09	−0.06	0.19	0.39	0.42	−0.01	0.01	0.06	0.13	0.09
Spread 1%	−8.65	23.20	−9.19	−1.15	0.13	−0.46	19.81	−0.37	−0.39	0.25	0.82	0.97	−0.01	0.00	0.14	0.20	0.46

Are Hedge Fund Managers Skilled?

- Avramov, Kosowski, Naik, and Teo (2011, RFS) observe that some strategies, such as global macro, perform better in times of crisis than others, such as equity long/short
- They show that HF strategies that allow for predictability based on business cycles outperform those that do not by 13% per annum
  - Conditioning on macroeconomic variables is particularly important in directional and security selection strategies
- Chen, Cliff, and Zhao (2017, JFQA) use the Expectation-Maximization algorithm to infer managerial skill
  - Their method assumes managers fall into a discrete number of skill categories and controls for both type-I (false discovery) and type-II (false non-discoveries) errors



Are Hedge Fund Managers Skilled?

- At the individual fund level, construct a new performance measure—the conditional prob. a fund comes from the highest-skilled group
- This performance measure incorporates both a fund's estimated alpha and the information about the cross-sectional fund skill
- When estimated alpha is very noisy with large estimation error, the measure relies more on cross-sectional information

- Empirically, a mixture of 4 skill groups best fits the empirical distribution of actual fund performance
  - The first two groups have positive mean alpha, including 9% funds with 0.72%/month and 38% good funds with alpha of 0.35%/month
  - 43% of the funds are neutral with zero-alpha after fees and 9% are deemed as bad funds with alpha of –0.80%/month
- They report that ca. 50% of hedge fund managers possess skill
- Another way to distinguish between luck and managerial skill is to examine whether a manager's abnormal performance is persistent
- The general conclusion of early studies was that performance persistence is scarce and, if present, only lasts for short horizons

Are Hedge Fund Managers Skilled?

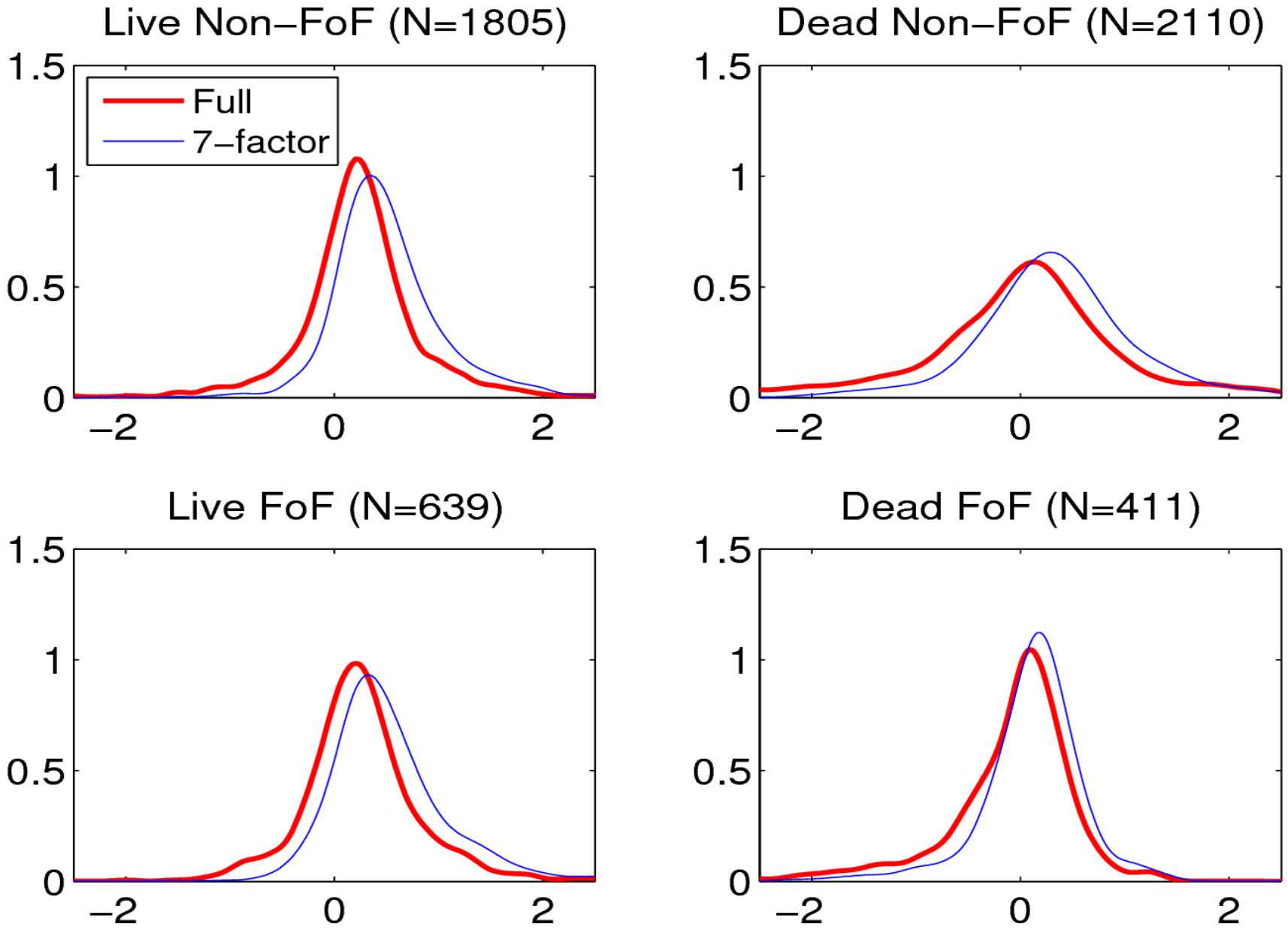
Transition probabilities

This table reports transition probabilities across the four skill groups from the current month to the next 3, 6 and 12 months. In each month from January 1996 through December 2011, we use a rolling window of the previous 24 months to evaluate fund skill and form four groups based on funds' conditional probabilities of being Excellent, Good, Neutral, and Bad. Then, for each skill group we report the portion of its funds that are Excellent, Good, Neutral, or Bad in the next 3, 6, and 12 months.

	Excellent	Good	Neutral	Bad
		Panel A: Next 3 months		
Excellent	58.64%	38.54%	2.59%	0.23%
Good	9.92%	70.77%	18.60%	0.70%
Neutral	0.81%	18.63%	69.23%	11.33%
Bad	0.33%	3.29%	37.20%	59.18%
		Panel B: Next 6 months		
Excellent	45.29%	47.32%	6.65%	0.73%
Good	11.70%	60.45%	25.62%	2.23%
Neutral	2.13%	25.29%	58.89%	13.69%
Bad	0.85%	8.99%	45.17%	44.99%
		Panel C: Next 12 months		
Excellent	30.23%	50.84%	16.60%	2.34%
Good	12.12%	50.32%	32.10%	5.45%
Neutral	4.90%	31.88%	49.06%	14.16%
Bad	2.88%	19.75%	49.37%	28.00%

Chen, Y., Cliff, M., & Zhao, H. (2017). Hedge funds: The good, the bad, and the lucky. *Journal of Financial and Quantitative Analysis*, *52*(3), 1081-1109.

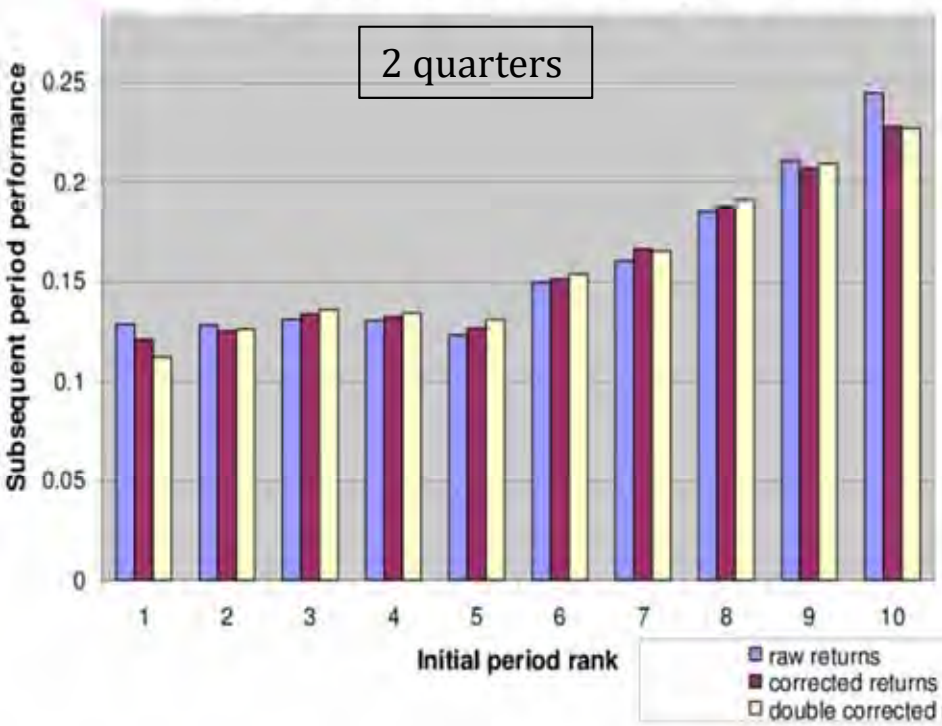
Are Hedge Fund Managers Skilled?

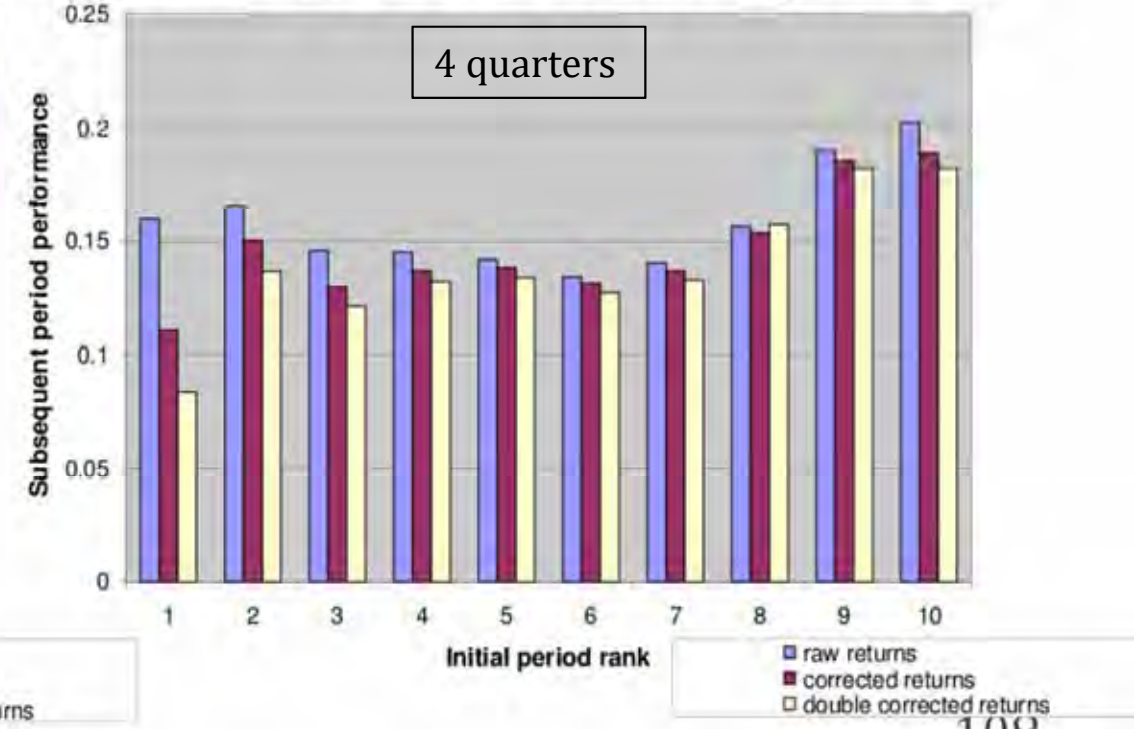


Chen, Yong, Michael Cliff, and Haibei Zhao, 2012, Hedge funds: the good, the (not-so) bad, and the ugly, Working paper, Texas A&M University and Georgia State University.

Are Hedge Fund Managers Skilled?

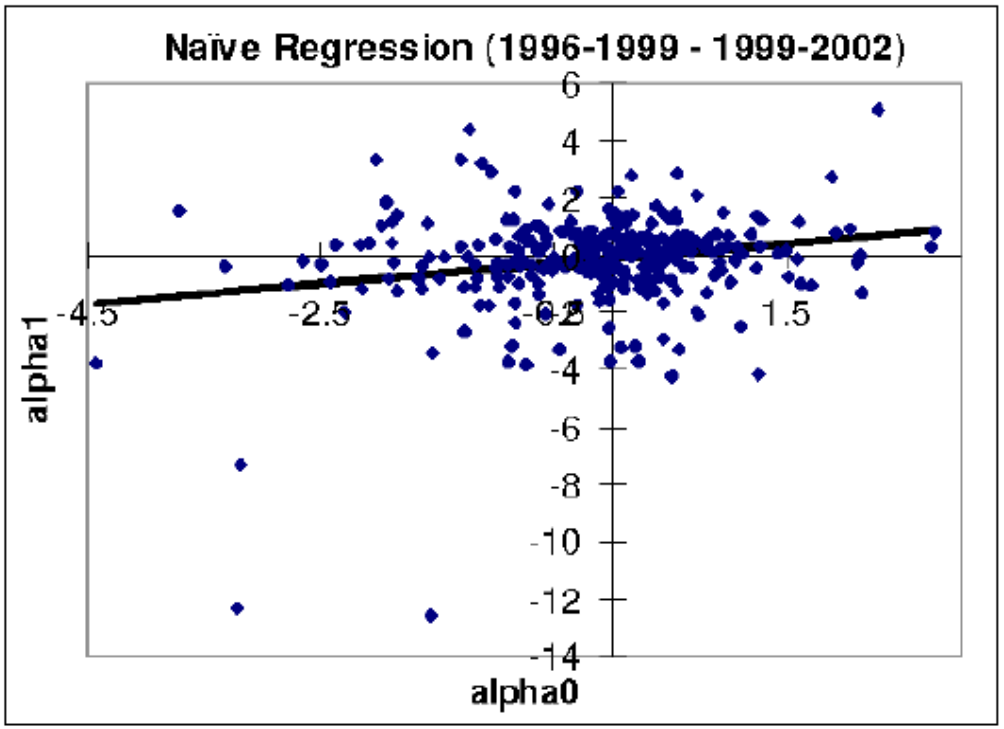
- Ter Horst and Verbeek (2007, RF) examine persistence after correcting for self-selection, liquidation, and look-ahead biases
  - Each quarter, they multiply a given performance by a ratio equal to an unconditional non-liquidation probability (i.e., the number of funds not liquidated divided by the number of funds in the sample at the beginning of a quarter) divided by a conditional non-liquidation probability (from a probit model) to correct for look-ahead bias
- They find that HF performance persists for two to four quarters

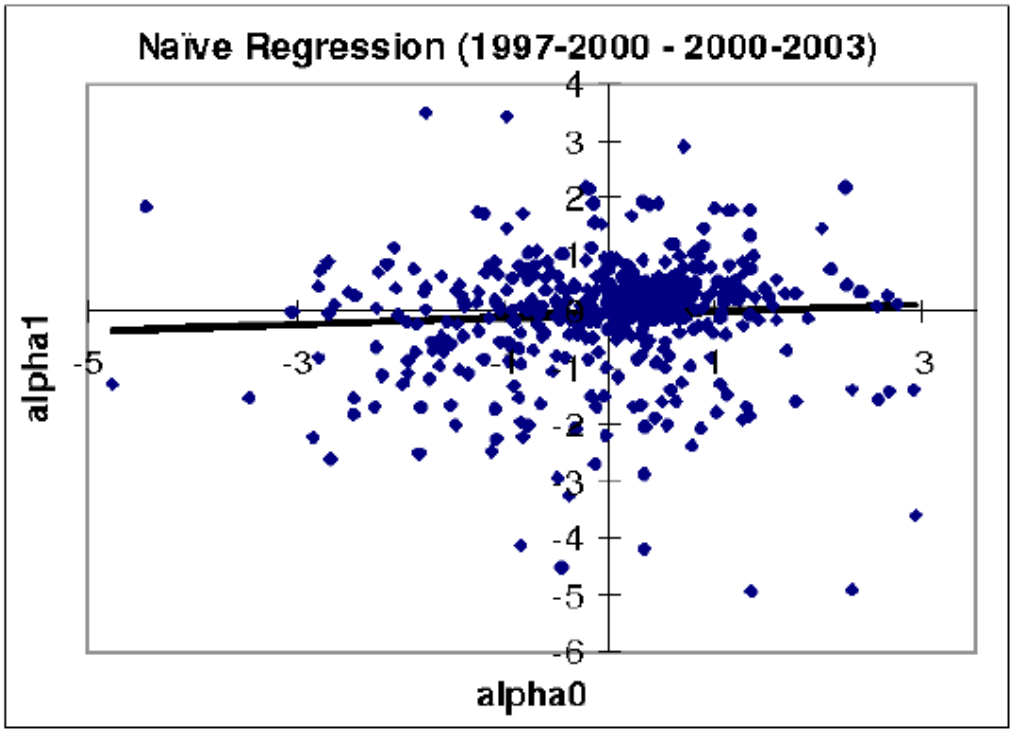




Are Hedge Fund Managers Skilled?

- Jagannathan, Malakhov and Novikov (2010, JF) evaluate whether "hot hands" exist among HF managers using relative fund performance to predict future relative performance
- Their results suggest that HF performance is persistent (the index is roughly 0.3) at a 3- year horizon and that this persistence is largely explained by persisten-ce in top performers
  - Higher relative past performance not only predicts higher future relative performance but also higher future absolute performance





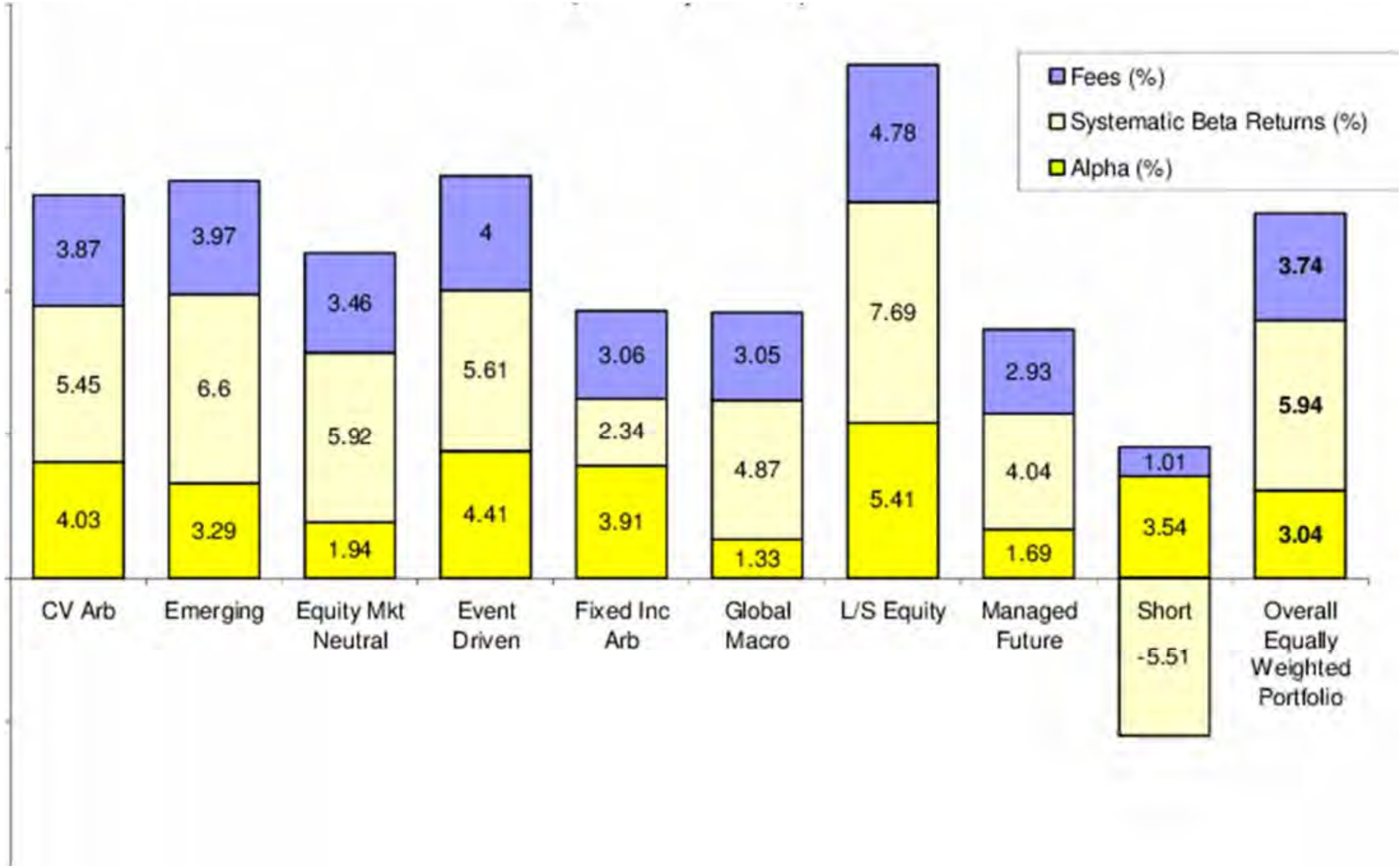
Are Hedge Fund Managers Skilled?

Out-of-Sample Performance of Three Relative Performance Ranked Portfolios

Portfolios are formed and ranked according to the previous relative *t*-alpha performance in the evaluation period with the 10% cutoff. The Fung and Hsieh (2004) portfolio alphas and appraisal ratios are then calculated for the prediction (i.e., out-of-sample) period, as well as past alphas for the evaluation period (i.e., in-sample alphas). Portfolio alphas marked with ***, **, and * are statistically significant at the 1%, 5%, and 10% levels, respectively.

Cross-section	Portfolio	Funds at Formation	Survived Funds	Past Alpha	Out-of-Sample Alpha	Appraisal Ratio
1996–1999 to 1999–2002	Inferior	50	34	−0.0857	0.1513	0.0749
	Neutral	394	252	0.3108	0.0174**	0.0155
	Superior	50	32	0.7460***	0.7883***	1.4514
1997–2000 to 2000–2003	Inferior	68	45	−0.3106	0.3758*	0.3537
	Neutral	537	361	0.4805**	−0.0159	−0.0257
	Superior	68	52	0.9348***	0.3213**	0.7923
1998–2001 to 2001–2004	Inferior	73	45	−0.5262	0.4722*	0.5329
	Neutral	577	405	0.4646**	0.2165**	0.4241
	Superior	73	57	1.1569***	0.2485***	0.8478
1999–2002 to 2002–2005	Inferior	77	43	−0.3503	0.1209	0.1453
	Neutral	609	415	0.5481***	0.1966**	0.3563
	Superior	77	61	1.0102***	0.3884***	0.8362

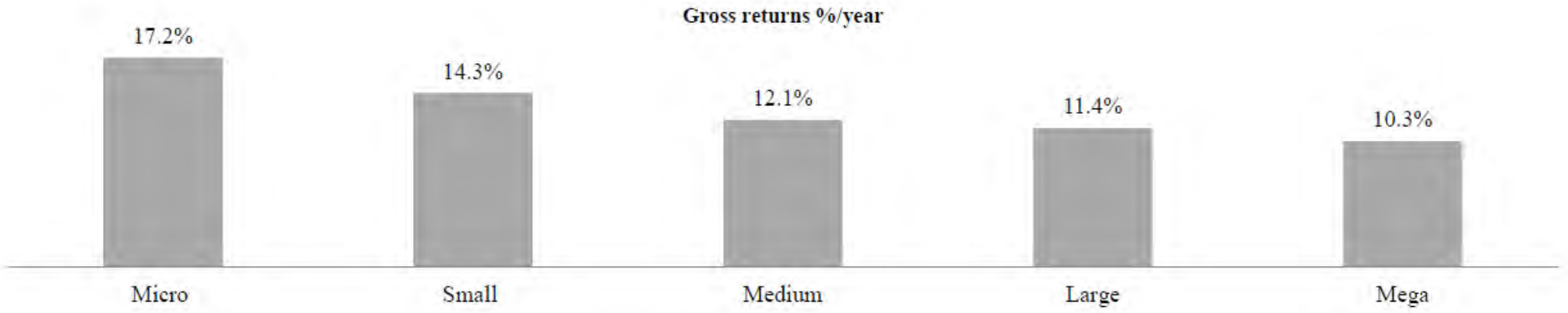
Are Hedge Fund Managers Skilled?

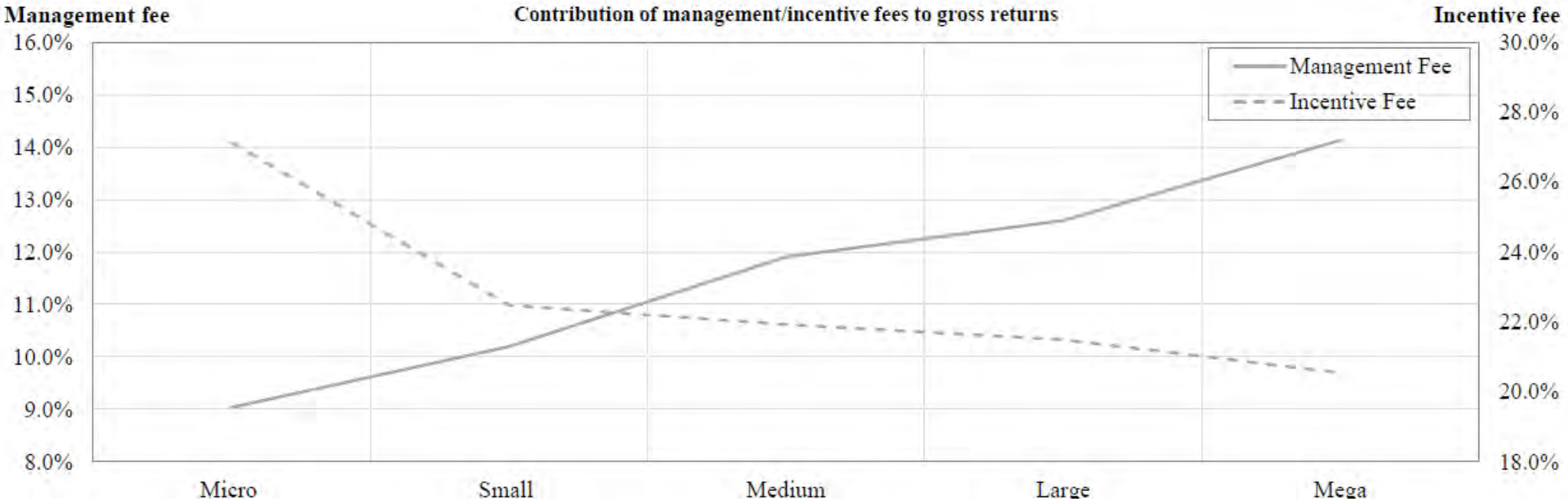


Are Hedge Fund Managers Conditionally Skilled?

- Sun, Wang and Zheng (2018, JFQA) investigate whether performance persistence varies with the overall HF market conditions
- They report strong evidence that HF performance persists following weak markets but does not persist following strong markets
  - This mimics Kacperczyk, Van Nieuwerburgh, and Veldkamp's (2014, JF) result that MFs exhibit more stock picking ability in booms and more market timing ability in recessions
  - Glode, Hollifield, Kacperczyk, and Kogan (2012) find that MF returns are predictable after periods of high market returns but not after periods of low market returns
- Funds with high returns in bad times outperform their low returns-in-bad times peers in both subsequent down and up markets, suggesting that strong performance in bad times may capture skill
- Joenvaara, Kosowski, and Tolonen (2014) account for the investment constraints faced by real-world HF investors and report a reduction in average performance and that even after controlling for the effect of 2 constraints (notice and lockup periods, size) some persistence remains

Are Hedge Fund Managers Conditionally Skilled?





Are Hedge Fund Managers Skilled? Factor Timing

- However, while HFs may generate abnormal performance, their opacity makes it difficult to pin down drivers
- Chen (2007, JIM) examines whether HFs time their focus mkts and finds that global macro and managed futures time bond and currency mkts but ability is low in equity

The results are from ordinary least squares (OLS) regressions of the joint timing model.

$$r_{p,t+1} = \alpha + \sum_{j=1}^{K} \beta_j r_{j,t+1} + \gamma \left(\frac{r_{m,t+1}}{\sigma_{m,t+1|s_t}} \right)^2 + \varepsilon_{t+1},$$

where r_p is the excess return on the equal-weighted portfolio of the funds. $K = 1$, 3, or 4 for the single-market factor, Fama-French (FF) three-factor, or Carhart four-factor models, respectively. We proxy market volatility by the implied volatility (VIX). ε_{t+1} is the idiosyncratic risk. Alternatively, we run the Busse (1999) regression to estimate both return timing and volatility timing.

$$r_{p,t+1} = \alpha + \sum_{j=1}^{K} \beta_j r_{j,t+1} + \gamma r_{m,t+1}^2 + \lambda r_{m,t+1}(\sigma_{m,t+1} - \bar{\sigma}_m) + \varepsilon_{t+1}.$$

α is in monthly percent. t-statistics are in parentheses.

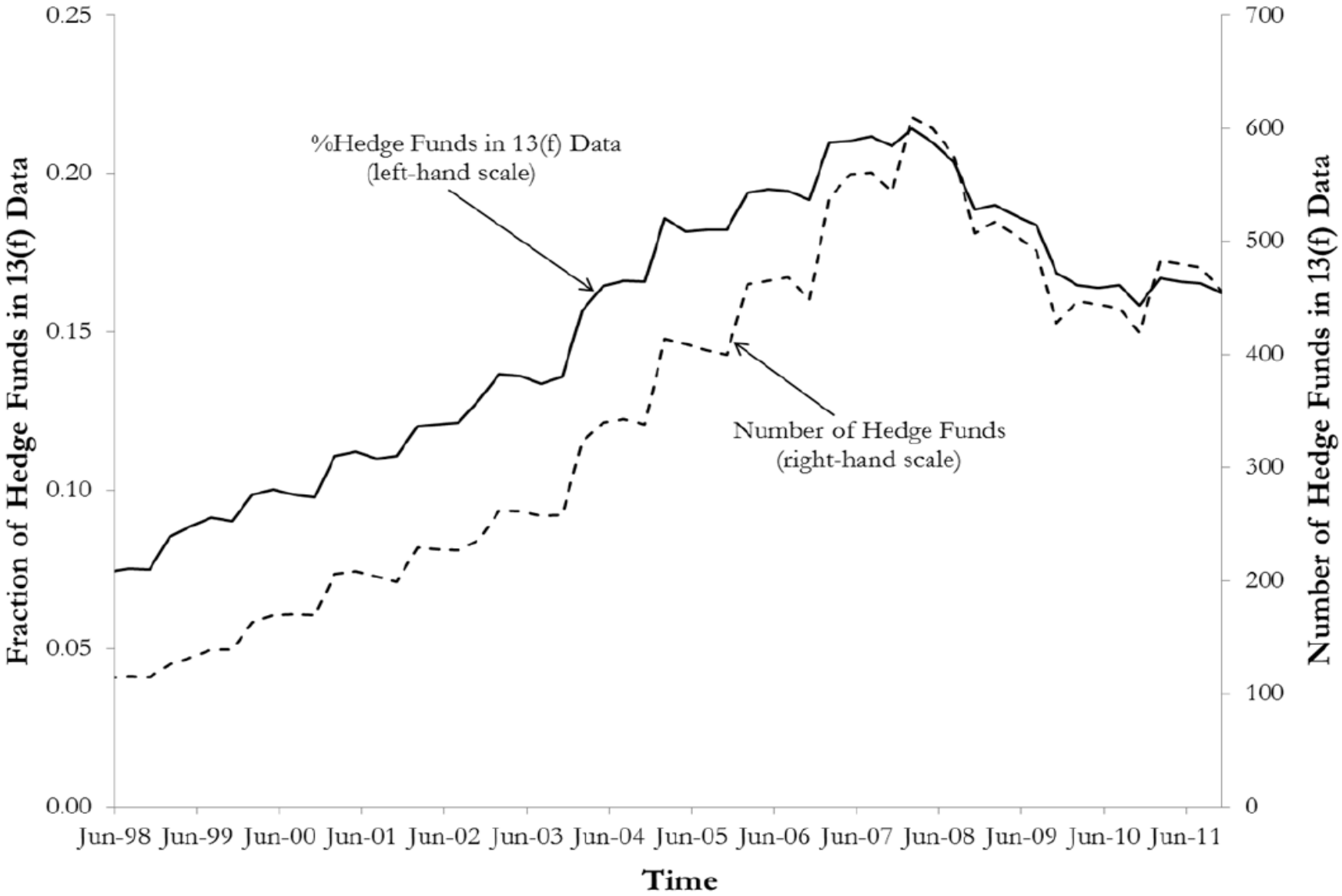
Model	α	β_m	γ	λ	β_{SMB}	β_{HML}	β_{UMD}	δ_{TB}	δ_{TERM}	δ_{QUAL}	δ_{DY}	$\bar{R}^2$
Panel A. Joint Timing												
Single factor	0.276	0.363	0.005									0.648
	(2.09)	(15.81)	(3.14)									
FF 3 factor	0.296	0.312	0.006		0.060	−0.096						0.705
	(2.40)	(12.72)	(3.89)		(2.38)	(−3.01)						
Carhart 4 factor	0.246	0.334	0.005		0.048	−0.083	0.057					0.726
	(2.05)	(13.63)	(3.86)		(1.94)	(−2.68)	(3.37)					
Conditional	0.220	0.339	0.006		0.059	−0.067	0.043	2.462	0.497	−4.52	2.258	0.727
	(1.77)	(13.36)	(3.91)		(2.32)	(−1.90)	(2.29)	(0.79)	(0.11)	(−0.31)	(0.32)	
Panel B. Return and Volatility Timing												
Single factor	0.271	0.397	1.355	−2.999								0.676
	(2.34)	(16.18)	(4.23)	(−2.70)								
FF 3 factor	0.316	0.346	1.422	−3.035	0.057	−0.095						0.731
	(2.91)	(13.68)	(4.85)	(−2.97)	(2.34)	(−3.09)						
Carhart 4 factor	0.260	0.360	1.403	−2.325	0.048	−0.081	0.051					0.747
	(2.43)	(14.43)	(4.93)	(−2.28)	(2.03)	(−2.70)	(3.07)					
Conditional	0.209	0.362	1.559	−2.284	0.062	−0.052	0.043	1.061	−3.193	1.025	2.041	0.749
	(1.88)	(14.24)	(5.26)	(−1.83)	(2.47)	(−1.51)	(2.37)	(0.33)	(−0.68)	(0.07)	(0.30)	

- Chen and Liang (2007, JFQA) use 221 market timing funds and find economically and statistically significant evidence of timing ability

Are Hedge Fund Managers Skilled? Factor Timing

- Timing ability is strong in bear and volatile markets, suggesting that market timing HFs provide investors with protection
  - Small and onshore funds tend to time better and show persistence
  - Results are robust to controlling for HFs' options trading and leverage
- Moreover, several studies use the 13F data on HF holdings to determine if funds have stock picking or market timing ability
- Brunnermeier and Nagel (2004, JF) suggest that HFs possess stock picking and timing abilities: the technology stocks held outperform the characteristic benchmarks proposed by Daniel et al. (1997, JF)
  - E.g., HF held large amounts technology stocks during the technology bubble but reduced these holdings prior to the bubble burst
- Although Griffin and Xu (2009, RFS) confirm Brunnermeier and Nagel's results on HFs' holdings of technology stocks, their overall conclusion is that HF are no more skilled than MF managers
- Yet, 13F data has several limitations:
  - The disclosure is at the fund company level and not at the fund level
  - Disclosure occurs only on a quarterly basis

Are Hedge Fund Managers Skilled? Factor Timing

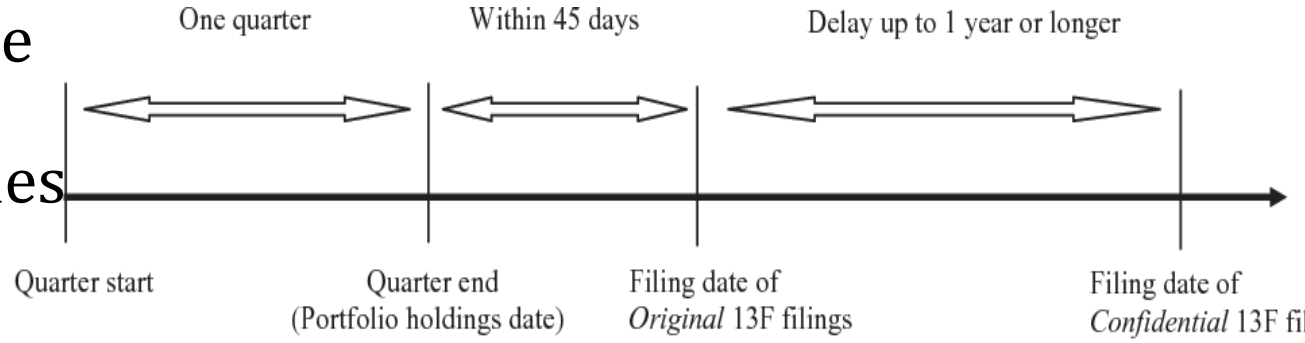


Hedge funds in 13(f) data over time (1998-2011). The solid line depicts the fraction of 13(f) institutions identified as hedge fund companies (left hand scale). The broken line depicts the number of 13(f) institutions identified as hedge fund companies (right hand scale).

Are Hedge Fund Managers Skilled? Factor Timing

- HF comps managing less than $100 million not required to disclose; reporting is required for all long stock positions of 10,000 or more shares and positions valued at $200,000 or more.
- Disclosure includes only the fund holdings and not actual trades

- HF can enhance their returns by varying their exposures to the risk factors over time (factor timing)
- Chen (2007, JIM) examines funds' ability to time various asset classes and finds evidence of successful market timing at both the category level and the individual fund level
- Agarwal, Jiang, Tang, and Yang (2013, JF) examine the "confidential holdings" of HFs, where the quarter-end equity holdings are disclosed with a delay through amendments to Form 13F and are usually excluded from the standard databases
- Funds managing large risky ptfs with non-conventional strategies seek confidentiality more frequently



Are Hedge Fund Managers Skilled? Factor Timing

- Hidden holdings are disproportionately associated with information-sensitive events or indicate greater information asymmetry
- Confidential holdings exhibit superior performance up to 12 months and take longer to build
- Aragon and Martin (2012, JFE) examine the derivative positions of 250 HFs using 13F filings to study mkt and volatility timing
- HFs' option positions predict stock returns and their non-directional positions (e.g. protective puts or straddles) predict volatility
- While the studies above generally find evidence of timing ability, a few studies find contrasting results
  - Fung, Xu, and Yau (2002, FAJ) and Fung and Hsieh (2004, FAJ) also find little evidence of timing ability

	Return Horizons						
	2m	3m	4m	5m	6m	9m	12m
Daily Four-Factor Alphas							
Conf. Holdings (in basis points)	5.39	5.04	4.36	3.74	4.32	3.7	4.5
Original Holdings (in basis points)	2.82	2.72	2.77	2.54	2.45	2.38	2.44
Diff: Conf. – Orig. (in basis points)	2.57***	2.31**	1.59**	1.21	1.88***	1.31*	2.05***
Annualized Diff.	6.48%***	5.83%**	4.01%**	3.04%	4.73%***	3.31%*	5.17%**
t-stat.	3.02	2.22	2.05	1.04	2.68	1.72	3.11
# of Conf. Filings	81	35	144	24	162	112	309
# of Original Filings	14,000	14,000	13,997	13,992	13,990	13,986	13,976
DGTW Benchmark-Adjusted Returns							
Conf. Holdings	5.48%	1.97%	0.89%	3.86%	2.64%	4.86%	8.08%
Original Holdings	0.22%	0.26%	0.15%	0.19%	0.17%	0.29%	0.57%
Diff: Conf. – Original	5.26%***	1.71%**	0.74%	3.67%**	2.47%**	4.57%***	7.51%**
Annualized Diff.	31.56%***	6.83%**	2.22%	8.80%**	4.94%**	6.09%***	7.51%**
t-stat.	6.78	2.39	0.93	2.56	2.46	2.83	4.27
# of Conf. Filings	78	34	142	19	165	102	331
# of Original Filings	13,973	13,973	13,973	13,973	13,973	13,973	13,973

Are Hedge Fund Managers Skilled? Factor Timing

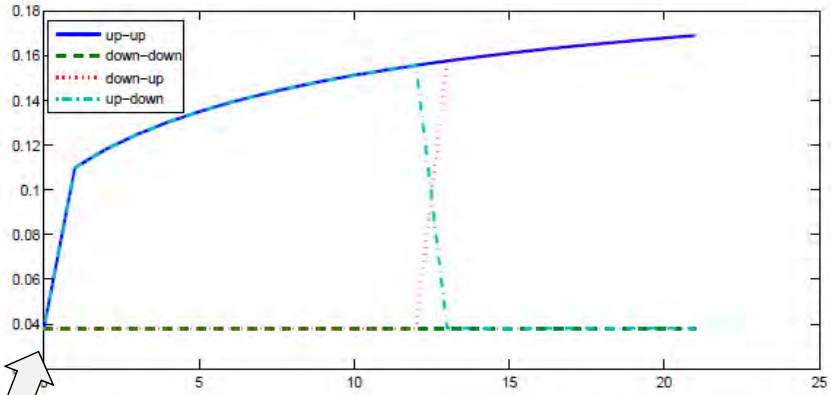
- Lo (2008, JIM) investigates the sum of covariances btw ptf weights and asset returns: these covariances represent managers' skill in anticipating future returns and allocating capital accordingly
- Park (2010) applies the methodology developed by Lo to decompose hedge fund returns from 1994 to 2008 into security selection, risk premia, and factor timing components
- She shows that security selection dominates with 90% of the explained variation in returns, compared to 9% for factor timing

Investment Style	Excess return	Security Selection Component	Factor Timing Component	Risk Premium Component
Illiquid-Style Hedge Funds	0.42 (100%)	0.52 (25%)	-0.07 (-16%)	-0.04 (-9%)
Convertible Arbitrage	0.17 (100%)	0.37 (216%)	-0.23 (-137%)	0.04 (21%)
Emerging Markets	0.55 (100%)	0.75 (137%)	-0.10 (-18%)	-0.10 (-19%)
Event Driven	0.51 (100%)	0.51 (99%)	0.00 (-1%)	0.01 (2%)
Fixed Income Arbitrage	0.31 (100%)	0.33 (106%)	0.02 (7%)	-0.04 (-13%)
Liquid-Style Hedge Funds	0.64 (100%)	0.50 (78%)	0.11 (18%)	0.03 (4%)
Dedicated Short Bias	0.03 (100%)	0.12 (424%)	0.18 (627%)	-0.28 (-951%)
Equity Market Neutral	0.45 (100%)	0.36 (80%)	0.09 (20%)	0.00 (0%)
Global Macro	0.43 (100%)	0.32 (75%)	0.10 (24%)	0.01 (2%)
Long/Short Equity Hedge	0.77 (100%)	0.58 (75%)	0.14 (19%)	0.05 (6%)
Multi-Strategy	0.47 (100%)	0.42 (89%)	0.04 (9%)	0.01 (2%)
All Hedge Funds	0.56 (100%)	0.51 (90%)	0.05 (9%)	0.00 (1%)
CTAs	0.69 (100%)	0.54 (78%)	0.22 (32%)	-0.06 (-9%)
Fund of Funds	0.22 (100%)	0.22 (100%)	0.02 (8%)	-0.02 (-8%)
All Funds	0.49 (100%)	0.44 (90%)	0.06 (11%)	-0.01 (-1%)

Factor Timing and Hedging Behavior

- In the light of the evidence that some HFs can and do time several asset markets, should we expect them to be market neutral?
- Intuitively, no – if a fund times the market and the market is serially correlated, then some non-zero exposure ought to result
- Detemple, Garcia and Rindisbacher (2010) analyze an asset pricing model and its implied optimal asset allocation policies to show that they include investments in HFs
- They report that correlations btw. HF returns and the market ought to depend on the timing model as well as on market dynamics when timing is path-dependent

Correlation HF and Market: HM



Treynor & Mazuy (TM):

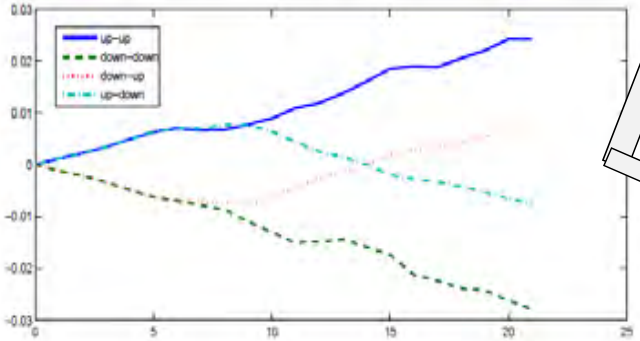
$$r_{t+1}^p = \alpha_p + \beta_p r_{t+1}^m + \gamma \left(r_{t+1}^m\right)^2 + \nu_{t+1}^p$$

Henriksson & Merton (HM):

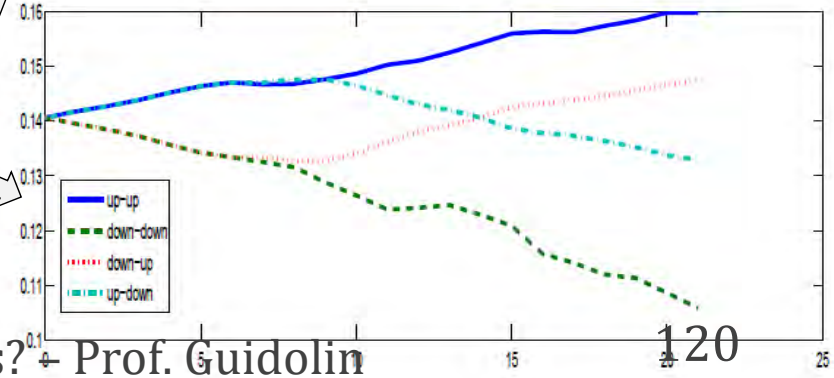
$$r_{t+1}^p = \alpha_p + \beta_p r_{t+1}^m + \gamma \left(r_{t+1}^m\right)^+ + \nu_{t+1}^p$$

$$\left(r_{t+1}^m\right)^+ \equiv \max\left\{0, r_{t+1}^m\right\}$$

Cumulative Excess Return Scenarios

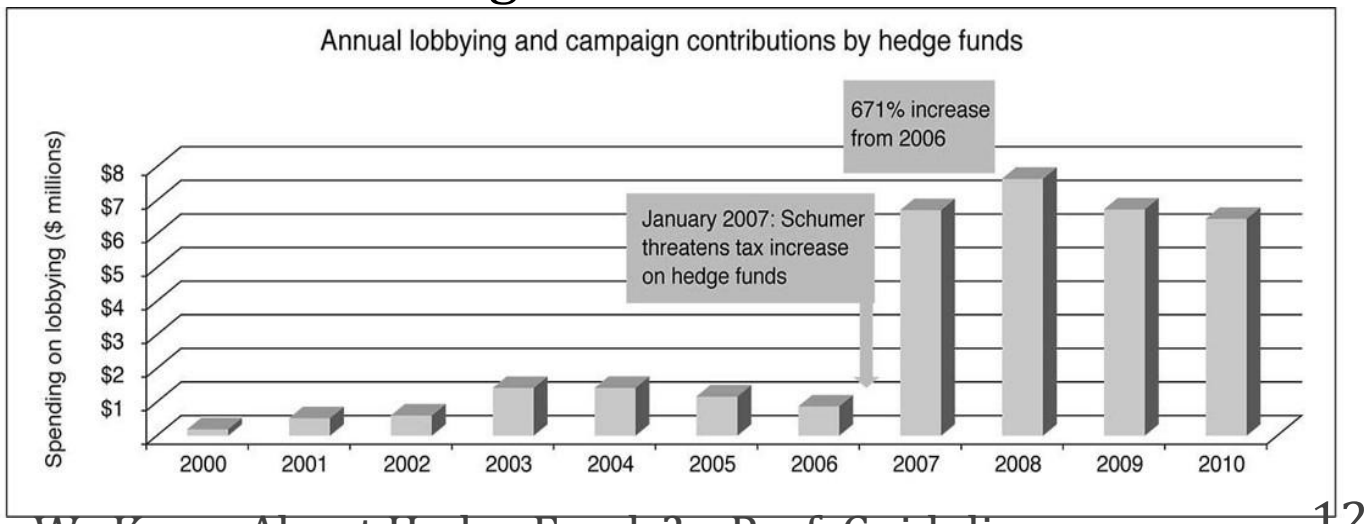


Correlation HF and Market: TM



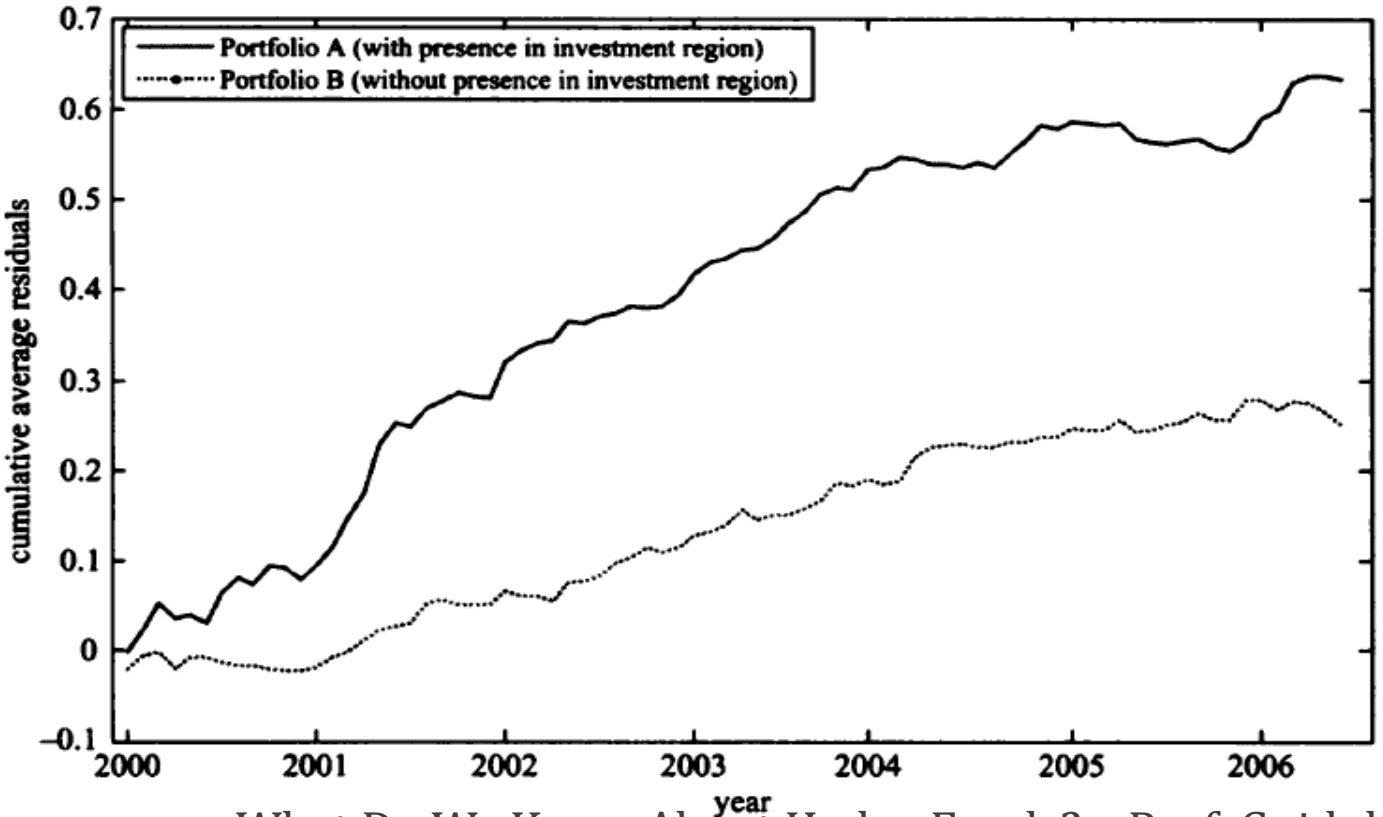
Do Hedge Funds Exploit Private Information?

- Gao and Huang (2016, JFE) examine the hypothesis that HF managers gain an informational advantage in securities trading through their connections with lobbyists
- Using data sets on the long-equity holdings and lobbyist connections of HFs from 1999 through 2012, we show that HFs outperform passive benchmarks by 56–93 basis points per month on their political holdings when they are connected to lobbyists
- The political outperformance of connected funds decreased significantly after the 2012 Stop Trading on Congressional Knowledge (STOCK) Act became effective
  - The "STOCK Act" stated that congressional members and staff were prohibited from using nonpublic information obtained due to their positions to turn a profit



Do Hedge Funds Exploit Private Information?

- Li, Zhang, and Zhao (2011, JFQA) conclude that education and career concerns can positively impact hedge fund performance—managers from undergraduate institutions with higher average SAT scores apparently have higher raw and risk-adjusted returns
- Teo (2009, RFS) shows that HFs with headquarters or a research office in their investment region outperform those without it, suggesting that local funds possess an informational advantage



Cumulative average residuals of hedge funds with presence in investment region versus hedge funds without presence in investment region

Equal-weighted portfolios of equity long/short hedge funds are constructed by sorting funds on whether they have a physical presence (head office or research office) in the geographical region they invest in. Cumulative average residual is the difference between a portfolio's excess return and its factor loadings multiplied by the augmented Fung and Hsieh (2004) risk factors. Factor loadings are estimated over the entire sample period. The sample period is from January 2000 to June 2006.

The Cross-Section of Hedge Funds: Who's the Best?

- HFs have a number of unique characteristics such as their compensation structure, flexibility arising from restrictions on withdrawals, light regulatory environment, and "skin in the game"
- Researchers have found that many of these features explain significant cross-sectional variation in fund performance
- HF managers are compensated using two types of fees: i) a mgmt fee, which is a fixed percentage of AUM, and ii) incentive fees, which are based on a fixed percentage of fund profits
  - Incentive fee often imply hurdle rate and high-water mark provisions
  - Hurdle rates specify a minimum return which a manager must achieve before receiving any incentive fees
  - Since managers are not required to pay any fees if the fund loses money, the incentive fee contract is asymmetric
  - Akin a portfolio of call options written by investors on the fund's assets, in which the strike price of each call option is determined by the NAV of the fund at the time of investors' entry into the fund
- Early studies showed that the compensation structure and mgmt co-investment, mitigates agency problems

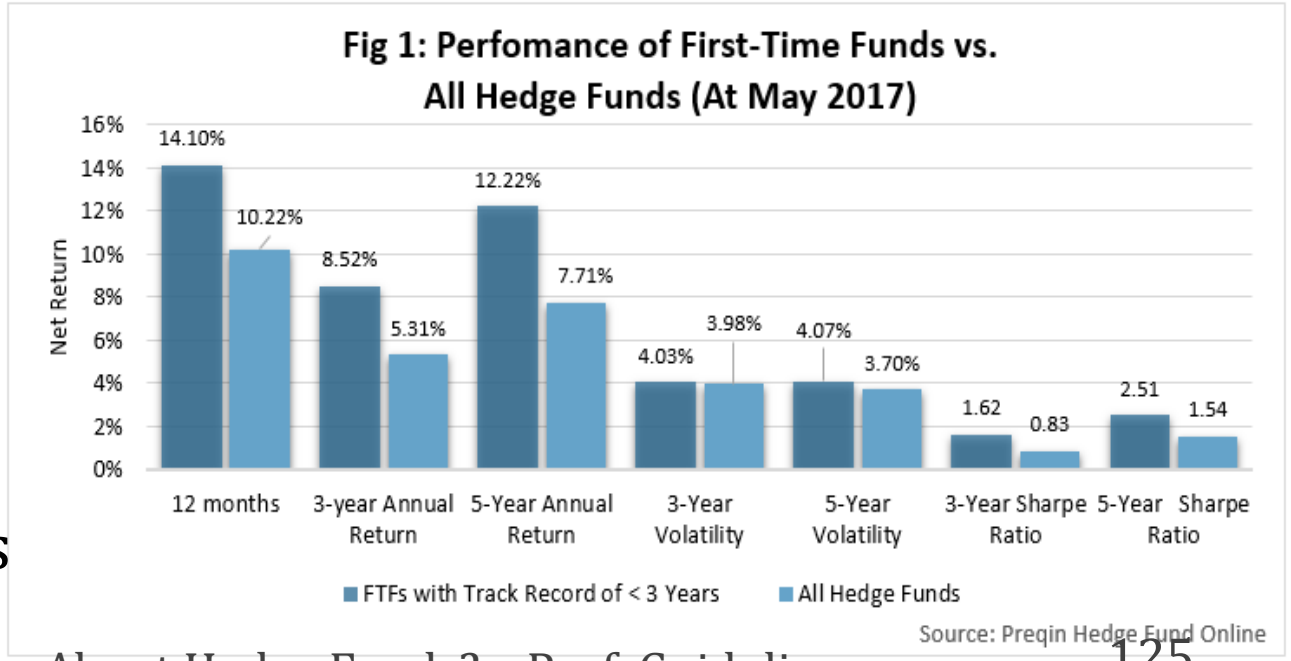
The Cross-Section of Hedge Funds: Who's the Best?

- Agarwal, Daniel, and Naik (2009, JF) use the "delta" of the HF manager (the expected dollar increase in the manager's compensation for a 1% increase in the net asset value), the hurdle rate, and the high-water mark provision to proxy for managerial incentives
- They find that HF that have larger deltas and high-water marks perform better

		Panel A: Alpha=returns in excess of median strategy returns			Panel B: Alpha based on intercepts from estimating Fung and Hsieh (2004) model		
Independent Variables	**Sign**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
MANAGERIAL INCENTIVES							
Total Delta$_{t-1}$	+	0.012*** (0.001)			0.009*** (0.002)		
Manager's Option Delta$_{t-1}$	+		0.017** (0.017)	0.016** (0.023)		0.010** (0.046)	0.009* (0.058)
Managerial Ownership$_{t-1}$	+		0.123*** (0.009)	0.285* (0.054)		0.082** (0.038)	0.185** (0.022)
Managerial Ownership$^2_{t-1}$	–			–0.472* (0.086)			–0.271* (0.087)
Hurdle Rate	+	0.005 (0.256)	0.009* (0.097)	0.011* (0.099)	0.003 (0.252)	0.006* (0.097)	0.008* (0.085)
High-Water Mark	+	0.026*** (0.001)	0.026*** (0.001)	0.027*** (0.001)	0.024*** (0.009)	0.024*** (0.008)	0.025*** (0.008)
MANAGERIAL DISCRETION							
Lockup Period	+	0.031* (0.076)	0.030* (0.079)	0.029* (0.088)	0.039** (0.035)	0.039** (0.036)	0.038** (0.039)
Restriction Period	+	0.017 (0.178)	0.017 (0.171)	0.016 (0.173)	0.025** (0.015)	0.025** (0.013)	0.025** (0.014)
CONTROLS							
Size$_{t-1}$		–0.012*** (0.008)	–0.011** (0.015)	–0.011** (0.012)	–0.012*** (0.000)	–0.011*** (0.001)	–0.011*** (0.001)
Flow$_{t-1}$		–0.007* (0.058)	–0.007* (0.080)	–0.006* (0.091)	–0.005** (0.028)	–0.005* (0.052)	–0.005* (0.069)
Volatility$_{t-1}$		0.279 (0.639)	0.249 (0.674)	0.233 (0.691)	–0.617* (0.059)	–0.640* (0.054)	–0.655* (0.051)
Age$_{t-1}$		–0.004* (0.100)	–0.005* (0.056)	–0.005* (0.066)	–0.001 (0.461)	–0.002 (0.296)	–0.002 (0.277)
Management Fee		–0.334 (0.518)	–0.547 (0.315)	–0.651 (0.284)	–0.358 (0.629)	–0.534 (0.488)	–0.608 (0.432)
Intercept		0.027 (0.207)	0.023 (0.285)	0.021 (0.346)	0.087** (0.012)	0.083** (0.013)	0.082** (0.014)
Adjusted R^2		7.0%	7.3%	7.6%	6.3%	6.6%	6.7%
No. of observations		16,901	16,901	16,901	16,901	16,901	16,901

The Cross-Section of Hedge Funds: Who's the Best?

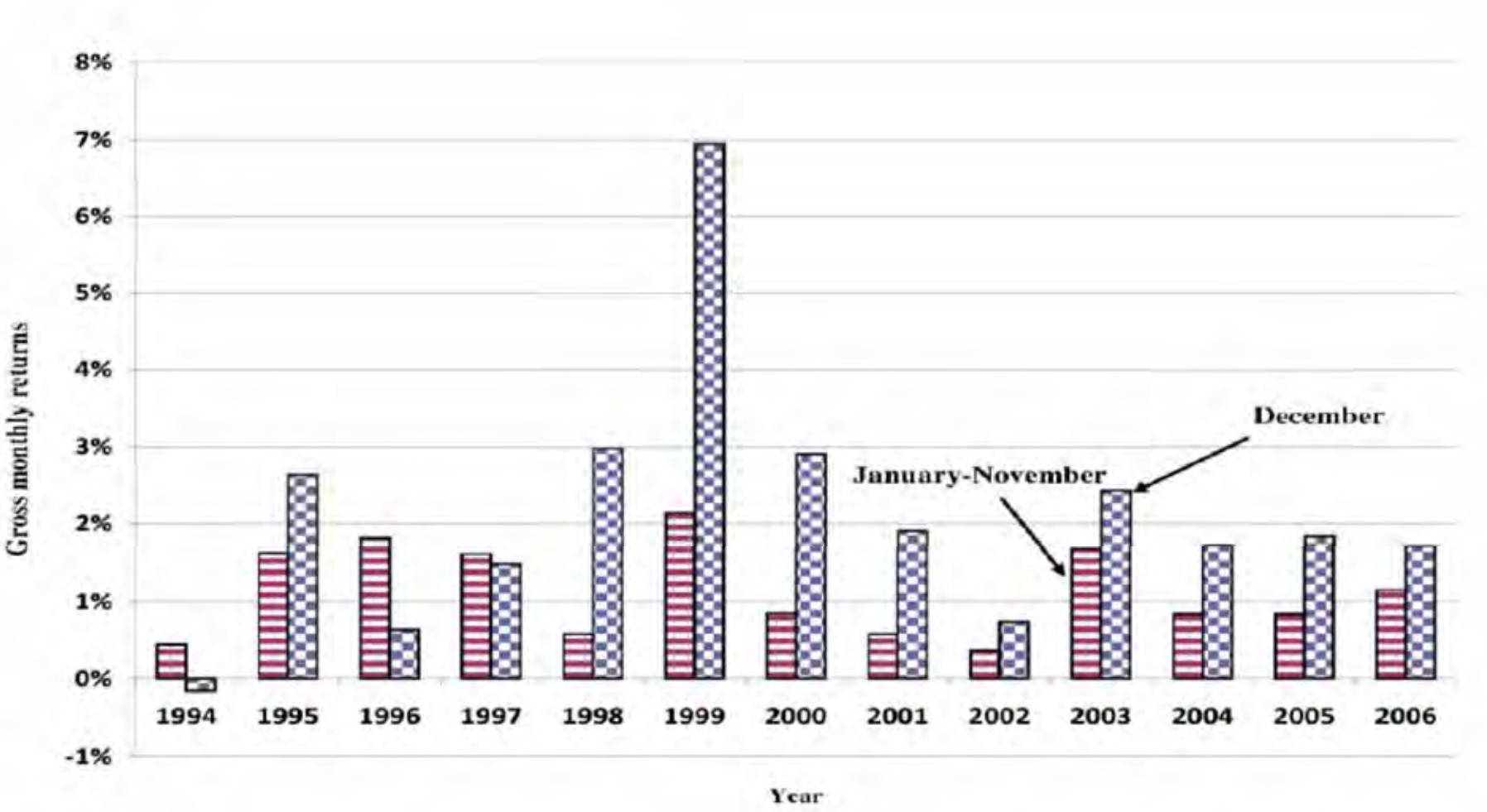
- With some exception, prevalent finding is that HF performance is increasing in the incentive fees or pay-for-performance sensitivity
- However, scholars have started to ask whether managers' incentives lead to other, more subtle agency problems
- For example, because the dollar value of both their management and incentive fees are increasing functions of fund size, managers have incentive to increase fund size at the expense of performances
  - Investors prefer for managers to close their funds at the point at which diseconomies of scale begin to negatively impact performance
- Liang and Schwarz (2011) report that HFs exhibit lower performance once they are closed, and tend to re-open even though they are still too large to generate their previous level of performance



The Cross-Section of Hedge Funds: Who's the Best?

- Recent studies also recognize that managers' convex compensation contracts can create perverse incentives
- Agarwal, Daniel, and Naik (2011, RFS) investigate if managers' contracts incentivize them to engage in returns management
- Managers have incentives to smooth their reported returns in order to mitigate capital outflows when performance monitoring takes place over short horizons, especially in the presence of shorter lockup and restriction (i.e., redemption and notice) periods
  - Managers may initially underreport returns so as to create "reserves" that can be used in loss-making months, with any unused reserves being added to December's return since the incentive fees are typically computed at the end of the year
  - Alternatively, HFs may be tempted to earn higher fees by "borrowing" from the following year's returns
  - Accomplished by last minute buying in Dec., which pushes up asset prices and increases end-of-year NAV, but results in a reversal in Jan.
  - The average return in December is 34-70 basis points higher than the average return for the other months after controlling for risk

The Cross-Section of Hedge Funds: Who's the Best?



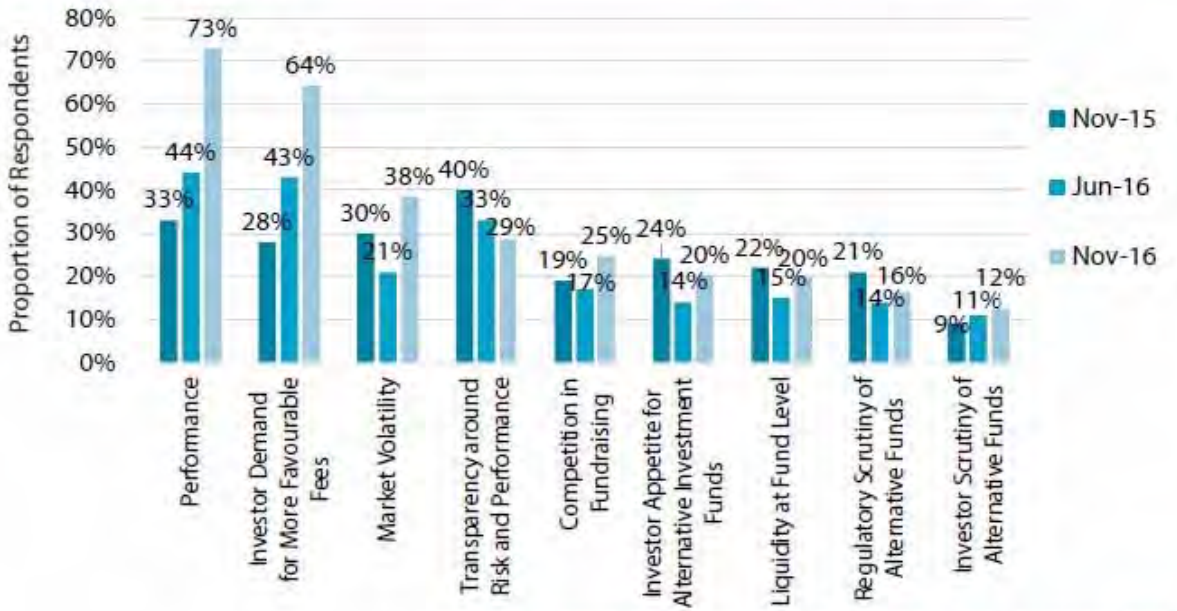
- Perhaps the most salient feature of the HF industry is the flexibility fund managers enjoy across several dimensions, e.g., they impose significant non-discretionary restrictions on capital withdrawals in the form of lockup, redemption, and notice periods

The Cross-Section of Hedge Funds: Who's the Best?

- These restrictions help managers to invest in arbitrage opportunities subject to noise trader risk in the short term or avoid the forced unwinding of positions during unfavorable market conditions

- Early studies found a positive relation between these non-discretionary withdrawal restrictions and performance ⇒ to buy illiquid assets is a source of performance (Khandani and Lo, 2011, QJF)
- Schaub and Schmid (2013, JBF) consider the effect of lockup periods during the financial crisis and find that HFs with restrictions hold illiquid assets/earn an illiquidity premium before the crisis
- However, during the crisis,these HFs experienced lower returns and alphas, possibly because lockups are not strict enough to protect them from asset-liability mismatches

Fig. 3: Fund Manager Views on the Key Drivers of Change Facing the Hedge Fund Industry, 2015 - 2016



Source: Preqin Hedge Fund Manager Survey, November 2015 - November 2016

The Cross-Section of Hedge Funds: Who's the Best?

- Ramadorai (2012, JF) finds evidence of HF fund share illiquidity also being priced in the secondary market: using secondary market transactions for HF closed to new investment, he finds a negative relation between premiums for NAV and funds' share illiquidity
- Investors pay less for a HF with more liquidity restrictions
- Ang and Bollen (2010, FM) find exercise restrictions to cost investors 1.5% of the initial NAV: an investor gives up an option—the right to get out of the fund when she wants, and she most wants to exercise the option when the manager is destroying value
- The cost of a two-year lockup is 4% and it increases to 15% if the HF suspends all redemptions during bad times
- The relation between restrictions and HF performance is more nuanced: although restrictions allows the manager more freedom, illiquidity exposes the manager to more risk during times of crisis
- Further, enacting discretionary withdrawal restrictions leads to adverse effects on managers' reputations
- At the international level, also the regulatory environment matters

The Cross-Section of Hedge Funds: Who's the Best?

- Cumming and Dai (2010) analyze the impact of regulatory restrictions on performance, using data on funds from 29 countries

The minimum capital requirements to operate as a hedge fund manager are vary in some countries depending on fund characteristics and as such are proxied, as summarized in this table, for the purpose of empirical analyses in the subsequent tabl (and the results are robust to alternative proxies).

Country	# Funds in Combined CISDM HFN Dataset	# Funds in CISDM Dataset	Proxy for minimum capital requirement to operate as hedge fund manager (2005 US $)	Main marketing channels								Restrictions on location of key service providers?	Legal Origin			GDP per Capita (2005 US $)
				Banks	Fund distribution companies	Wrappers	Private placements	Investment managers	Other regulated financial services institutions	Non-regulated financial intermediaries	Total number of marketing channels		English	French	German	
Australia	2	1	0	1	1	1	1	1	1	0	6	0	1	0	0	$30,700
Austria	2	1	$6,750,000	1	1	1	0	0	0	0	3	0	0	0	1	$31,300
Bahamas	19	18	$25,000	0	0	0	1	1	0	0	2	1	1	0	0	$17,700
Bermuda	76	70	$0	1	0	0	1	1	0	0	3	1	1	0	0	$36,000
Brazil	6	4	$362,000	1	1	0	1	1	1	0	5	1	0	1	0	$8,100
British Virgin Islands	97	97	$500,000	1	0	0	1	1	0	0	3	1	1	0	0	$24,500
Canada	20	13	$0	1	1	1	1	1	1	0	6	0	1	0	0	$31,500
Cayman Islands	372	371	$500,000	1	0	0	1	0	0	0	2	1	1	0	0	$32,300
Channel Islands	4	0	$44,077	1	1	1	1	1	1	1	7	0	1	0	0	$35,264
China	1	0	$0	1	1	1	1	1	1	0	6	1	0	0	1	$5,600
France	8	7	$168,750	0	1	1	1	1	0	0	4	0	0	1	0	$28,700
Hong Kong	1	0	$2,275,000	1	1	0	1	1	1	0	5	0	1	0	0	$34,200
Ireland	24	20	$67,500	1	0	0	1	0	1	0	3	1	1	0	0	$31,900
Isle of Man	1	1	$142,500	0	1	1	1	1	0	0	4	1	1	0	0	$35,000
Japan	2	0	$0	1	1	1	1	1	1	0	6	0	0	0	1	$29,400
Luxembourg	9	9	$168,750	1	0	0	0	0	1	0	2	0	0	1	0	$58,900
Mauritius	2	2	$0	0	0	0	1	0	0	0	1	1	1	0	0	$12,800
Netherlands	1	0	$303,750	0	0	1	0	1	1	0	3	1	0	1	0	$29,500
Netherland Antilles	6	6	$0	0	0	0	1	0	0	0	1	1	0	1	0	$11,400
New Zealand	1	1	$0	1	1	1	1	1	1	0	6	0	1	0	0	$23,200
Switzerland	2	0	$4,300,000	1	1	1	0	1	1	0	5	1	0	0	1	$33,800
UK	20	0	$67,500	1	0	1	1	1	0	0	4	0	1	0	0	$29,600
US	1455	503	$0	0	0	0	1	0	0	0	1	0	1	0	0	$40,100
US Virgin Islands	6	0	$500,000	1	0	0	1	1	0	0	3	1	1	0	0	$15,000

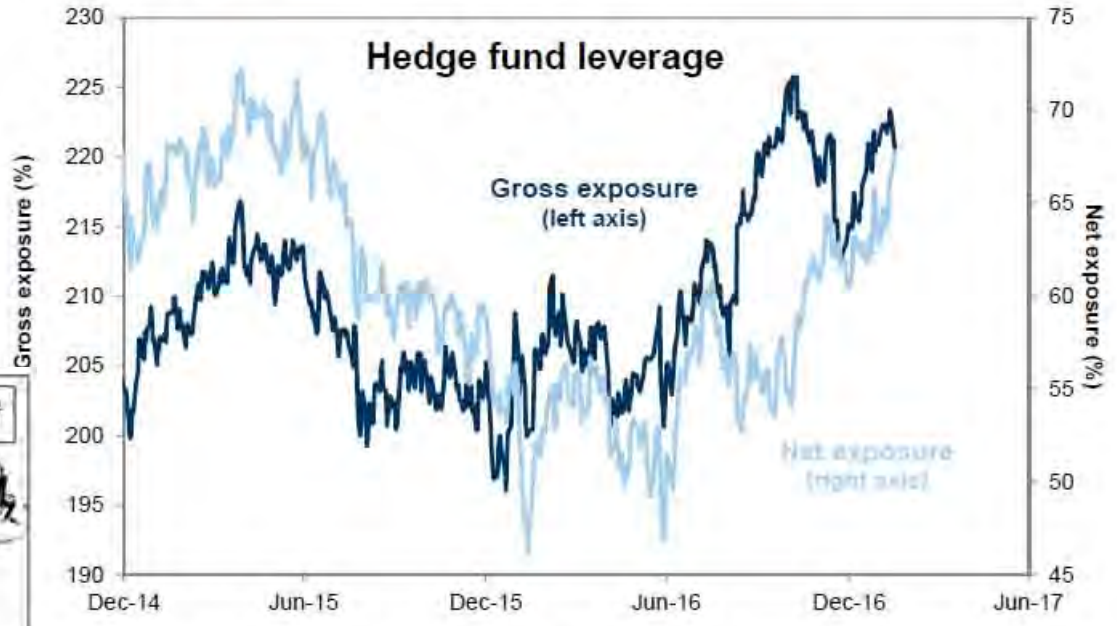
The Cross-Section of Hedge Funds: Who's the Best?

- They find that minimum capital requirements, restrictions on distribution channels and the location of fund service providers, are associated with lower performance and higher fees
- However, these restrictions result in lower return standard deviations ⇒ make HF investments less risky
- Joenväärä and Kosowski (2015) compare Undertakings for Collective Investment in Transferable Securities (UCITS) HF to other HFs
  - UCITS HFs are registered in the EU and are subject to stricter restrictions on their use of leverage and short selling as well as having higher liquidity requirements
- UCITS funds are found to have lower risk-adjusted performance than do their less restricted counterparts; however, investors do benefit from them, as UCITS funds are also less likely to misreport

The Cross-Section of Hedge Funds: Who's the Best?

- In an imperfect market in which HFs cannot raise unlimited capital, the use of leverage acts as a way to take advantage of opportunities
- Ang, Gorovyy, and van Inwegen (2011, JFE) investigate the determinants of HF leverage using self-reported leverage data
- Average leverage of HFs is approximately 2.1 times their NAV and that variation is largely explained by macroeconomic conditions
  - Leverage increases with returns of investment banks and returns to the S&P 500, and decreases with increases in proxies for risk such as investment banks' CDS protection, VIX, and TED spread

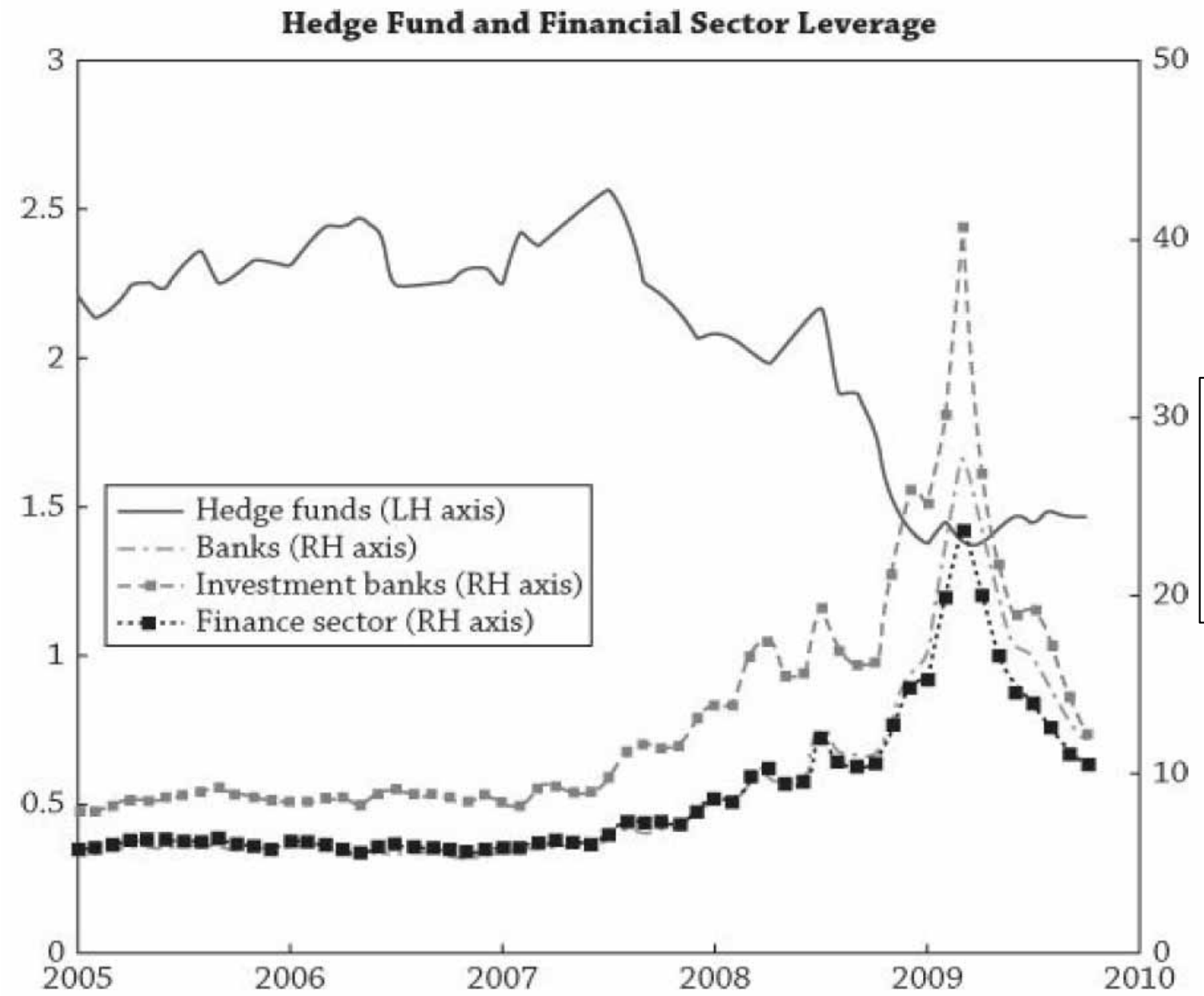
Exhibit 2: Hedge funds have raised net and gross exposures above 2016 averages
as of February 14, 2017



Source: Goldman Sachs Prime Services Weekly and Goldman Sachs Global Investment Research.

What Determines Capital Flows to Hedge Funds?

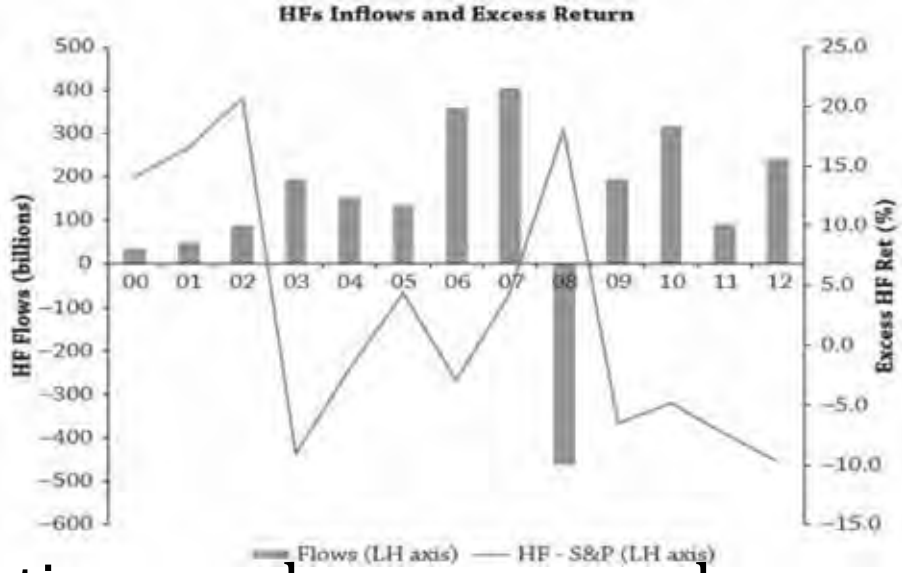
- HF leverage is counter-cyclical to the leverage of investment banks



Ang, A. (2014). *Asset management: A Systematic Approach to Factor Investing*. Oxford University Press.

What Determines Capital Flows to Hedge Funds?

- Interestingly, we do not know much about how the cross-sectional distribution of leverage affects HF performances
- Motivated by the idea that active fund managers may face decreasing returns to scale, a number of papers have examined the relation between fund size (its growth) and performance
- Early studies find that flows are increasing in fund performance (not always a smart idea) and managerial incentives, similar to MFs
- Flows have a negative relation with share restrictions, see Agarwal, Daniel, and Naik (2004)
- Recent research continues to find that past performance is a determinant of flows but recognizes that relation may be more complex
- Getmansky (2012, QJF) finds a positive and concave relation btw. past returns and current flows; she also finds negative relations between age and fund flows, and between volatility and flows



What Determines Capital Flows to Hedge Funds?

Table 1: Literature Summary, Performance Impact on Future Capital Flow

Authors	Period Covered	Data Source	Fund Universe	Performance-Flow Relationship
Goetzmann, Ingersoll, and Ross [2003]	Jan1990-Dec1995	Offshore Funds Directory	Hedge Funds	Negative
Agarwal, Daniel and Naik [2004]	Jan 1994- June 2000	HFR, TASS, and ZCM/MAR	Hedge Funds	Convex or Smile
Getmansky [2004]	Jan 1994- Dec 2002	TASS	Hedge Funds	Concave or Frown
Fung, Hsieh, Naik and Ramadorai [2006]	Jan 1995- Dec 2004	HFR, TASS, and CISDM	Funds of Hedge Funds	Not Convex
This Paper, XICI [2007]	Jan 1995- Dec 2006	Morningstar, TASS	Funds of Hedge Funds	Almost Linear

** Papers are listed in the order of publication.*

Table 2: Literature Summary, Asset Size Impact on Performance

Authors	Period Covered	Data Source	Fund Universe	Size - Performance Relationship
Liang [1999]	Jan 1992 – Dec 1996	HFR	Hedge Funds	Positive
Gregoriou and Rouah [2003]	Jan 1994 – Dec 1999	204 hedge funds and 72 funds of hedge funds	Hedge Funds & Funds of Hedge Funds	No correlation
Hedges [2003]	Jan 1995-Dec 2001	268 Hedge Funds	Hedge Funds	Small Funds are the Best, Medium ones the Worst
Amenc and Martellini	1996 - 2002	CISDM	Hedge Funds	Positive
Getmansky [2004]	Jan 1994 – Dec 2002	TASS	Hedge Funds & Funds of Hedge Funds	Mostly Concave
Ammann and Moerth	Jan 1994 – April 2005	TASS	Hedge Funds	Concave or Frown
Ibbotson and Chen [2006]	Jan 1995 – April 2006	TASS	Hedge Funds	Positive
This Paper, XICI [2007]	Jan 1995- Dec 2006	Morningstar, TASS	Funds of Hedge Funds	Largely Concave or Frown

** Papers are listed in the order of publication.*

What Determines Capital Flows to Hedge Funds?

- Baquero and Verbeek (2009) explore the flow-performance relationship by separating inflows/outflows in a model with regimes
- They find a weak positive response of fund inflows to past performance at quarterly horizons but a strong positive response of outflows to past performance; a pattern reversed at annual horizon
- Teo (2011, JFE) finds that for liquid HFs, funds with high net inflows subsequently outperform funds with low net inflows by 4.79% per year after adjusting for risk
- He defines liquid funds as those allowing monthly or less than-monthly redemptions
- Fung, Hsieh, Naik, and Ramadorai (2008) find that α-producing FoF experience greater and steadier inflows than non- α producers
- Getmansky, Liang, Schwarz, and Wermers (2015) study the effect of share restrictions on inflows/outflows and performance
- There is a convex flow-performance relation in the absence of share restrictions (similar to MFs), but a concave relation in the presence of restrictions

What Determines Capital Flows to Hedge Funds?

- Ter Horst and Salganik (2014, JBF) examine capital inflows at both the strategy- and fund- levels
- Capital flows to the highest-performing strategies and funds within in each strategy generating the best performance experience incrementally higher flows than other funds in the same strategy
- They find that allocating capital to well-performing strategies is only a successful allocation criterion when it is combined with allocating capital to top performers within a strategy
- Agarwal, Green, and Ren (2018, JFE) run a performance-flow horserace between the alphas from different multifactor models to find that the CAPM alpha wins the race, suggesting that investors pool the returns from other systematic risks together with alphas
- They examine how investors respond to returns arising from manager skill (alpha), conventional risk exposures such as market, size, and book-to-market, and nonstandard risk exposures including momentum, option-like investments, macro uncertainty, and liquidity (exotic betas)

What Determines Capital Flows to Hedge Funds?

- While investors respond to all three return components, they place greater emphasis on the returns driven by exotic betas

coefficient in parentheses.

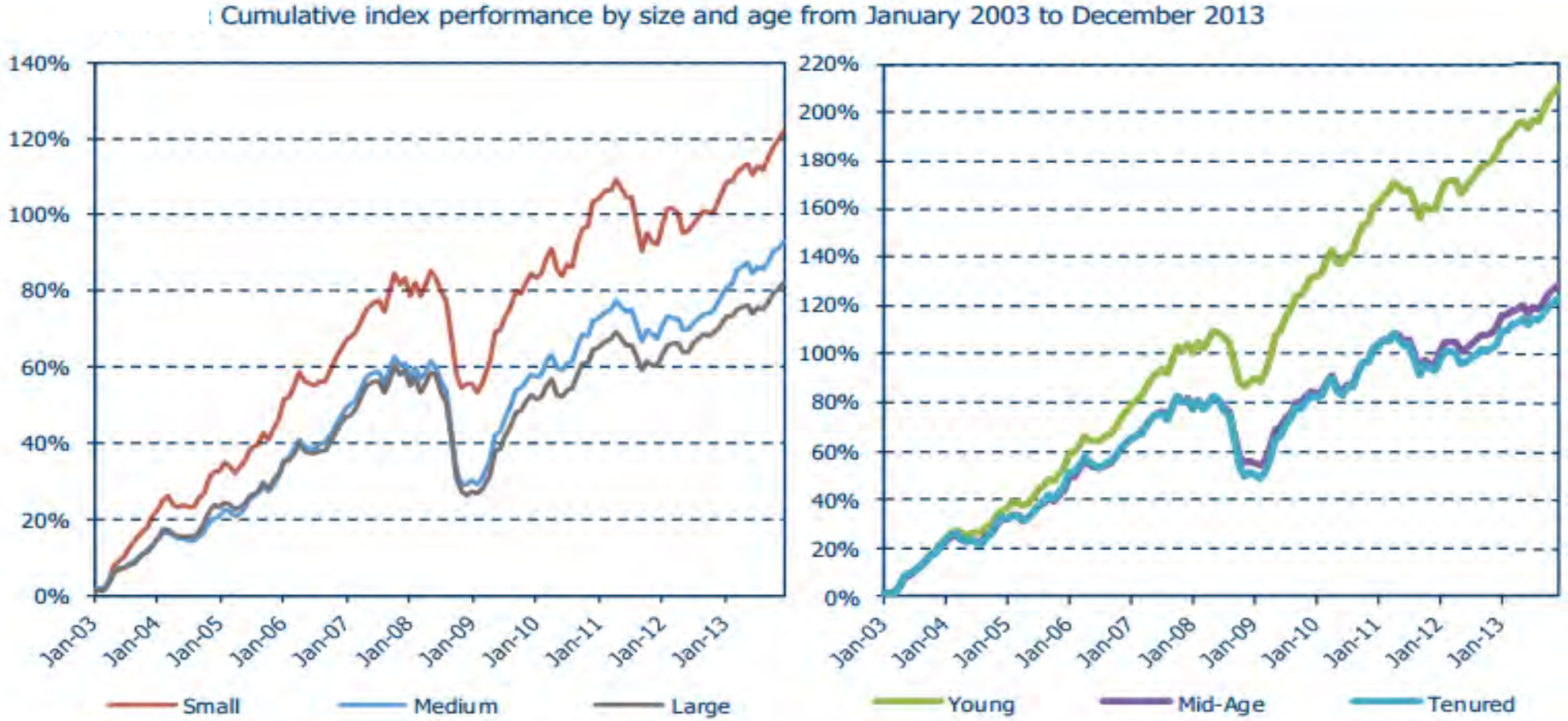
	Overall (1996-2012)	Sub-period 1 (1996-2004)	Subperiod 2 (2005-2012)
	S (Flow)	S (Flow)	S (Flow)
S (CAPM alpha)	61.14%	64.14%	59.48%
	(0.0000)	(0.0000)	(0.0000)
S (FF3 alpha)	59.00%	62.01%	57.32%
	(0.0000)	(0.0000)	(0.0000)
S (Carhart4 alpha)	59.81%	62.51%	58.29%
	(0.0000)	(0.0000)	(0.0000)
S (AN alpha)	57.45%	61.64%	55.10%
	(0.0000)	(0.0000)	(0.0002)
S (FH7 alpha)	59.21%	62.22%	57.96%
	(0.0000)	(0.0000)	(0.0000)
S (12-factor alpha)	56.06%	58.66%	54.02%
	(0.0000)	(0.0000)	(0.0046)
S (Max R^2 alpha)	54.85%	56.53%	53.11%
	(0.0000)	(0.0000)	(0.0082)
N	71,117	71,117	71,117

Are Small or Big Funds Better?

- Their findings suggest that HF investors may be viewing returns from exotic beta as alpha
- Traditionally the relation btw. HF size and performance was mixed
  - Liang (1999, FAJ) finds a positive relation between size and performance ⇒ economies of scale
  - Brown, Fraser, and Liang (2008, JIM) find that larger FOFs outperform smaller FOFs and suggest that this outperformance can be attributed to economies of scale with respect to due diligence
  - In contrast, Agarwal, Daniel, and Naik (2004), and Fung et al. (2008, JF) find evidence of decreasing returns to scale
- Since then, researchers have generally found that fund performing is negatively related to size and suggest that the decreasing returns to scale managers experience outweigh any economies of scale, consistently with Berk and Green (2004, JPE)
- Joenväärä, Kosowski, and Tolonen (2014) study the size performance relation and confirm previous findings that the relation between size and past (future) performance is positive (negative)

Can Investors Pick? The Smart Money Effect

- They also find support for decreasing returns to scale as well as for the idea that managers seek to increase fund size since their compensation increases with fund size



- Size relates to funds' capacity, the maximum assets that a HF can manage before performance starts to deteriorate or the maximum number of people that a HF may want to employ

Can Investors Pick? The Smart Money Effect

- Not all boutique HF managers want their businesses to grow into substantial companies with the operational, political, and bureaucratic characteristics typical in such companies
- For many managers, performance often degrades once assets grow beyond a certain level
- The reason is simple: slippage (also called friction)
- Slippage is defined as the degree to which market prices are moved through the process of entering or exiting a position

- The larger the position, the greater the effect of slippage
- Recent research has examined the relation between investor flows and HF future performance to detect a smart money effect

Can Investors Pick? The Smart Money Effect

- Ozik and Sadka (2014, JFQA) find that managers' capital withdrawals forecast future poor performance ⇒ insiders' flows contain information about funds' future performance

	Personal Investment				Personal Investment	High Personal Investment
	Zero (N = 1,242)	Positive (N = 440)	Low (N = 220)	High (N = 220)	minus Zero Personal Investment	minus Low Personal Investment
F1	-0.19%	-0.33%	0.06%	-0.36%	-0.14%	-0.43%
	[-2.18]	[-1.75]	[0.24]	[-1.57]	[-0.72]	[-1.11]
F5	0.18%	0.62%	0.43%	0.58%	0.45%	0.15%
	[2.37]	[3.33]	[1.65]	[2.21]	[2.69]	[0.37]
F5 - F1 Return	0.37%	0.96%	0.37%	0.95%	0.58%	0.57%
	[3.39]	[4.17]	[1.16]	[3.09]	[2.58]	[1.18]
Alpha	0.39%	0.97%	0.23%	1.03%	0.58%	0.80%
	[3.90]	[4.20]	[0.71]	[3.33]	[2.49]	[1.62]

- Jorion and Schwarz (2015) find evidence that funds receiving higher inflows have higher future performance and a lower prob. of failure; however, they do not find evidence that outflows predict poor performance or fund failure (asymmetric smart money effect)

Are Small or Big Funds Better?

- Dichev and Yu (2011, JFE) estimate the returns investors actually earn and compute dollar-weighted returns, reflecting that investors allocate their capital among different funds at different times
  - This measure is a more accurate reflection of the true benefits of investing in hedge funds
- Risk-adjusted dollar-weighted returns turn out to be 3 to 7 percent lower than average buy-and-hold fund returns, and the true alpha earned by investors is found to be nearly zero
- Absolute dollar-weighted returns are slightly higher than risk-free

Panel A: Portfolio returns for all funds

	# of funds	Buy-and-hold return (a)	Dollar-weighted return (b)	Difference (a) - (b)	p-value†
All funds	10,954	0.126	0.060	0.066	0.012
Early periods (1980–1994)	1,232	0.164	0.117	0.048	0.184
Later periods (1995-2008)	10,923	0.086	0.058	0.029	0.003
Excluding 2008 (1980-2007)	10,744	0.138	0.097	0.041	0.068
Excluding backfilled years*	5,888	0.117	0.067	0.050	0.030
Excluding first 12 months of returns (Teo 2009)	10,358	0.124	0.057	0.067	0.024

Are Small or Big Funds Better?

- From 1980 to 2007, the HF industry underperformed the S&P 500, with returns of 9.7% compared to 13.1% for the stock index
- Including the following year, 2008, takes things from bad to atrocious: HF returns from 1980 to 2008 were 6.0% compared to 10.9% returns for the S&P 500 over the same time period
- The 6.0% HF return barely beats the T-bill return of 5.6%

Ang, A. (2014). *Asset management: A Systematic Approach to Factor Investing*. Oxford University Press.

Are Small or Big Funds Better?

- Ramadorai (2013, JFE) uses the secondary market transactions to overcome some of the limitations of prior studies
  - Because these transactions do not affect fund size, he is able to circumvent the endogenous relation btw. fund size and performance
- He confirms the existence of a negative relation between size and future performance, and a negative relation between capital flows and future performance, i.e., the absence of smart money effect
- The lucrative nature of HFs makes entering the industry an attractive proposition for successful money managers
- Opponents of this practice argue that managers have incentives to direct their best investment ideas away from MFs to HFs to earn incentive fees from superior performance
- Proponents argue that allowing successful MF managers to start a HF is a mechanism by which the MF industry can retain its talent
- Chen and Chen (2009, JBF) find that MF managers take more risk and generate better performance for both types of funds managed

Concurrent Hedge and Mutual Fund Management

- In contrast, when a HF manager starts a MF, HF managers reduce risk in both types of funds
- Nohel, Wang, and Zheng (2010, RFS) find that MFs affiliated with HFs outperform their peers while HF managers starting MFs struggle to attain the performance level of their peers

	Sharpe Ratio		4-Factor Alpha	
	Mean	Median	Mean	Median
Side-by-Side Funds	0.139*** (0.00)	0.155*** (0.00)	0.044% (0.22)	0.033% (0.31)
Funds with Same Investment Objectives	0.108*** (0.00)	0.103*** (0.00)	-0.087%*** (0.00)	-0.085%*** (0.00)
Performance Difference (Average across funds)	*0.032*** (0.00)*	*0.040*** (0.00)*	*0.132%*** (0.00)*	*0.080%*** (0.00)*
Performance Difference (average across managers)	*0.026*** (0.00)*	*0.033*** (0.00)*	*0.076%** (0.04)*	*0.045%* (0.06)*

Concurrent Hedge and Mutual Fund Management

- Cici, Gibson, and Moussawi (2010, JFI) find opposite result, side-by-side MFs' performance is lower than MFs not affiliated with HFs
- MFs affiliated with HFs underperform most when the two fund types' investment styles are more closely related
- Deuskar, Pollet, Wang and Zheng (2011, RFS) find MFs can retain successful managers by allowing them to launch HFs, while un-successful ones leave MFs to manage small HFs but underperform

THE TOP TWENTY MANAGERS

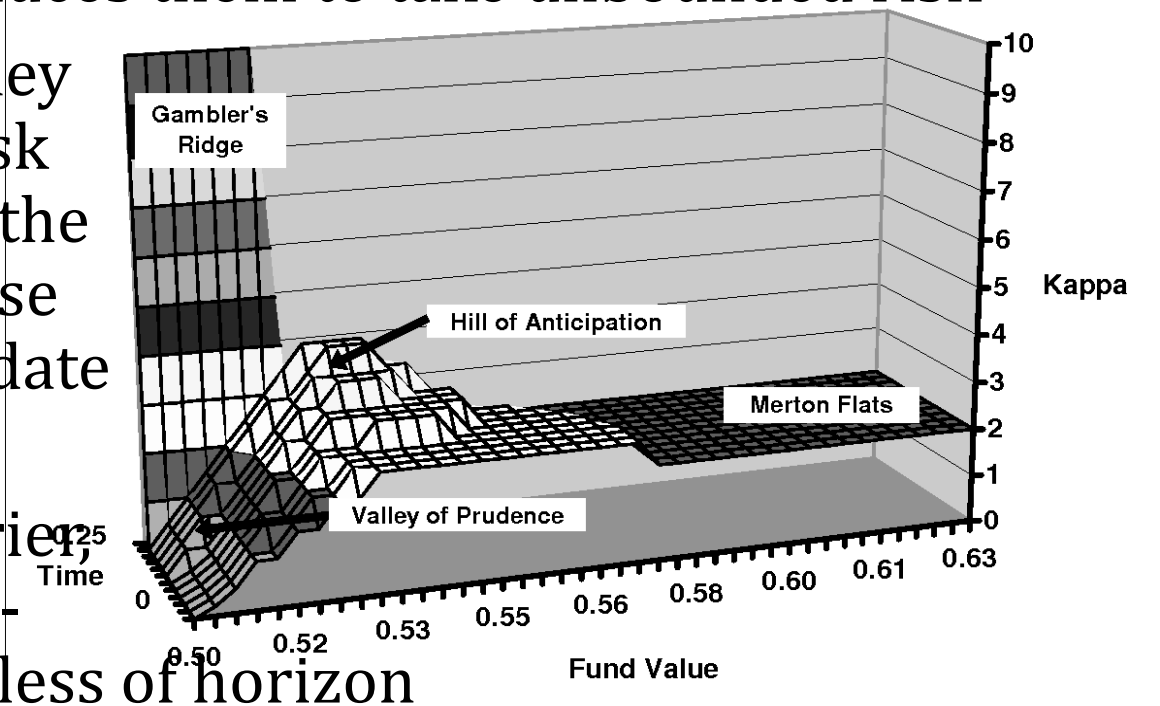
The Top Twenty Hedge Fund Managers
by Net Gains (after fees) Since Inception to 31 December 2016

2015 Ranking	2016 Ranking	Firm	Founder/Manager(s)	AUM ($bn)	Net Gains since inception ($bn)	Net Gains in 2016 ($bn)	Year of Inception
1	1	Bridgewater	Ray Dalio	117.8	49.4	4.9	1975
2	2	Soros Fund Management	George Soros	26.0	41.8	(1.0)	1973
n/a	3	DE Shaw	David Shaw / team	27.0	25.3	1.2	1988
4	4	Baupost	Seth Klarman	31.0	25.3	2.7	1983
n/a	5	Citadel	Ken Griffin	24.1	25.2	1.0	1990
3	6	Appaloosa	David Tepper	15.8	23.5	0.7	1993
14	7	Och Ziff	Daniel Och	33.5	23.1	1.1	1994
6	8	Lone Pine	Steve Mandel	26.3	22.2	(0.1)	1996
5	9	Viking	Andreas Halvorsen	27.8	22.0	(0.6)	1999
9	10	Elliott Associates	Paul Singer	31.3	21.8	3.3	1977
8	11	SAC/Point 72	Steve Cohen	11.1	19.8	0.1	1992
11	12	Farallon	Tom Steyer / Andrew Spokes	19.3	18.9	1.2	1987
7	13	Paulson & Co	John Paulson	9.8	18.4	(3.0)	1994
10	14	Moore Capital	Louis Moore Bacon	13.6	18.4	0.4	1990
13	15	Brevan Howard	Alan Howard	16.7	18.4	0.5	2003
12	16	Millennium	Israel Englander	34.4	18.2	1.1	1989
15	17	Caxton Associates	Bruce Kovner / Andrew Law	8.0	15.7	0.5	1983
16	18	King Street Capital	Brian Higgins, Francis Biondi	19.0	14.6	1.1	1995
20	19	Tudor Investment Corp	Paul Tudor Jones	9.1	13.5	0.0	1986
n/a	20	Two Sigma	John Overdeck, David Siegel	32.0	13.1	1.1	2002
			TOTAL OF TOP 20	535.6	448.7	16.1	
			TOTAL OF ALL MANAGERS	3,043.0	957.0	122.0	

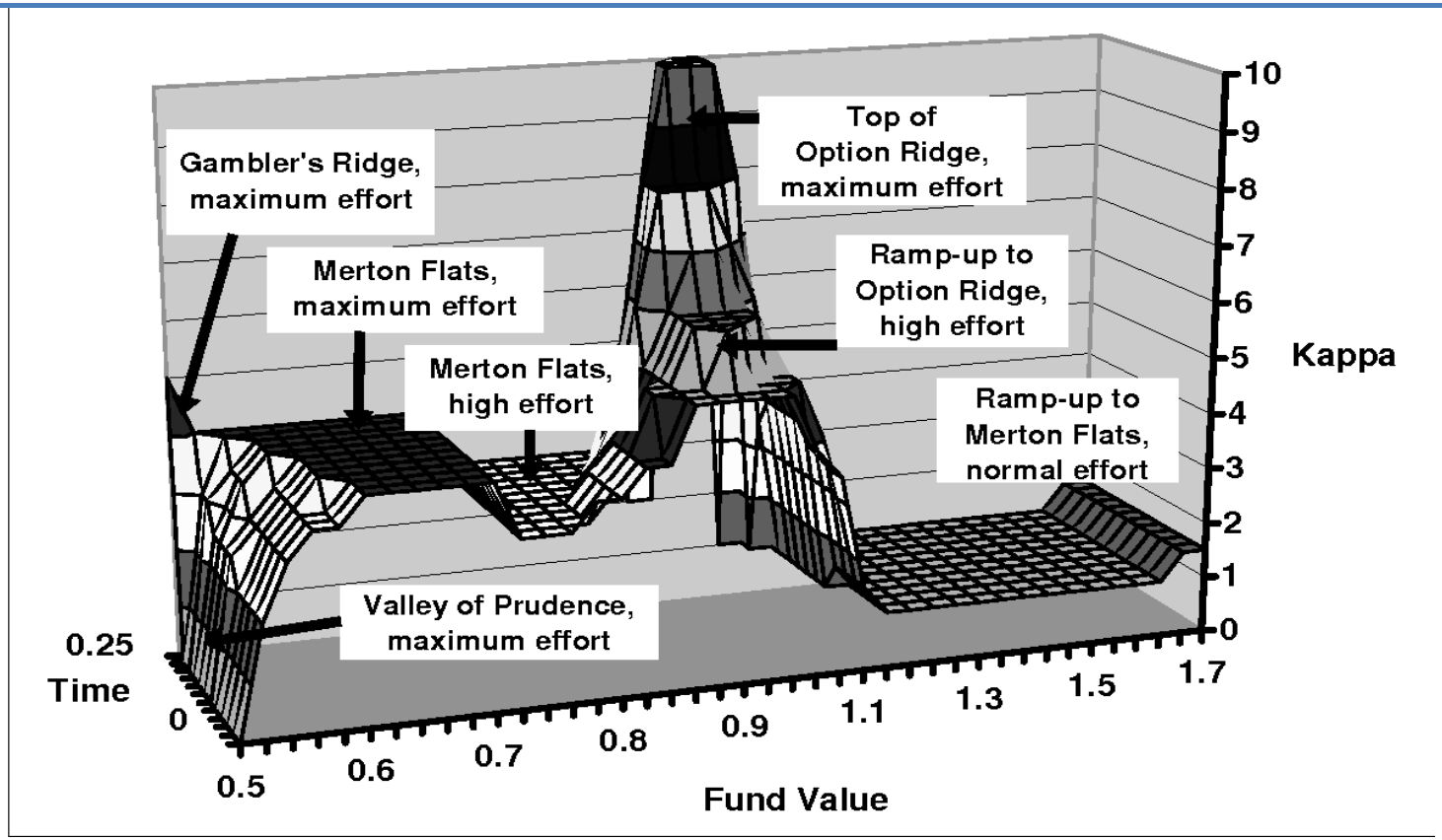
Source: LCH Investments NV estimates; eVestment

Hedge Funds' Gambling Bias

- A HF manager's incentive fee contract is a portfolio of call options
- Intuitively, managers can increase the value of these options by increasing the volatility of their funds
- The conclusions on whether managers take unlimited risk because of their compensation structures depends on the assumption on managers' tenure, see Hodder and Jackwerth (2007, JFQA)
- When managers have short horizons, the convexity of their compensation contracts induces them to take unbounded risk
- When the horizon grows, they are less likely to increase risk because doing so increases the probability that fund will lose value and be forced to liquidate
- However, when ptf. value is close to the liquidation barrier, the manager chooses to drastically increase risk regardless of horizon



Hedge Funds' Gambling Bias



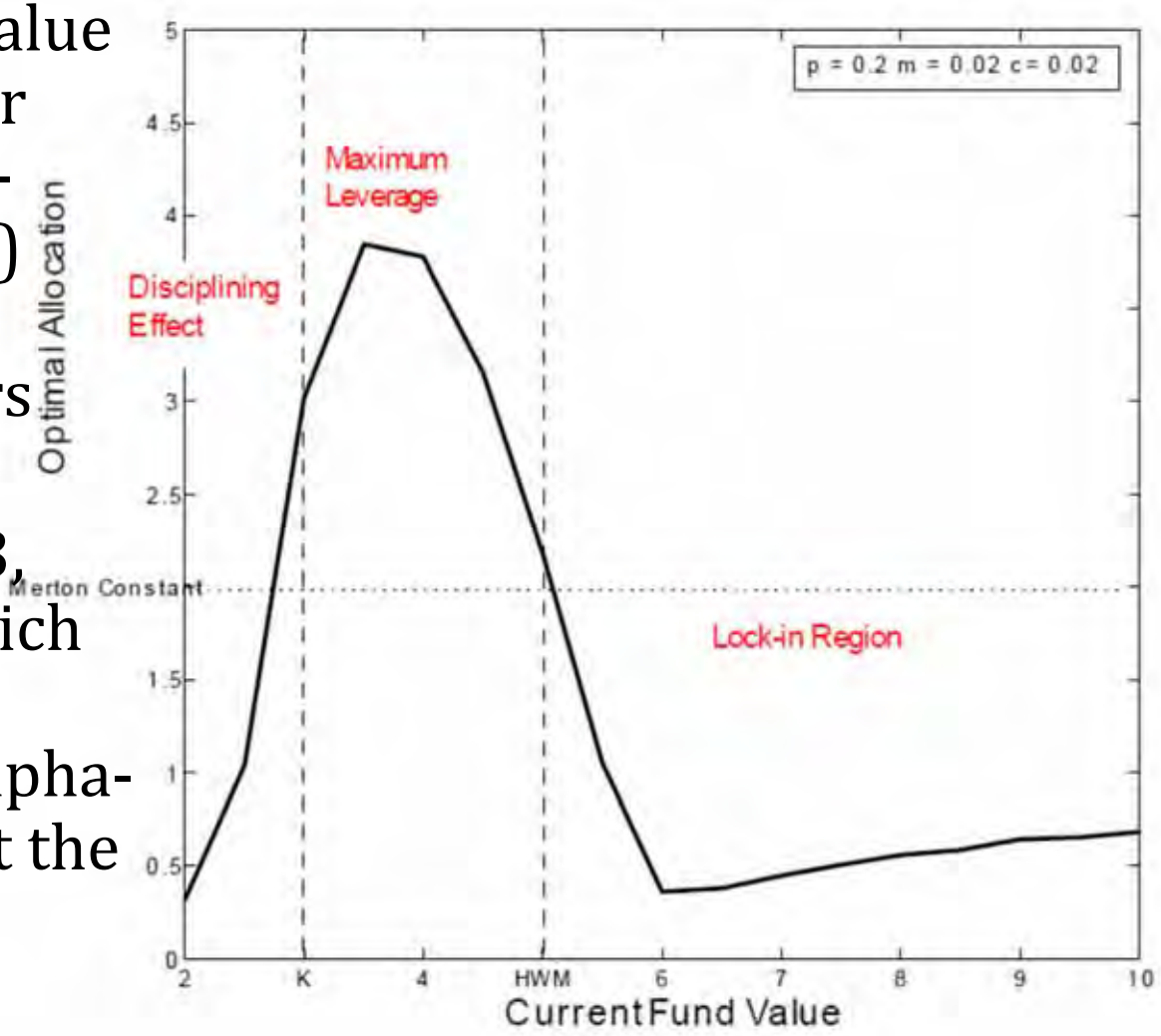
- Kouwenberg and Ziemba (2007, JBF) indicate that risk-taking behavior is dampened significantly when a manager invests a substantial fraction (more than 30%) of his own money in the fund
- Aragon and Qian (2010) develop a competitive equilibrium model of the HF industry: high-water mark contracts are optimal in the presence of asymmetric information about managers' skill

Hedge Funds' Gambling Bias

- When share restrictions are high, highwater marks play a "certification" role as they are more costly for managers who are less likely to produce good performance
- The model's predictions are confirmed empirically as highwater mark contracts are more often used when asymmetric information is greatest (especially when managers have less of a reputation)
- Buraschi, Kosowski, and Sritrakul (2014, JF) endogenize the incentives to take risk (e.g., use leverage) after considering that while the manager's compensation acts as a long call option on the fund's performance, the ability of the prime broker and the equity investor to withdraw funding act as short put options
- Managers use the highest amount of leverage when fund value is just below the high-water mark and decrease that amount as the fund's value moves further above or below that point
- They use structural estimation to show that considering the endogenous decision to use leverage drastically impacts the estimation of hedge fund alphas, particularly for low-quality funds

Hedge Funds' Gambling Bias

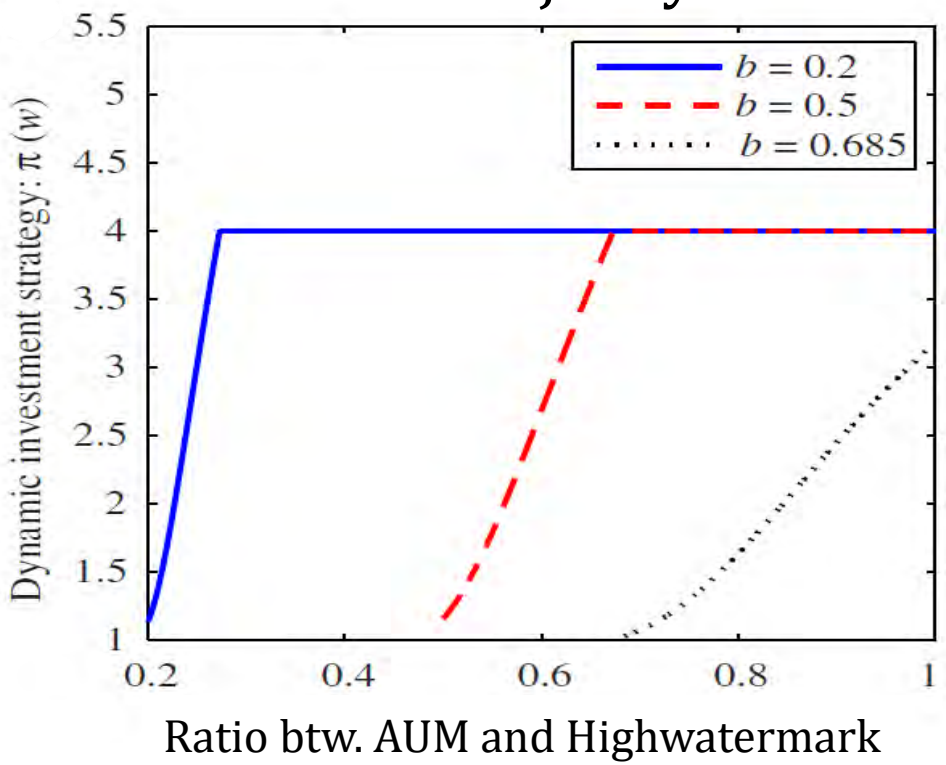
- The relation between HF value and risk-taking is nonlinear and depends on the distance btw. a fund's value and i) its high water mark and ii) the point at which investors withdraw their capital
- Lan, Wang, and Yang (2013, JFE propose a model in which HF managers trade off the benefits of leveraging on alpha-generating strategy against the costs of inefficient fund liquidation



- In contrast to the standard risk-seeking intuition, even with a constant-return-to-scale alpha-generating strategy, a risk-neutral manager becomes endogenously risk-averse and decreases leverage following poor performance to increase survival likelihood

Hedge Funds' Gambling Bias

- Money flows, managerial restart options, and management ownership increase the importance of high-water-mark-based incentive fees but management fees remain the majority
- The relation between HF value and risk-taking is nonlinear and depends on the distance btw. a fund's value and i) its high water mark and ii) the point at which investors with-draw their capital



- Aragon and Nanda (2012) examine risk shifting among HFs and show that tournament-style behavior is the best explanation for why fund managers increase volatility
- Funds that lag their peers and those that are below their previous year's net asset value are more likely to increase risk in the second half of the year to improve their chances of achieving a good return

How Can Hedge Funds Be?

- One of the most enduring challenges to the very existence of the HF industry is the Efficient Markets Hypothesis (EMH), the idea that market prices fully reflect all available information
- If the EMH holds, how can HFs earn "excess" expected returns
- One possible answer is that the EMH is false and HFs routinely exploit the departures from efficiency
  - This explanation does not account for the high failure rate in the HF industry, the capacity constraints that the most successful funds face, and the occasional periods of significant underperformance
- The other extreme is that EMH is true and HFs are simply taking on additional risk that have positive risk premia associated with them
  - Some empirical evidence for this view based on estimates of linear factor models for HF returns in which liquidity, credit, and volatility are statistically significant factors driving industry returns
  - HFs are «expensive», exotic beta (see Ang, 2014)
  - However, there are a number of inordinately successful managers that earn risk-adjusted returns even after controlling for such factors, including icons such as W. Buffett, D. Shaw, and G. Soros

How Can Hedge Funds Be?

- The theoretical foundations of the HF industry can be found in Grossman and Stiglitz (1980, AER): perfectly informationally efficient markets are an impossibility
- If markets are perfectly efficient, there is no profit to gathering information and there would be little reason to trade
- Alternatively, market efficiency is not a binary state but rather a continuum; the degree of market inefficiency determines the effort investors will expend to gather and trade on information
- Therefore, a non-degenerate equilibrium occurs only when there are sufficient profit opportunities, i.e., inefficiencies, to compensate investors for the costs of trading and information-gathering
- The profits earned by these industrious investors, here called HFs, are not free lunches, but the "economic rents"
- Who are paying these rents? Black (1986, JF) provides the answer: "noise traders", individuals who trade for non-informational reasons such as liquidity needs, ptf rebalancing trades, or misin-formation

How Can Hedge Funds Be?

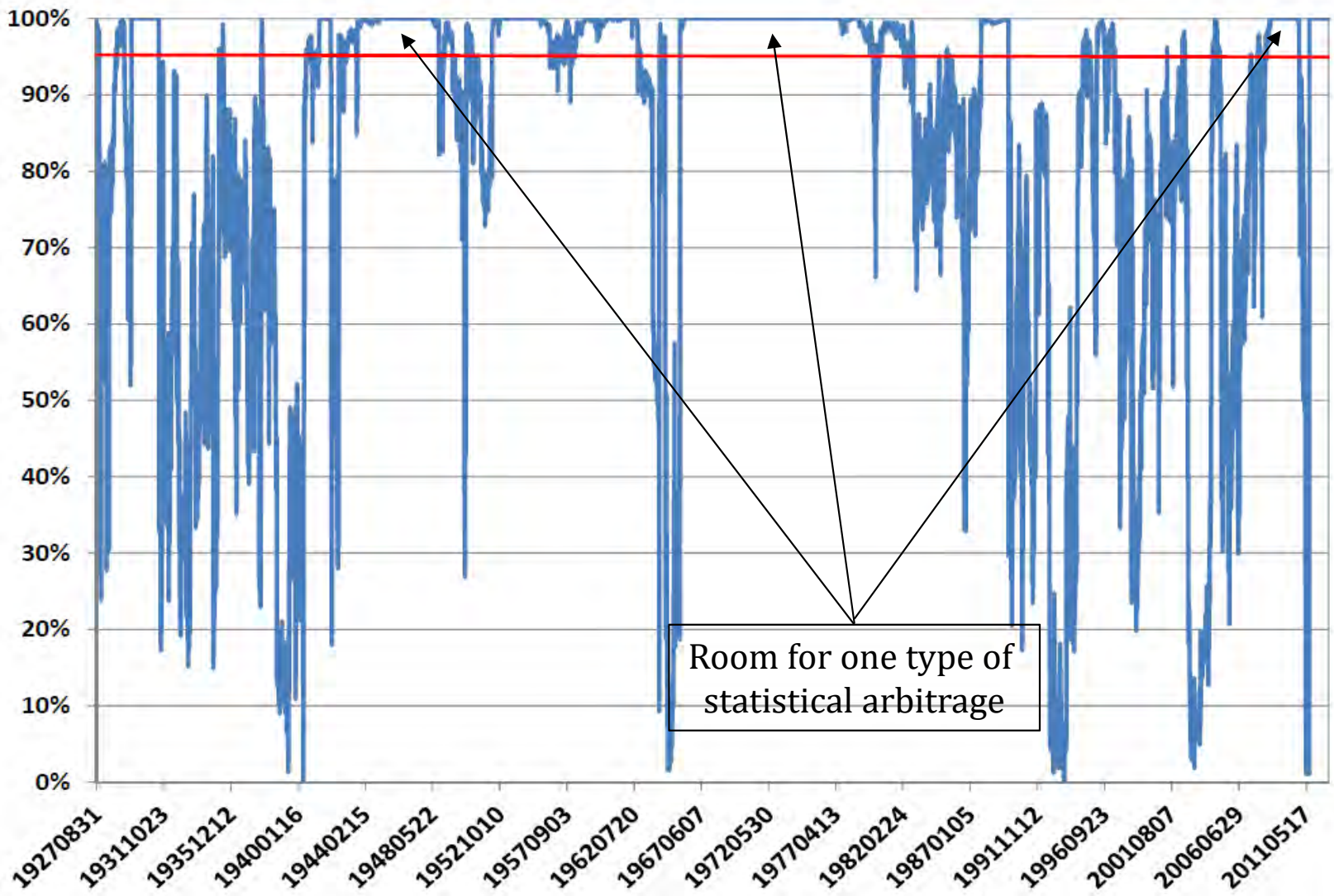


Figure 10: 500-day rolling-window statistical significance ($1-p$-value) of the Ljung-Box Q-statistic for autocorrelation in daily CRSP Value-Weighted Index returns using the first five autocorrelation coefficients, from August 31, 1927 through December 31, 2014. The red line denotes 95% significance, hence all realizations above this line are significant at the 5% level.

How Can Hedge Funds Be?

- There is yet another story for successful HFs and, hence, for the success of the HF industry: a systematic, priced effect of behavioral biases, in particular of overconfidence
- Experiments reveal that individuals are consistently poor assessors of probabilities
  - They use a variety of heuristics to estimate probabilities that can lead to biases (Tversky and Kahneman ,1974, Psych Bull) that are not random but instead correlated across subjects
  - People agree which particular player has a "hot hand" (Gilovich, Valone, and Tversky, 1985, Cogn Psycg), and they see the same nonexistent patterns in artificially generated as in real stock prices
- Experts and novices alike are too certain about their predictions given the true odds of being wrong
- Overconfidence in the precision of one's estimate does not arise from lack of concern by subjects for accuracy of their distributions
  - Students were more overconfident when their performance was linked to grades than when it was not
  - Overconfidence gets worse when the difficulty of the task increases

How Can Hedge Funds Be?

How Can Hedge Funds Be?

- Overconfidence in the precision of one's estimate is likely to become more extreme over time as those who succeed attribute success to own skill and judgment: "Heads I win, tails it's chance."
- In asset markets, the richest individuals may well be those who placed large bets on very risky gambles and won, like HFs do
  - This may occur directly or as former traders and investment bankers use their wealth and connections to open HFs
- Their success would naturally tend to reinforce their confidence in their own hunches whether or not such confidence is justified
- This psychological literature provides suggestive hints of how noise traders might tend to behave
- First, perceptions of risks and opportunities might well be strongly correlated across agents, and might depend on past patterns of prices and volume in not very rational ways
- Second, noise traders might fail to accurately assess expected returns although it is hard to predict in what direction any systematic bias might lie