HEDGE FUND RESEARH

selected research papers
and their key findings

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Fung & Hsieh (2004) - Hedge Fund Benchmarks: A Risk-Based Approach

(Financial Analysts Journal)

Recall the Basic Fung and Hsieh factors

Table 2. Average Exposure of Indexes to the ABS Risk Factors, Data for 1994–2002
(standard errors in parentheses)

Factor	HFRI	CTI	TASSAVG	MSCI
Intercept	0.00660	0.00730	0.00780	0.00942
	(0.00102)**	(0.00191)**	(0.00100)**	(0.00092)**
S&P	0.36852	0.27075	0.29167	0.22991
	(0.02292)**	(0.04280)**	(0.02236)**	(0.02074)**
SC–LC	0.33075	0.24496	0.25882	0.21806
	(0.02895)**	(0.05406)**	(0.02824)**	(0.02620)**
10Y	–0.50809	–3.54883	–1.06047	–0.88658
	(0.52170)	(0.97428)**	(0.50905)**	(0.47222)*
CredSpr	–1.09738	–4.05286	–1.60482	–0.34130
	(0.95076)	(1.77556)**	(0.92770)*	(0.86058)
BdOpt	–0.00855	–0.03014	–0.00417	–0.00157
	(0.00583)	(0.01089)**	(0.00569)	(0.00528)
FXOpt	0.00512	0.01225	0.01238	0.01631
	(0.00534)	(0.00998)	(0.00521)**	(0.00483)**
ComOpt	0.00927	0.03048	0.02067	0.01776
	(0.00831)	(0.01552)*	(0.00811)**	(0.00752)**
R^2	0.84	0.48	0.73	0.67

Note: Factor definitions in Table 1.

*Significant at the 5 percent level in a one-tailed test.
**Significant at the 1 percent level in a one-tailed test.

Fung & Hsieh (2004) - Hedge Fund Benchmarks: A Risk-Based Approach
(Financial Analysts Journal)

- Seven-factor model:
  - S&P 500
  - SMB (Wilshire SC 1750 – Wilshire LC 750)
  - Monthly change in 10-year Treasury Yield
  - Monthly change in the difference between Baa and 10-year Treasury yield
  - Return on a lookback straddle portfolio on:
    - Bond futures
    - Currency futures
    - Commodity futures
- Regressing the model on HFR Funds of Hedge Funds (FoHFs) index
  - Aiming to avoid the problems in HF databases
- The sample period includes two breakpoints in the risk factor exposures:
  - March 2000: the peak of the Internet bubble
  - September 1998: the LTCM debacle
  - The risk exposures change between the periods
    - Especially in the intercept which suggests that most of the alpha was generated during a bull market (insignificant alphas for the two crisis periods)

Table 1. Regression of the HFRFOF on Seven Hedge Fund Risk Factors
(standard errors in parentheses)

Factor	1/1994–12/2002	1/1994–9/1998	4/2000–12/2002
Intercept	0.00477	0.00192	0.00212
	(0.00128)**	(0.00176)	(0.00133)
S&P	0.21533	0.32426	0.17300
	(0.02873)**	(0.04539)**	(0.02938)**
SC–LC	0.22561	0.17794	0.14972
	(0.03629)**	(0.06628)**	(0.03633)**
10Y	–1.56445	–1.11718	–2.70801
	(0.65403)**	(0.94950)	(0.63269)**
CredSpr	–2.96390	–6.66498	–2.13051
	(1.19194)**	(2.24776)**	(0.98164)*
BdOpt	–0.01529	–0.01057	–0.00682
	(0.00731)*	(0.01064)	(0.00601)
FXOpt	0.00703	0.00655	0.00313
	(0.00670)	(0.00741)	(0.00692)
ComOpt	0.01903	0.02719	0.03563
	(0.01042)*	(0.01382)*	(0.01280)**
R^2	0.55	0.69	0.80

Notes: *S&P* = Standard & Poor's 500 stock return; *SC–LC* = Wilshire Small Cap 1750 – Wilshire Large Cap 750 return; *10Y* = month-end to month-end change in the U.S. Federal Reserve 10-year constant-maturity yield; *CredSpr* = month-end to month-end change in the difference between Moody's Baa yield and the Federal Reserve's 10-year constant-maturity yield; *BdOpt* = return of a portfolio of lookback straddles on bond futures; *FXOpt* = return of a portfolio of lookback straddles on currency (foreign exchange) futures; *ComOpt* = return of a portfolio of lookback straddles on commodity futures.

*Significant at the 5 percent level in a one-tailed test.
**Significant at the 1 percent level in a one-tailed test.

Edelman, Fung, Hsieh & Naik (2012) – Funds of hedge funds: performance, risk and capital formation 2005 to 2010 (Financial Markets and Portfolio Management)

- Essentially adding an emerging market equity factor to the Fung & Hsieh (2004) and evaluating the model over a more recent sample period 2005-2010
  - IFC Emerging Market Index
- Studying funds of hedge funds due to the problems in HF databases
- The EM Index becomes a dominant factor for the studied period when included
  - With the original model the dominant factors are equity market and default spread
- Two breakpoints in the sample period:
  - July 2007: start of the subprime crisis
    - Prior dominant factors: EM, SMB, 10-year Treasury yield change, default spread
    - During the crisis: default spread
  - March 2009: the end of the crisis
    - Dominant factors after the crisis: equity market

- The proportion of HFs generating alpha decreases over time:
  - Over the sample period about 2% FoHFs produce significant alpha
  - The level of alpha remains stable, just the volume of funds decreases

Table 2 *The risks of funds-of-hedge-funds during 2005–2010.* The top panel of this table contains estimates: $R_t = \alpha_t + \beta X_t + \varepsilon_t$, where X_t = [SNPMRF$_t$ SCMLC$_t$ BD10RET$_t$ BAAMTSY$_t$ PTFSBD$_t$ PTFSFX$_t$ PTFSCOM$_t$] for the seven-factor model used in FHNR (2008), X_t = [SNPMRF$_t$ SCMLC$_t$ BD10RET$_t$ BAAMTSY$_t$ PTFSBD$_t$ PTFSFX$_t$ PTFSCOM$_t$ IFCMRF$_t$] for the eight factor model and X_t = [CSLAB] for the robustness check model. The regressors X are as described in Sect. 3.1 of the text and the regression is estimated over the whole sample period from January 2005 to December 2010 (72 months). Standard errors are in square brackets estimated using Newey and West (1987). Statistical significance at 1, 5, and 10 percent levels is denoted by ***, ** and * respectively

Constant	0.0017	−0.0003	
SNPMRF	0.2003 [0.0327]***	0.0095 [0.0451]	
SCMLC	−0.0395 [0.0062]	−0.0437 [0.0605]	
BD10RET	−0.0803 [0.0685]	−0.1068 [0.0607]*	
BAAMTSY	0.2177 [0.0684]***	0.1304 [0.0731]*	
PTFSBD	−0.0139 [0.0142]	−0.0125 [0.0115]	
PTFSFX	0.0023 [0.0086]	0.0009 [0.0058]	
PTFSCOM	0.005 [0.0111]	0.0012 [0.0093]	
IFCMRF		0.1738 [0.0257]***	
Observations	72	72	72
Adjusted R-sq.	0.55	0.69	0.71

Edelman, Fung, Hsieh & Naik (2012) – Funds of hedge funds: performance, risk and capital formation 2005 to 2010 (Financial Markets and Portfolio Management)

Table 3 *The changing risks of funds of hedge funds*. The panel below contains estimates of the following regresson: $R_t = \alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3 + (D_1 X_t)\beta_{D1} + (D_2 X_t)\beta_{D2} + (D_3 X_t)\beta_{D3} + \varepsilon_t$ where $X_t = [\text{SNPMRF}_t\ \text{SCMLC}_t\ \text{BD10RET}_t\ \text{BAAMTSY}_t\ \text{PTFSBD}_t\ \text{PTFSFX}_t\ \text{PTFSCOM}_t\ \text{IFCMRF}_t]$. Here, R_t is the (equally-weighted) average annualized excess return across all funds in month t, D_1 is set to one during the first period (January 2005 to June 2007) and zero elsewhere, D_2 is set to one during the second part (July 2007 to March 2009) and zero elsewhere, and D_3 is set to one during the third period (April 2009 to December 2010) and zero elsewhere. Standard errors are in square brackets estimated using Newey and West (1987). The results of Chow Structural Break test are reported below the regression estimates. The bottom panel contains estimates of Chow structural break test Chi-squared statistics. White heteroskedasticity-consistent standard errors are reported below the coefficients. Statistical significance at 1, 5, and 10 percent levels is denoted by ***, ** and *, respectively

8 factor model	Period 1	Period 2	Period 3
Constant	0.0044	−0.0026	0.0026
	[0.0019]**	[0.0052]	[0.0023]
SNPMRF	0.0842	0.0582	0.2018
	[0.0756]	[0.1141]	[0.0858]**
SCMLC	0.1356	−0.274	−0.0897
	[0.0611]**	[0.1613]	[0.0783]
BD10RET	−0.1679	−0.0079	−0.0573
	[0.0897]*	[0.2090]	[0.0758]
BAAMTSY	0.2371	0.3086	0.0545
	[0.1292]*	[0.1219]**	[0.0531]
PTFSBD	0.019	−0.0486	0.0092
	[0.0114]	[0.0450]	[0.0118]
PTFSFX	0.0008	−0.0041	0.0087
	[0.0079]	[0.0195]	[0.0225]
PTFSCOM	−0.0019	0.0129	−0.0069
	[0.0085]	[0.0265]	[0.0291]
IFCMRF	0.1635	0.1045	0.0289
	[0.0339]***	[0.0730]	[0.0685]
Observations	30	21	21
Adjusted R-squared	0.77	0.68	0.67

8 Factor	FOF	*p*-value
Test Period 1 and 2		
F(9, 33)	1.991	0.0726
Chi2(9)	17.9178	0.0361
Test Period 2 and 3		
F(9, 24)	1.1639	0.3604
Chi2(9)	10.4749	0.3134

The panel below of this table contains estimates of:
$R_t = \alpha_1 D_1 + \alpha_2 D_2 + \alpha_3 D_3 + (D_1 X_t)\beta_{D1} + (D_2 X_t)\beta_{D2} + (D_3 X_t)\beta_{D3} + \varepsilon_t$
where $X_t = [\text{CS LAB}]$.

Hasanhodzic & Lo (2007) – Can Hedge-Fund Returns Be Replicated?: The Linear Case (Journal of Investment Management)

- Five-factor model to replicate HF returns:
  - US Dollar Index
  - Lehman AA Intermediate Bond Index
  - Spread between Lehman BAA Corp Bond Index and Lehman Treasury Index
  - S&P 500
  - Goldman Sachs Commodity Index (GSCI)
  - First-difference of CBOE VIX
- Estimating both a static model over the sample and a 24-month rolling-window model
  - The static model offers a better fit but is affected by look-ahead bias
- Sample period: 2/1986-9/2005
- Low R^2s explained by the exclusion of non-linear factors (e.g. option strategies)
- Cloned strategies generally underperform the corresponding indices
  - Authors normalize the clone portfolios to have the same volatility as the corresponding HF time series

			Significance (%)				
Category	Sample size	Statistic	Min	Med	Mean	Max	SD
Convertible arbitrage	82	Adj. R^2	−11.0	16.0	17.3	66.2	15.4
		p(F)	0.0	1.0	11.8	97.1	23.6
Dedicated short bias	10	Adj. R^2	−3.5	39.7	40.4	79.5	25.4
		p(F)	0.0	0.0	8.3	83.0	26.2
Emerging markets	102	Adj. R^2	−4.7	17.4	19.4	54.7	14.3
		p(F)	0.0	0.2	8.4	78.8	17.7
Equity market neutral	83	Adj. R^2	−8.1	7.2	10.4	63.2	13.7
		p(F)	0.0	7.4	19.9	94.1	24.6
Event driven	169	Adj. R^2	−7.5	15.5	19.5	68.5	16.4
		p(F)	0.0	0.3	11.1	88.6	20.0
Fixed income arbitrage	62	Adj. R^2	−8.9	12.8	14.9	78.9	15.9
		p(F)	0.0	2.1	17.7	94.6	26.3
Global macro	54	Adj. R^2	−12.6	8.9	14.8	74.0	17.3
		p(F)	0.0	4.9	16.8	97.0	24.3
Long/Short equity hedge	520	Adj. R^2	−13.8	18.8	21.6	90.2	19.0
		p(F)	0.0	0.4	11.8	97.7	22.9
Managed futures	114	Adj. R^2	−6.0	13.3	15.3	70.0	13.3
		p(F)	0.0	0.6	8.2	88.5	17.0
Multi-strategy	59	Adj. R^2	−13.5	8.9	12.9	51.7	15.7
		p(F)	0.0	6.7	21.7	97.5	28.9
Fund of funds	355	Adj. R^2	−7.2	20.4	22.3	72.3	14.9
		p(F)	0.0	0.2	5.7	84.0	14.3

Hasanhodzic & Lo (2007) – Can Hedge-Fund Returns Be Replicated?: The Linear Case (Journal of Investment Management)

Table 5 Summary statistics for multivariate linear regressions of monthly returns of hedge funds in the TASS Live database from February 1986 to September 2005 on six factors: the S&P 500 total return, the Lehman Corporate AA Intermediate Bond Index return, the US Dollar Index return, the spread between the Lehman US Aggregate Long Credit BAA Bond Index and the Lehman Treasury Long Index, the first-difference of the CBOE Volatility Index (VIX), and the Goldman Sachs Commodity Index (GSCI) total return.

			Intercept					R_{sp500}					R_{lb}					R_{usd}				
Category	Sample size	Statistic	Min	Med	Mean	Max	SD	Min	Med	Mean	Max	SD	Min	Med	Mean	Max	SD	Min	Med	Mean	Max	SD
Convertible arbitrage	82	beta	−0.52	0.41	0.43	1.57	0.37	−0.63	−0.01	−0.02	0.45	0.15	−0.08	0.26	0.30	1.73	0.29	−0.98	0.01	−0.02	0.68	0.28
		t-stat	−1.56	2.12	4.55	83.10	11.35	−2.58	−0.14	0.06	7.65	1.53	−0.52	1.60	1.60	4.50	1.12	−2.23	0.15	0.12	2.91	1.22
Dedicated short bias	10	beta	−0.04	0.77	0.67	1.13	0.38	−1.78	−1.01	−0.88	−0.11	0.50	−0.60	0.18	0.25	0.96	0.48	−0.08	0.73	0.67	1.25	0.51
		t-stat	−0.12	0.73	0.91	1.83	0.66	−10.95	−3.29	−3.88	−0.48	2.72	−1.37	0.24	0.17	1.05	0.70	−0.19	1.26	1.07	1.99	0.77
Emerging markets	102	beta	−0.75	1.19	1.41	6.50	1.08	−0.41	0.31	0.43	3.30	0.52	−4.53	0.02	0.01	2.33	0.77	−4.66	−0.39	−0.42	2.18	0.79
		t-stat	−1.03	1.83	2.74	44.67	4.57	−1.77	1.69	1.65	5.46	1.61	−2.17	0.09	0.22	3.71	1.09	−3.74	−1.03	−0.97	2.53	1.20
Equity market neutral	83	beta	−0.61	0.59	0.59	2.42	0.41	−1.22	0.05	0.05	0.90	0.27	−1.16	0.05	0.02	0.82	0.33	−2.83	0.02	−0.04	1.24	0.44
		t-stat	−1.40	2.02	2.88	13.89	3.00	−4.86	0.75	0.65	4.16	1.98	−3.74	0.30	0.27	2.67	1.09	−4.17	0.08	0.16	3.65	1.39
Event driven	169	beta	−0.12	0.78	0.93	6.18	0.78	−0.35	0.08	0.13	1.17	0.22	−4.23	0.08	0.04	1.31	0.46	−6.38	−0.05	−0.13	1.46	0.60
		t-stat	−0.69	3.38	3.88	21.54	2.89	−2.80	1.26	1.34	10.87	1.88	−2.31	0.40	0.42	3.21	1.08	−2.86	−0.31	−0.14	3.40	1.35
Fixed income arbitrage	62	beta	0.00	0.52	0.58	2.03	0.42	−0.39	0.03	0.02	0.23	0.10	−0.55	0.20	0.27	1.86	0.40	−0.66	0.05	0.07	0.77	0.35
		t-stat	0.00	2.85	3.85	24.30	3.91	−2.42	0.55	0.44	3.23	1.25	−2.63	1.00	1.26	11.02	1.99	−3.48	0.38	0.66	4.62	1.68
Global macro	54	beta	−0.79	0.63	0.59	1.75	0.54	−0.49	0.01	0.10	1.14	0.30	−0.74	0.21	0.34	2.03	0.56	−2.00	−0.23	−0.23	1.35	0.67
		t-stat	−1.56	1.53	1.71	7.66	1.62	−2.97	0.19	0.59	6.16	1.84	−1.93	0.71	0.92	6.05	1.51	−6.51	−0.83	−0.73	4.52	1.95
Long/Short equity hedge	520	beta	−1.53	0.84	0.89	7.60	0.75	−1.37	0.33	0.38	3.13	0.44	−3.04	−0.01	0.03	3.49	0.59	−2.57	−0.03	−0.09	2.45	0.60
		t-stat	−1.80	1.84	1.86	10.47	1.38	−3.72	2.06	2.27	20.07	2.50	−3.47	−0.01	0.06	3.33	1.06	−4.60	−0.10	−0.19	3.41	1.18
Managed futures	114	beta	−1.84	0.48	0.42	3.69	0.73	−0.81	−0.01	0.03	2.30	0.37	−0.44	0.88	0.89	2.62	0.67	−2.65	−0.37	−0.39	1.14	0.63
		t-stat	−2.36	0.72	0.65	4.98	1.08	−2.94	−0.05	0.20	7.88	1.43	−1.70	1.46	1.60	4.34	1.22	−4.25	−0.83	−0.72	1.99	0.98
Multi-strategy	59	beta	−0.41	0.71	0.71	2.68	0.47	−0.31	0.07	0.15	1.34	0.26	−1.81	0.10	0.12	2.40	0.51	−1.84	0.07	0.01	0.78	0.41
		t-stat	−0.43	3.22	3.41	10.51	2.41	−2.22	1.27	1.37	5.98	1.68	−1.49	0.58	0.57	3.49	1.13	−2.78	0.36	0.39	3.19	1.34
Fund of funds	355	beta	−0.77	0.42	0.43	1.88	0.34	−0.80	0.09	0.12	0.85	0.15	−0.50	0.12	0.18	2.25	0.29	−1.12	−0.07	−0.10	0.62	0.24
		t-stat	−3.55	2.34	2.67	10.51	2.14	−2.65	1.56	1.84	9.44	1.80	−1.59	0.83	0.95	4.84	1.17	−3.63	−0.53	−0.42	3.32	1.28

Hasanhodzic & Lo (2007) – Can Hedge-Fund Returns Be Replicated?: The Linear Case (Journal of Investment Management)

Table 5 (*Continued*)

Category	Sample size	Statistic	R_{cs} Min	R_{cs} Med	R_{cs} Mean	R_{cs} Max	R_{cs} SD	ΔVIX Min	ΔVIX Med	ΔVIX Mean	ΔVIX Max	ΔVIX SD	R_{gsci} Min	R_{gsci} Med	R_{gsci} Mean	R_{gsci} Max	R_{gsci} SD	Statistic	Significance (%) Min	Med	Mean	Max	SD
Convertible arbitrage	82	beta	0.00	0.39	0.52	2.87	0.57	−0.25	0.05	0.05	0.32	0.08	−0.07	0.01	0.02	0.16	0.03	Adj. R^2	−11.0	16.0	17.3	66.2	15.4
		t-stat	0.19	3.06	2.95	7.72	1.58	−1.41	0.50	0.66	3.56	0.98	−1.15	0.52	0.51	2.17	0.69	p(F)	0.0	1.0	11.8	97.1	23.6
Dedicated short bias	10	beta	−0.98	−0.26	−0.19	0.93	0.67	−0.26	0.05	0.04	0.44	0.23	−0.38	−0.11	−0.12	0.06	0.13	Adj. R^2	−3.5	39.7	40.4	79.5	25.4
		t-stat	−2.67	−0.68	−0.44	2.54	1.64	−1.11	0.24	0.23	2.56	1.10	−2.19	−0.86	−0.95	0.54	0.92	p(F)	0.0	0.0	8.3	83.0	26.2
Emerging markets	102	beta	−0.56	0.46	0.59	2.89	0.67	−1.41	−0.05	0.01	3.91	0.50	−0.34	0.05	0.06	0.34	0.09	Adj. R^2	−4.7	17.4	19.4	54.7	14.3
		t-stat	−1.97	1.32	1.33	4.82	1.36	−3.95	−0.35	−0.28	3.88	1.17	−1.46	0.68	0.60	2.40	0.79	p(F)	0.0	0.2	8.4	78.8	17.7
Equity market neutral	83	beta	−1.78	−0.03	−0.06	0.72	0.31	−1.19	0.02	0.03	0.80	0.23	−0.12	0.01	0.02	0.38	0.07	Adj. R^2	−8.1	7.2	10.4	63.2	13.7
		t-stat	−3.83	−0.27	−0.35	3.34	1.44	−3.10	0.22	0.25	3.95	1.23	−2.05	0.48	0.43	2.80	1.11	p(F)	0.0	7.4	19.9	94.1	24.6
Event driven	169	beta	−1.96	0.25	0.33	2.01	0.45	−1.81	0.02	0.05	1.19	0.26	−0.27	0.01	0.01	0.27	0.06	Adj. R^2	−7.5	15.5	19.5	68.5	16.4
		t-stat	−1.66	1.51	1.81	8.31	1.99	−2.76	0.42	0.36	4.58	1.17	−2.27	0.50	0.60	4.06	1.15	p(F)	0.0	0.3	11.1	88.6	20.0
Fixed income arbitrage	62	beta	−0.70	0.10	0.19	1.54	0.46	−0.71	0.05	0.07	0.50	0.18	−0.06	0.01	0.02	0.15	0.05	Adj. R^2	−8.9	12.8	14.9	78.9	15.9
		t-stat	−3.29	0.80	1.25	11.74	2.56	−3.16	0.85	1.16	5.62	1.93	−1.76	0.57	0.52	2.52	1.10	p(F)	0.0	2.1	17.7	94.6	26.3
Global macro	54	beta	−0.61	0.13	0.18	1.73	0.42	−0.36	0.03	0.07	0.55	0.19	−0.09	0.02	0.04	0.27	0.08	Adj. R^2	−12.6	8.9	14.8	74.0	17.3
		t-stat	−1.60	0.44	0.60	3.96	1.25	−3.08	0.33	0.34	3.61	1.11	−1.22	0.37	0.60	3.92	1.20	p(F)	0.0	4.9	16.8	97.0	24.3
Long/Short equity hedge	520	beta	−1.37	0.17	0.28	4.55	0.59	−1.67	0.07	0.07	2.76	0.33	−0.33	0.04	0.06	0.88	0.11	Adj. R^2	−13.8	18.8	21.6	90.2	19.0
		t-stat	−5.28	0.58	0.69	4.94	1.36	−4.70	0.46	0.38	3.67	1.28	−3.31	0.74	0.77	5.91	1.13	p(F)	0.0	0.4	11.8	97.7	22.9
Managed futures	114	beta	−5.98	−0.33	−0.35	3.20	0.82	−0.75	0.14	0.15	1.29	0.32	−0.31	0.11	0.13	0.80	0.15	Adj. R^2	−6.0	13.3	15.3	70.0	13.3
		t-stat	−2.85	−0.92	−0.73	2.56	1.04	−2.81	0.73	0.74	4.36	1.28	−2.15	1.32	1.36	5.25	1.22	p(F)	0.0	0.6	8.2	88.5	17.0
Multi-strategy	59	beta	−0.48	0.07	0.17	1.64	0.41	−0.38	0.04	0.09	0.95	0.19	−0.05	0.03	0.04	0.75	0.11	Adj. R^2	−13.5	8.9	12.9	51.7	15.7
		t-stat	−2.20	0.72	1.21	6.34	2.12	−1.59	0.68	0.87	3.72	1.31	−1.34	0.87	0.81	2.90	0.97	p(F)	0.0	6.7	21.7	97.5	28.9
Fund of funds	355	beta	−0.78	0.17	0.17	1.41	0.22	−0.32	0.06	0.07	0.48	0.09	−0.23	0.03	0.05	0.35	0.05	Adj. R^2	−7.2	20.4	22.3	72.3	14.9
		t-stat	−3.62	1.38	1.53	6.35	1.55	−2.74	0.98	0.98	4.69	1.12	−3.16	1.38	1.39	4.28	1.01	p(F)	0.0	0.2	5.7	84.0	14.3

Hasanhodzic & Lo (2007) – Can Hedge-Fund Returns Be Replicated?: The Linear Case (Journal of Investment Management)

Table 6 Decomposition of total mean returns of hedge funds in the TASS Live database according to percentage contributions from six factors and manager-specific alpha, for 1610 hedge funds from February 1986 to September 2005.

Category description	Sample size	Avg. $E[R]$	Average of percentage contribution of factors to total expected return (%)						
			CREDIT	USD	SP500	BOND	DVIX	CMDTY	ALPHA
Convertible arbitrage	82	8.4	27.1	67.1	−19.3	34.9	−8.4	31.8	−33.3
Dedicated short bias	10	6.0	12.2	19.4	−108.2	7.0	8.9	−64.9	225.6
Emerging markets	102	20.4	−0.3	−3.2	19.3	0.1	−0.4	6.2	78.3
Equity market neutral	83	8.1	0.2	3.6	4.0	3.9	1.3	6.3	80.8
Event driven	169	13.0	2.1	3.0	4.3	9.4	−0.7	3.1	79.0
Fixed income arbitrage	62	9.5	−1.4	3.3	2.7	18.5	−0.5	4.4	73.1
Global macro	54	11.4	2.0	8.1	9.7	25.0	−3.3	10.0	48.6
Long/Short equity hedge	520	14.6	1.1	1.9	17.8	2.1	−1.8	8.4	70.5
Managed futures	114	13.6	1.9	23.4	−3.4	53.8	−1.5	53.2	−27.5
Multi-strategy	59	10.8	0.5	3.5	5.7	10.1	−1.9	3.2	78.9
Fund of funds	355	8.3	0.5	5.4	9.7	8.8	−2.8	7.3	71.1
All Funds	1,610	11.3	2.3	7.8	8.5	11.3	−1.9	10.9	61.0

Agarwal & Naik (2004) – Risks and Portfolio Decisions Involving Hedge Funds (The Review of Financial Studies)

- Studying equity-related HFs
- Including returns from option strategies into a factor model:
  - Equities: Russell 3000, lagged Russell 3000, MSCI World ex. US, MSCI Emerging Markets
  - Bonds: Salomon Brothers gov't, SB world gov't, SB corp., Lehman HY Index
  - FED Dollar Index
  - GSCI
  - HML, SMB, MOM
  - Default spread (BAA – 10-year Tr.)
  - ATM and OTM option strategies on S&P 500
    - In the beginning of month t buy an option expiring in month t+1
    - In the beginning of month t+1, sell the option expiring in month t+1, and buy an option expiring in month t+2
    - Calls and puts
- Utilizing a stepwise regression to recognize the dominant factors for each HF style, and selecting a model for that style
  - 6 out of 8 styles include the option strategy as a significant factor for HFR data
  - 1 out of 4 for CSFB/Tremont data
- The model seems to perform well also out-of-sample (7/2000-12/2001)
  - Models underperform HF style indices but not statistically significantly

- Using mean-variance analysis to form HF portfolios can understate the expected tail-loss by 54% compared to Mean-conditional Value at Risk analysis due to the tail-risk taken by many HFs
- Event-arbitrage loadings:
  - Negative on the OTM put-strategy: asymmetric payoff from successful deals and unsuccessful ones
  - Positive on SMB: acquiring firms tend to be larger than target firms
- Restructuring loadings:
  - Negative on the OTM put-strategy: firms less likely to emerge from distress when markets are down
  - Positive on SMB and HML: smaller firms more likely to face distress; distressed firms have higher B/M ratios
  - Positive on lagged Russell 3000 and HY: securities often illiquid and infrequently traded
- Event-driven loadings:
  - Negative on the OTM put-strategy: non-realization of events more likely when markets are down
  - Other loadings similar as above
- Relative value arbitrage loadings:
  - Negative on the OTM put-strategy and MOM: contrarian trades when prices diverge from value; greater divergence in market distress
  - Positive on SMB and HML: as above
- Similar reasoning holds for other styles as well

Agarwal & Naik (2004) – Risks and Portfolio Decisions Involving Hedge Funds (The Review of Financial Studies)

Table 4
Results with HFR equally-weighted indexes

Event arbitrage		Restructuring		Event driven		Relative value arbitrage		Convertible arbitrage		Equity hedge		Equity non-hedge		Short selling	
Factors	λ	Factors	λ	Factors	λ	Factors	λ	Factors	λ	Factors	λ	Factors	λ	Factors	λ
C	0.04	C	0.43	C	0.20	C	0.38	C	0.24	C	0.99	C	0.56	C	−0.07
SPP_o	−0.92	SPP_o	−0.63	SPP_o	−0.94	SPP_o	−0.64	SPP_a	−0.27	RUS	0.41	RUS	0.75	SPC_o	−1.38
SMB	0.15	SMB	0.24	SMB	0.31	MOM	−0.08	LRUS	0.10	SMB	0.33	SMB	0.58	RUS	−0.69
HML	0.08	HML	0.12	HML	0.12	SMB	0.17	SMB	0.05	HML	−0.08	MEM	0.05	SMB	−0.77
		LRUS	0.06	RUS	0.17	HML	0.08	MEM	0.03	GSCI	0.08			HML	0.40
		LHY	0.13	MEM	0.06	MXUS	0.04	SBG	0.16						
		FRBI	0.27												
		MEM	0.09												
Adj-R^2	44.04	Adj-R^2	65.57	Adj-R^2	73.38	Adj-R^2	52.17	Adj-R^2	40.51	Adj-R^2	72.53	Adj-R^2	91.63	Adj-R^2	82.02

This table shows the results of the regression $R_t^i = c^i + \sum_{k=1}^{K} \lambda_k^i F_{k,t} + u_t^i$ for the eight HFR indexes during the full sample period from January 1990 to June 2000. The table shows the intercept (C), statistically significant (at the 5% level) slope coefficients on the various buy-and-hold and option-based risk factors and adjusted R^2 (Adj-R^2). The buy-and-hold risk factors are Russell 3000 index (RUS), lagged Russell 3000 index (LRUS)), MSCI excluding the U.S. index (MXUS), MSCI emerging markets index (MEM), Fama and French size and book-to-market factors (SMB and HML), momentum factor (MOM), Salomon Brothers government and corporate bond index (SBG), Salomon Brothers world government bond index (SBW), Lehman high yield composite index (LHY), Federal Reserve Bank competitiveness-weighted dollar index (FRBI), Goldman Sachs commodity index (GSCI), and the change in the default spread in basis points (DEFSPR). The option-based risk factors include the at-the-money and out-of-the-money call and put options on the S&P 500 composite index ($SPC_{a/o}$ and $SPP_{a/o}$). For the two call and put option-based strategies, subscripts a and o refer to at-the-money and out-of-the-money, respectively.

Agarwal & Naik (2004) – Risks and Portfolio Decisions Involving Hedge Funds (The Review of Financial Studies)

Table 5
Results with CSFB/Tremont value-weighted indexes

Event driven		Convertible arbitrage		Long/short equity		Short selling	
Factors	λ	Factors	λ	Factors	λ	Factors	λ
C	0.59	C	0.59	C	0.26	C	0.40
SPP_o	−0.66	LRUS	0.09	HML	−0.25	RUS	−1.03
SMB	0.08	SBW	−0.20	RUS	0.53	SMB	−0.42
MEM	0.08	LHY	0.41	SMB	0.31	DEFSPR	−0.32
LHY	0.50					MOM	0.22
SBG	−0.94					HML	0.19
DEFSPR	−0.46						
Adj-R^2	73.55	Adj-R^2	33.35	Adj-R^2	83.50	Adj-R^2	84.97

This table shows the results of the regression $R_t^i = c^i + \sum_{k=1}^{K} \lambda_k^i F_{k,t} + u_t^i$ for the four CSFB/Tremont indexes during the full sample period from January 1994 to June 2000. The table shows the intercept (C), statistically significant (at the 5% level) slope coefficients on the various buy-and-hold and option-based risk factors and adjusted R^2 (Adj-R^2). The buy-and-hold risk factors are the Russell 3000 index (RUS), lagged Russell 3000 index (LRUS), MSCI excluding the U.S. index (MXUS), MSCI emerging markets index (MEM), Fama and French size and book-to-market factors (SMB and HML), momentum factor (MOM), Salomon Brothers government and corporate bond index (SBG), Salomon Brothers world government bond index (SBW), Lehman high yield composite index (LHY), Federal Reserve Bank competitiveness-weighted dollar index (FRBI), Goldman Sachs commodity index (GSCI), and the change in the default spread in basis points (DEFSPR). The option-based risk factors include the at-the-money and out-of-the-money call and put options on the S&P 500 composite index ($SPC_{a/o}$ and $SPP_{a/o}$). For the two call and put option-based strategies, subscripts a and o refer to at-the-money and out-of-the-money, respectively.

Capocci & Hübner (2004) – Analysis of hedge fund performance (Journal of Empirical Finance)

- Evaluating the performance of individual HFs with three models:
  - CAPM
  - Carhart's four-factor model (Market: Russell 3000)
  - Combined model:
    - Carhart's four factors
    - International HML
    - MSCI World ex. US
    - Lehman US Bond Index
    - SB World Gov't Bond Index
    - JPM EM Bond Index
    - Lehmann BAA Corp. Bond Index
    - GSCI
- Sample period: 1/1994-6/2000
- CAPM generally not sufficient to explain returns
- MKT and SMB positive and significant in almost all cases; HML and PR1YR (momentum) less significant factors on a general level
  - Carhart's model offers a decent fit
- MSCI World, GSCI and the bond factors increase the fit in several cases, suggesting the use of the combined model
- Highest R^2s (>0.90) in Equity non-hedged, US Opportunistics
  - >0.80: Global Macro, Sector HFs, Long-only levered
  - All funds R^2: 0.88, mean: 0.66
- Conclusions from the authors:
  - Almost all managers seem to prefer smaller stocks
  - Most Event Driven, Market Neutral and US Opportunistics managers prefer stocks with high book-to-market ratios
  - Some Event Driven and Market Neutral managers follow a momentum strategy and others are momentum contrarian
  - More than half of the managers invest in emerging bond markets

- Best performers:
  - Follow momentum strategies
  - Low exposure to EM bonds
- The opposite is true for the worst performers
- Average performers prefer low B/M stocks while top and bottom performers hold high B/M stocks
  - Offers an explanation for the differences in performance

Capocci & Hübner (2004) – Analysis of hedge fund performance (Journal of Empirical Finance)

	Panel C: The combined model																
	Alpha	Mkt	Wd × US	SMB	HML	I HML	PR1YR	US Bd	World GV Bd	Emerg Bd	Default	Comm.	R^2_{adj}	No. of funds	Alpha distrib.		+/0/−
Event Driven	0.34%*	0.42***	0.01	0.25***	0.10***	0.050	−0.034	−0.04	−0.012	0.0631***	0.11*	0.00	0.79	84	27%	69%	4%
Distressed Sec.	0.09%	0.40***	0.06	0.27***	0.12***	0.041	−0.075**	−0.075	−0.029	0.071**	0.16**	0.00	0.74	37	19%	78%	3%
Risk Arbitrage	0.60%***	0.44***	−0.03	0.24***	0.08***	0.065	−0.024	0.0085	−0.092	0.0504*	0.13	−0.01	0.66	38	39%	55%	5%
No Sub-strategy	−0.05%	0.43***	0.00	0.16***	0.10	0.048	0.1239***	−0.095	0.3855***	0.0639	−0.16	0.00	0.51	9	11%	89%	0%
Global	−0.50%	0.68***	0.12*	0.16***	0.07	0.036	0.0057	−0.327*	−0.408***	0.1278***	−0.12	0.09**	0.67	258	10%	77%	12%
International	−0.21%	0.56***	0.13**	0.13***	0.03	−0.047	−0.02	−0.172	−0.205*	0.0636*	−0.05	0.08***	0.72	50	10%	82%	8%
Emerging	−0.71%	0.73***	0.13*	0.17***	0.06	0.062	0.0182	−0.382*	−0.482***	0.1624***	−0.17	0.12**	0.60	151	8%	75%	17%
Regional Est.	0.27%	0.50***	0.10**	0.18***	0.09*	−0.024	−0.028	−0.218**	−0.091	0.0325	−0.16*	−0.03	0.71	57	18%	77%	5%
Global Macro	0.56%***	0.53***	0.06*	0.25***	0.04	−0.086*	0.0295	−0.111	0.0142	0.064***	−0.06	−0.02	0.85	252	42%	56%	1%
Market Neutral	0.28%***	0.21***	0.07***	0.11***	0.04**	−0.037	0.018	−0.15***	−0.063	0.0262	0.07	0.01	0.72	553	30%	65%	5%
Long/Short	0.67%***	0.16***	0.01	0.13***	0.08***	−0.072***	−0.004	−0.117*	−0.049	0.0178	0.10*	0.02*	0.61	102	27%	71%	2%
Convertible Arb.	0.42%***	0.05***	0.05**	0.05***	0.04**	0.022	−0.024*	0.0587	−0.113***	0.0295*	0.16***	0.00	0.49	39	59%	41%	0%
Fixed Income	−0.26%	0.36***	0.09*	0.13***	−0.07*	0.040	0.0527*	−0.167	−0.021	0.0422	−0.09	0.02	0.55	48	8%	79%	13%
Stock Arbitrage	0.22%*	0.25***	0.09***	0.13***	0.06**	−0.052	0.0213	−0.19***	−0.077	0.0248	0.04	0.01	0.68	310	29%	65%	6%
Mortgage-Backed	0.23%	0.02	0.02	0.02	0.01	0.009	0.0368*	−0.126*	−0.005	0.0281	0.33***	0.00	0.22	46	33%	63%	4%
Rel. Value Arb.	0.43%	0.21***	0.03	0.02	0.02	0.076	0.023	0.029	−0.23*	0.101**	0.05	0.05*	0.36	8	50%	38%	13%
Short Sellers	0.75%***	−0.34***	0.01	−0.31***	0.10	0.072	−0.053	0.0507	−0.14	−0.01	−0.07	−0.08**	0.72	18	44%	56%	0%
US Opport.	0.46%***	0.80***	0.09**	0.32***	0.04	−0.164**	−0.002	−0.184*	0.178**	0.0394*	−0.29**	0.02	0.92	180	21%	76%	3%
Growth	0.74%***	0.85***	0.04	0.36***	−0.12	−0.345***	−0.031	−0.214	0.1489	0.1026***	−0.18	0.00	0.89	68	28%	72%	0%
Value	0.20%	0.77***	0.12***	0.26***	0.13***	0.018	0.012	−0.121	0.1981***	−0.002	−0.34***	0.04**	0.91	100	16%	79%	5%
Small Caps	1.34%***	0.73***	0.08	0.46***	0.16**	−0.245***	−0.064	−0.27	0.144	0.0534	−0.51**	0.06	0.65	12	25%	75%	0%
Long Only Lev.	0.00%	0.88***	0.14*	0.47***	0.07	−0.14	0.0787	−0.166	0.0043	0.1882***	0.17	−0.01	0.82	18	17%	78%	6%
Market Timing	0.48%**	0.19***	0.02	0.09***	0.00	0.036	0.0631	0.0239	0.2132*	−0.052	−0.16	−0.12**	0.25	34	12%	88%	0%
Equity non−Hed.	0.23%*	0.84***	0.08**	0.31***	−0.02	−0.065	−0.045*	−0.201**	0.2109***	0.028	−0.21***	0.04*	0.94	112	28%	71%	1%
Foreign Exch.	−0.02%	0.15***	0.00	0.07***	−0.01	0.027	−0.031	−0.098*	−0.112	0.0801***	0.23***	−0.01	0.56	9	0%	78%	22%
Sector	0.69%***	0.63***	0.06*	0.37***	0.00	−0.079	−0.004	−0.176	0.0636	0.0211	0.01	0.03	0.89	128	30%	69%	2%
Funds of Funds	−0.28%*	0.39***	0.07*	0.14***	0.06*	−0.007	0.0356	−0.178*	−0.202**	0.0768***	−0.01	0.04*	0.75	278	14%	72%	14%
Non Classified	4.86%***	0.14	0.10	0.11***	0.14	−0.126	0.027	0.0641	0.0828	−0.12***	−0.20	−0.04	0.05	230	35%	62%	3%
All funds	0.25%**	0.44***	0.06**	0.19***	0.04*	−0.039	0.0109	−0.159**	−0.053	0.048***	−0.03	0.01	0.88	2154	26%	68%	6%
												Mean R^2_{adj}	0.66	Mean	25%	70%	5%

This table presents the results of the estimation of the single index model (Panel A) of Carhart's (1997) model (Panel B) and of our combined model (Panel C) for the 1/1994–6/2000 period. We report the OLS estimators for equally weighted portfolio's per investment strategy, sub-strategy, and for all funds. The last column gives the distribution of individually estimated monthly alphas for all funds with 24 monthly data or more in a specific investment style. We report the percentage of significantly positive alpha's (+), significantly negative alpha's (−), and alpha's that are insignificantly different from zero (0) at the 5% level. The next to last column reports the number of individual funds used for the individual estimation of the last column. *t*-stats are heteroskdasticity consistent.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Dupleich et al. (2010) – Unbundling common style exposure, time variance and style timing of hedge fund beta (Journal of Asset Management)

- Only equity-oriented HF indices:
  - Equity hedge; Equity market-neutral; Quantitative directional; Short bias
- Building models from a list of factors utilizing several methods:
  - Straight multiple regression
  - Stepwise regression
  - AIC and BIC
- 8 style factors based on MSCI World stocks ranked according to:
  - Earnings Yield –12-month forward
  - Book to Price Ratio
  - Long Term Earnings Growth
  - Deviation from Fair P/E
  - Earnings Quality (Accruals)
  - Price Momentum – 1 month
  - Price Momentum – 3 months
  - Earnings Revision
- 6 market and macro factors:
  - MSCI World Equity Index in US$
  - Lehman Corp. AA Intermediate Bond Index
  - US Dollar Index
  - The spread between the Lehman BAA Corp. Bond Index and the Lehman Treasury Index
  - GSCI
  - The first difference of the end-of-month value of VIX
- Models evaluated over a rolling-window of 60 months
  - The proportion when each factor is significant in a model is measured

Table 1: Average model R^2 and size (number of factors) July 1995 – July 2008

	Model R^2				*Model size*			
	EH	*EMN*	*EQ*	*ES*	*EH*	*EMN*	*EQ*	*ES*
Straight	0.85	0.51	0.88	0.84	3.4	2.8	3.0	2.6
Stepwise	0.80	0.38	0.85	0.81	3.1	3.1	2.4	2.9
AIC	0.84	0.47	0.87	0.83	6.6	5.7	5.3	4.6
BIC	0.82	0.39	0.86	0.82	4.0	3.3	3.6	3.1

- Three factors seems to be adequate to explain 80% of HF returns (with the exception of EMN)
  - Market
  - Value
  - Momentum
- HFs adjust their beta exposures over time, and somewhat correctly in terms of future market returns but not for other factors

Jaeger & Wagner (2005) – Factor Modelling and Benchmarking of Hedge Funds: Can Passive Investments in Hedge Fund Strategies Deliver? (The Journal of Alternative Investments)

- Regressing HF style indices on a large pool of factors:
  - Convertible bond index
  - Credit spread
  - Value spread
  - Small-cap spread
  - HY Bond index
  - Small-cap equity index
  - Trend-following index (sGFI)
  - Different bond indices
  - GSCI
  - AR(1)
  - Possibly some others
- Showing the most significant ones for each style index
- Also a simple three-factor model to replicate a diversified HF portfolio:
  - sGFI Trend-following index
  - BMX Index – "option writing" index on S&P 500
  - HY bond index
- Return/volatility similar to HFR Composite Index (10.3%/5.6% vs. 11.7%/7.2%) in 1994-2005

EXHIBIT 4

Results of Linear Asset Class Factor Modeling for the Different Hedge Fund Strategies with a Broader Set of Risk Factors (based on monthly data: HFR; for managed futures: CISDM Managed Futures Qualified Universe and Trend Following Indices, data From Jan. 1994 to Dec. 2004)

Alternative Factors

HFR Index 01/94 - 12/04	Asset Class Factor	Beta (Alpha)	t-value (absolute)	Adj. R2
Equity Hedge (Long/Short Equity)	Citigroup Convertible	0.545	19.49	88.5%
	Small-Cap Spread (Wilshire)	0.179	6.42	
	CPPI S&P 12M	0.181	4.31	
	AR(1)	0.125	4.05	
	Alpha	0.350	3.80	
Equity Market Neutral	Fama-French UMD	0.101	7.94	35.3%
	S&P 500	0.070	4.63	
	Value Spread (MSCI)	0.063	2.59	
	Small-Cap Spread (Wilshire)	0.035	*1.90*	
	Alpha	0.215	3.47	
Short Selling	Citigroup Convertible	-1.042	-8.78	81.2%
	Value Spread (MSCI)	0.554	5.93	
	S&P 600 Small Cap	-0.303	-3.97	
	Alpha	0.195	*0.80*	
Event Driven	S&P 500	0.254	13.41	79.3%
	Small-Cap Spread (Wilshire)	0.233	9.81	
	CSFB High Yield	0.255	5.03	
	AR(1)	0.155	3.64	
	Alpha	0.432	5.37	
Distressed	AR(1)	0.386	7.38	68.4%
	S&P 500	0.151	7.33	
	Small-Cap Spread (Wilshire)	0.145	5.71	
	CSFB High Yield	0.280	5.21	
	Alpha	0.240	2.79	
Merger Arbitrage	S&P 600 Small Cap	0.071	4.22	52.9%
	Russell 3000 Value	0.057	3.52	
	BXM Covered Call Writing Index	0.092	3.06	
	Merger Fund	0.077	2.90	
	Alpha	0.328	4.72	
Fixed Income Arbitrage	Citigroup Convertible	0.276	5.59	40.5%
	JP Morgan EM Global Bond	0.104	3.04	
	AR(1)	0.140	2.01	
	Credit Spread (BB vs AAA)	0.026	3.10	
	Alpha	0.227	1.50	
Convertible Arb.	AR(1)	0.427	7.07	54.0%
	Citigroup Conv Inv.Grade	0.242	5.03	
	CSFB High Yield	0.173	4.71	
	S&P 500	-0.085	-3.08	
	Alpha	0.160	2.54	
Macro	Lehman World Gov. Bond	0.518	4.23	49.7%
	Citigroup Convertible	0.231	4.21	
	sGFI	0.164	4.08	
	MSCI EM Global Equity	0.086	3.02	
	Alpha	0.196	1.43	
Managed Futures	sGFI	0.343	6.55	34.3%
	Lehman World Gov. Bond	0.442	2.75	
	Goldman Commodity Index	0.075	2.37	
	Alpha	-0.027	-0.15	
Managed Futures Trend Followers	sGFI	0.584	6.85	35.4%
	Lehman World Gov. Bond	0.709	2.71	
	Goldman Commodity Index	0.110	2.12	
	Alpha	-0.156	-0.53	

Racicot & Théoret (2014) – Cumulant instrument estimator for hedge fund return models with errors in variables (Applied Economics)

- Simplifying Fung & Hsieh (2004) model
- Using more advanced statistical techniques to evaluate models
- An alternative model aiming to include business cycle and monetary policy components:
  - Market
  - SMB
  - 10y-3m Treasury spread
  - VIX
- Spread proxies for both monetary policy (and its effects through risk-taking channel, i.e. monetary policy affect risk perception) and business cycle
- VIX capturing the effect of volatility on haircuts, asset pricing, and hedging
- Sample period: 1995-2010

Table 4. OLS estimation of the Fung and Hsieh model (Model 1) by strategy

	c	$r_m - r_f$	*Russel-S&P*	*BdOpt*	*ComOpt*	*CurOpt*	*CredSpr*	*10Y*	R^2	*DW*
MNG	–1.8118	0.3355	0.2481	–0.0202	0.0043	–0.0014	6.7783	4.6178	0.65	1.75
	–2.13	*14.53*	*6.71*	*–2.62*	*0.53*	*–0.24*	*1.99*	*2.99*		
EMN	1.2150	0.1812	0.1378	–0.0264	–0.0005	–0.0061	–7.6811	0.0013	0.40	1.68
	1.34	*7.38*	*3.50*	*–3.22*	*–0.06*	*–0.99*	*–2.12*	*0.00*		
ED	1.0214	0.1579	0.0444	0.0404	0.0428	0.0335	0.1414	–1.0482	0.28	1.96
	0.80	*4.56*	*0.80*	*3.49*	*3.50*	*3.85*	*0.03*	*–0.45*		
DS	–1.0183	0.2734	0.2177	–0.0218	0.0032	–0.0019	2.6545	3.4273	0.63	1.74
	–1.36	*13.46*	*6.69*	*–3.22*	*0.45*	*–0.37*	*0.88*	*2.53*		
DED	–1.3741	0.0610	0.1239	–0.0102	0.0050	0.0047	–0.9470	4.8918	0.26	1.96
	–1.96	*3.22*	*4.08*	*–1.62*	*0.74*	*0.98*	*–0.34*	*3.86*		
AI	2.5212	0.0054	0.0169	0.0544	0.0620	0.0554	–5.4667	–3.1404	0.26	1.81
	1.32	*0.10*	*0.20*	*3.15*	*3.39*	*4.25*	*–0.71*	*–0.91*		
LS	–1.3409	0.3568	0.2062	0.0000	0.0060	0.0026	4.1851	3.8549	0.73	1.62
	–1.92	*18.88*	*6.81*	*0.01*	*0.90*	*0.54*	*1.50*	*3.05*		
GR	–1.5468	0.7220	0.4227	0.0092	0.0095	0.0001	4.5399	4.1240	0.72	1.53
	–1.07	*18.50*	*6.76*	*0.71*	*0.69*	*0.01*	*0.79*	*1.58*		
OI	–1.5327	0.4962	0.2954	0.0034	0.0023	0.0019	4.0838	4.4550	0.78	1.55
	–1.84	*21.93*	*8.15*	*0.46*	*0.29*	*0.33*	*1.22*	*2.95*		
SS	–0.0934	0.1247	0.0571	–0.0173	–0.0037	0.0020	3.9940	0.3764	0.26	1.93
	–0.13	*6.49*	*1.86*	*–2.70*	*–0.55*	*0.42*	*1.41*	*0.29*		
VI	0.6280	0.2989	0.1051	0.0276	0.0365	0.0034	4.5487	–1.8874	0.17	1.87
	0.33	*5.86*	*1.29*	*1.62*	*2.03*	*0.27*	*0.60*	*–0.55*		
DTGI	–0.9208	0.1795	0.1393	–0.0118	0.0011	–0.0021	1.2014	3.3982	0.56	1.56
	–1.59	*11.43*	*5.54*	*–2.25*	*0.19*	*–0.53*	*0.52*	*3.24*		
FUT	–1.5928	0.3908	0.0951	–0.0161	0.0109	0.0014	8.0520	3.3601	0.57	1.74
	–1.59	*14.38*	*2.18*	*–1.77*	*1.13*	*0.21*	*2.01*	*1.85*		
MI	–0.5282	0.3578	0.1112	–0.0234	0.0063	0.0018	6.2981	0.9713	0.57	1.55
	–0.56	*13.94*	*2.70*	*–2.73*	*0.70*	*0.27*	*1.66*	*0.57*		
SPEC	–2.1021	0.4531	0.3352	–0.0049	0.0118	0.0061	5.2732	5.9205	0.59	1.64
	–1.69	*13.45*	*6.21*	*–0.44*	*0.99*	*0.72*	*1.06*	*2.63*		
LSCRED	1.6302	–0.9820	–0.4627	0.0056	–0.0074	–0.0077	–9.6560	–1.7266	0.67	1.73
	0.77	*–17.06*	*–5.02*	*0.29*	*–0.37*	*–0.53*	*–1.14*	*–0.45*		
MS	–1.6494	0.5266	0.2966	0.0082	–0.0061	0.0010	4.5087	4.9069	0.81	1.69
	–2.00	*23.60*	*8.30*	*1.10*	*–0.77*	*0.18*	*1.37*	*3.29*		
Mean	–0.4997	0.2317	0.1406	–0.0002	0.0108	0.0056	1.9122	2.1472	0.52	1.72
	1.32	*12.28*	*4.52*	*1.85*	*1.02*	*0.86*	*1.14*	*1.84*		
Median	–1.0183	0.2989	0.1378	–0.0049	0.0050	0.0018	4.0838	3.3982	0.57	1.73
	1.36	*13.46*	*5.02*	*1.77*	*0.70*	*0.42*	*1.14*	*1.85*		
GI	–0.4409	0.1515	0.0526	–0.0041	–0.0011	–0.0057	0.7684	2.2002	0.36	1.41
	–0.68	*8.60*	*1.86*	*–0.69*	*–0.18*	*–1.29*	*0.30*	*1.87*		

Notes: The estimated model (Model 1) is given by Equation 1. The strategies, here abbreviated, are listed in the same order as in Table 3. Coefficient *t*-statistics are in italics.

Papers that predict hedge fund returns

Bali, Brown & Caglayan (2011, 2012, 2014)

Bali, Brown & Caglayan (2011) – Do hedge funds' exposures to risk factor predict their future returns? (Journal of Financial Economics)

- Investigating if factor loadings (betas) on 15 financial and macro-economic variables explain HF returns
- Exposure to default spread (the yield spread between BAA and AAA-rated corporate bonds) has a positive relationship with future HF returns and cross-sectional differences in returns
- Exposure to inflation has a negative relationship with future HF returns and cross-sectional differences in returns
- Both relationships hold even after controlling for fund characteristics and Fama-French-Carhart and FH2004 factors
- These relationships hold especially for HF following a directional trading style, and not strongly for non-directional HFs
- Tested using both regression and non-parametric test (dividing fund into quintiles based on the two significant factor loadings)

Bali, Brown & Caglayan (2012) – Systematic risk and the cross section of hedge fund returns (Journal of Financial Economics)

- One-month ahead HF returns positively related to previous (36-month) volatility but not to higher return moments (skewness and kurtosis)
- Other positively related factors:
  - Lagged returns
  - Incentive fee
  - Redemption period
  - Minimum investment
  - Existence of a lockup period
- Extracting systematic and unsystematic risk from four-, six-, and nine-factor models based on FFC and FH2004
- Future returns load positively on systematic risk
  - Also to the five factors listed above
- The effect strong for HFs following a directional investment style, not so strong for non-directional HFs
- Interpretation: HFs are capable to time shifts in financial markets and adjust their position accordingly

Bali, Brown & Caglayan (2014) – Macroeconomic Risk and Hedge Fund Returns

- Explaining future HF return with the exposure to the uncertainty (volatility) macroeconomic variables and to an economic uncertainty index extracted from these variables
  - Uncertainty in macro variables measured with a time-varying conditional volatility model
  - The index extracted by using principal components analysis
  - Both explain significantly HF returns, even after controlling for common fund characteristics and a common set of other risk factors (namely FFC and FH2004)
  - The effect is stronger for directional funds, and non-existent for non-directional ones
- No significant relation between the exposure to the common risk factors (FFC and FH2004) and the future returns
- HFs seem to be able the adopt to the changes in financial markets and macroeconomic conditions

Bali, Gokcan & Liang (2007) – Value at risk and the cross-section of hedge fund returns (Journal of Banking and Finance)

Table 3
Average return of live and defunct fund portfolios sorted by non-parametric and parametric VaRs (January 1995–December 2003)

VaR						CF VaR					
Live			Defunct			Live			Defunct		
Decile	VaR (%)	Return (%)	Decile	VaR (%)	Return (%)	Decile	CF VaR (%)	Return (%)	Decile	CF VaR (%)	Return (%)
Low VaR	0.08	0.93	Low VaR	0.04	0.81	Low CF VaR	−0.57	0.90	Low CF VaR	−0.66	0.82
2	0.91	0.85	2	1.08	0.80	2	1.05	0.86	2	1.19	0.68
3	1.59	0.92	3	1.88	0.63	3	1.77	0.93	3	2.07	0.63
4	2.31	1.06	4	2.75	0.60	4	2.53	0.99	4	2.94	0.76
5	3.15	1.19	5	3.64	0.67	5	3.36	1.17	5	3.96	0.63
6	3.98	1.21	6	4.60	0.78	6	4.26	1.30	6	5.05	0.72
7	4.91	1.16	7	5.63	0.84	7	5.31	1.09	7	6.20	0.63
8	6.05	1.46	8	6.96	0.50	8	6.45	1.33	8	7.60	0.67
9	7.50	1.29	9	9.10	0.67	9	8.05	1.51	9	9.80	0.62
High VaR	11.70	1.65	High VaR	15.74	−0.06	High CF VaR	12.07	1.63	High CF VaR	16.65	0.08
Average return differential for VaR			Average return differential for VaR			Average return differential for CF VaR			Average return differential for CF VaR		
High VaR–low VaR		0.72%	High VaR–low VaR		−0.87%	High CF VaR–low CF VaR		0.73%	High CF VaR–low CF VaR		−0.74%
Standard *t*-statistic		2.15**	Standard *t*-statistic		−1.90*	Standard *t*-statistic		2.26**	Standard *t*-statistic		−1.60
Newey–West *t*-statistic		2.03**	Newey–West *t*-statistic		−1.89*	Newey–West *t*-statistic		2.05**	Newey–West *t*-statistic		−1.67*

The first panel shows the average returns of the non-parametric VaR and the parametric VaR (CF VaR) portfolios for Deciles 1–10 for both live and defunct funds. The VaR and CF VaR values are calculated using the past 24–60 monthly returns (as available) for each month from January 1995 to December 2003. The original VaR values are multiplied by −1 so that we expect a positive relation between expected return and downside risk. The second panel presents the average return differential between Deciles 10 and 1, the standard *t*-statistics for the average return differential, and the Newey and West (1987) adjusted *t*-statistics for both live and defunct funds. ***, **, * denotes significance level at least at the 1%, 5%, and 10% level, respectively.

Caglayan & Ulutas (2012) – Emerging Market Exposures and the Predictability of Hedge Fund Returns (Financial Management)

- Testing the relationship between EM exposure and returns for Emerging Market and Global Macro HFs
- Multivariete Fama-MacBeth regression
- EM equity beta (measured with MSCI EM Index) and EM FX beta (Emerging Market Currency basket index) have a positive and significant link to EM and Global Macro returns
- Also when controlling for liquidity (Sadka 2010 measure) and using an alternative factor models (4- and 9-factor models including an EM index)
    - The Sadka liquidity measure also loads positively (see next page)
- The phenomenon applies only to directional HFs (compared to semi-directional or non-directional)

Caglayan & Ulutas (2012) – Emerging Market Exposures and the Predictability of Hedge Fund Returns (Financial Management)

Table VII. Multivariate Fama-MacBeth Cross-Sectional Regressions of One-Month ahead Fund Excess Returns on the Emerging Market Betas after Controlling for the Effect of Liquidity Beta

This table reports the average intercept and slope coefficients from the Fama-MacBeth (1973) cross-sectional regressions of one-month-ahead hedge fund excess returns on the multivariate emerging market betas after controlling for the effect of Liquidity beta. In the first stage, liquidity (LIQ), MSCI, EMBI+, and EMFX factor betas (β^{LIQ},β^{MSCI}, β^{EMBI+}, β^{EMFX}) are estimated for each fund from the time-series regressions of hedge fund excess returns on the LIQ, MSCI, EMBI+, and EMFX factors using a 36-month rolling window period. In the second stage, the cross-section of one-month ahead funds' excess returns are regressed on the funds' aforementioned factor betas (in different groupings) each month for the period 1999:01 – 2010:12. Newey-West *t*-statistics are given in parentheses to determine the statistical significance of the average intercept and slope coefficients. Numbers in bold denote statistical significance of the average slope coefficients.

Intercept	β^{LIQ}	β^{MSCI}	β^{EMBI+}	β^{EMFX}	Lagged Return	Size	Age	Management Fee	Incentive Fee	Redemption Period	Minimum Investment	Dummy Lockup	Dummy Leverage
0.171	**0.040**	**1.533**											
(1.45)	**(2.48)**	**(2.01)**											
0.212	**0.036**		**1.146**										
(1.41)	**(2.12)**		**(2.54)**										
0.224	**0.049**			**0.881**									
(1.79)	**(2.62)**			**(2.15)**									
0.191	**0.031**	**1.501**	0.627										
(1.91)	**(2.05)**	**(1.98)**	(1.76)										
0.155	**0.042**	**1.437**		**0.653**									
(1.45)	**(2.42)**	**(1.96)**		**(2.15)**									
0.203	**0.040**		**0.895**	**0.774**									
(1.70)	**(2.29)**		**(2.16)**	**(2.23)**									
0.181	**0.031**	**1.495**	0.608	**0.564**									
(1.68)	**(1.88)**	**(2.04)**	(1.70)	**(2.13)**									
-0.225	**0.030**	**1.407**	**0.694**	**0.510**	**0.071**	-0.178	**-0.003**	**0.233**	-0.001	0.003	**0.086**	0.218	0.022
(-1.20)	**(1.90)**	**(2.14)**	**(2.19)**	**(2.25)**	**(3.76)**	(-0.87)	**(-2.40)**	**(3.51)**	(-0.26)	(1.48)	**(2.64)**	(1.34)	(0.28)

Boyson, Stahel & Stulz (2010) – Hedge Fund Contagion and Liquidity Shocks (The Journal of Finance)

- Studying the characteristics of HF contagion
- Combining Fung & Hsies (2001) and Agarwal & Naik (2004) model to control for possible variables affecting contagion
  - Factors selected to explain contagion but offer also insights to HF returns
- The model (next page):
  - Most variable are self-explanatory
  - Prime Broker Index: Monthly change in the equally weighted stock price index of prime broker firms (GS, UBS, BofA, etc.)
  - Bank Index: Monthly change in the equally weighted stock price index of large commercial banks
  - CSS Liquidity measure: Change in average round-trip cost of a trade on the NYSE within a month; calculated as the monthly average of daily changes of the NYSE stock market liquidity after removing deterministic day-of-the-week effects and effects related to changes in tick size. The daily changes are calculated from daily cross-sectional value-weighted averages of individual stock proportional bid-ask spreads. (Source: Chordia et al. (2005))
  - Contemporary HF Flows: Monthly change in hedge fund outflows as a percentage of assets under management
- Sample period: 1/1990-10/2008

Table IA.XI
Omitted Factor Test Filtering Analysis using AR(1) Models, Common Risk Factors, and Contagion Channel Variables

Raw monthly hedge fund returns from January 1990 to October 2008 are filtered using AR(1) models to adjust for autocorrelation and a number of other factors from the asset pricing literature to control for well-known commonalities in hedge fund returns. These include a stock market factor (Russell 3000 Index), a bond market factor (the return on the Lehman Brothers U.S. bond index), a currency factor (the change in the FRB Dollar index), an equity size spread factor, the change in the 10-year constant maturity Treasury yield to maturity, the change in the BAA-10-year CMT credit spread, lookback straddle factors for bonds, currencies, commodities, short-term interest rates, and equities, the return on a three-month Treasury bill, and the negative portion of the S&P 500 index to proxy for a put option. In addition, five continuous contagion channel variables are added as described in Section IV of the main text. The residuals from this filtering exercise are used in all the analyses in Section IV and reported in Internet Appendix Tables IA.X to IA.XII. Below, the regression coefficients are listed with their corresponding I-values in parentheses. Coefficients with ***, **, and * are statistically significant at the 1%, 5%, and 10% levels, respectively.

Boyson, Stahel & Stulz (2010) – Hedge Fund Contagion and Liquidity Shocks (The Journal of Finance)

	Convertible Arbitrage	Distressed Securities	Event Driven	Equity Hedge	Equity Market Neutral	Merger Arbitrage	Global Macro	Relative Value
Intercept	-0.24	0.55***	0.50***	-0.11	-0.02	0.36	0.81*	0.30
	(-1.01)	*(2.54)*	*(2.34)*	*(-0.38)*	*(-0.09)*	*(1.64)*	*(1.75)*	*(1.30)*
AR1	0.53***	0.45***	0.22***	0.14***	0.07	0.09	0.14**	0.18***
	(12.4)	*(10.57)*	*(4.67)*	*(3.83)*	*(1.08)*	*(1.44)*	*(2.20)*	*(3.12)*
Russell 3000 index	0.03	0.06	0.18***	0.51***	0.04	0.02	0.20***	0.00
	(0.68)	*(1.33)*	*(4.70)*	*(9.39)*	*(1.25)*	*(0.54)*	*(2.64)*	*(0.10)*
Return on LB Bond index	0.94***	0.70***	0.52*	0.17	-0.25	-0.23	0.98*	0.54**
	(3.62)	*(2.43)*	*(1.87)*	*(0.44)*	*(-1.21)*	*(-0.78)*	*(1.68)*	*(2.16)*
Change in FRB Dollar index	0.05	-0.01	-0.01	0.00	0.01	-0.01	-0.21***	0.02
	(1.30)	*(-0.32)*	*(-0.33)*	*(0.08)*	*(0.49)*	*(-0.20)*	*(-3.26)*	*(0.37)*
Equity size spread	0.04	0.18***	0.22***	0.32***	0.06***	0.10***	0.19***	0.07***
	(1.62)	*(7.27)*	*(9.59)*	*(10.69)*	*(2.52)*	*(4.31)*	*(4.61)*	*(4.04)*
Δ in 10-year CMT YTM	2.93**	2.43*	2.02	0.72	-1.49	-1.00	2.15	1.76
	(2.27)	*(1.76)*	*(1.52)*	*(0.41)*	*(-1.44)*	*(-0.72)*	*(0.79)*	*(1.43)*
Δ in Baa-10yr CMT spread	-1.68***	-0.69	-0.09	1.50	0.54	-0.25	2.62**	-1.21*
	(-2.53)	*(-0.95)*	*(-0.13)*	*(1.44)*	*(0.77)*	*(-0.39)*	*(2.08)*	*(-1.80)*
Lookback straddle: bonds	-0.06	-1.31***	-0.61	-0.01	-0.44	0.08	-0.33	-0.50
	(-0.13)	*(-2.96)*	*(-1.29)*	*(-0.01)*	*(-1.02)*	*(0.16)*	*(-0.35)*	*(-1.02)*
Lookback straddle: currencies	-0.05	0.19	0.32	0.60	0.62*	0.35	2.41***	-0.11
	(-0.13)	*(0.50)*	*(0.90)*	*(1.20)*	*(1.92)*	*(0.84)*	*(3.68)*	*(-0.23)*
Lookback straddle: commodities	0.04	0.18	-0.09	0.63	0.35	-0.21	2.18***	0.00
	(0.07)	*(0.35)*	*(-0.19)*	*(1.04)*	*(0.73)*	*(-0.38)*	*(2.44)*	*(0.00)*
Lookback straddle: interest rates	-0.36	0.01	-0.29	-0.97**	-0.50**	-0.06	-1.05	-0.36
	(-1.59)	*(0.02)*	*(-1.00)*	*(-1.99)*	*(-2.25)*	*(-0.18)*	*(-1.62)*	*(-1.25)*
Lookback straddle: equities	0.58	0.26	0.59*	1.02	0.32	0.25	2.06***	0.63
	(1.20)	*(0.46)*	*(1.73)*	*(1.64)*	*(0.93)*	*(0.51)*	*(3.16)*	*(1.36)*
Three month Treasury bill	0.19	-0.21	0.10	0.78***	0.69***	0.62***	-0.31	0.28
	(1.13)	*(-1.39)*	*(0.61)*	*(3.25)*	*(4.11)*	*(3.29)*	*(-0.93)*	*(1.53)*
Negative Portion of S&P 500	0.04	0.12**	0.14**	0.03	-0.01	0.14***	0.06	0.10*
	(0.77)	*(2.02)*	*(2.30)*	*(0.40)*	*(-0.17)*	*(2.37)*	*(0.57)*	*(1.93)*
TED Spread	-0.03***	-0.02***	-0.02***	-0.01	0.00	-0.01*	-0.01	-0.01**
	(-3.95)	*(-2.86)*	*(-2.65)*	*(-1.18)*	*(-0.53)*	*(-1.80)*	*(-0.93)*	*(-2.07)*
Prime Broker Index	0.02	0.05**	0.01	0.02	0.02	0.01	0.04	0.02
	(0.83)	*(2.27)*	*(0.76)*	*(0.83)*	*(1.56)*	*(0.46)*	*(1.11)*	*(0.93)*
Bank Index	-0.02	-0.03	-0.01	-0.13***	-0.04**	0.02	-0.05	-0.01
	(-1.30)	*(-1.31)*	*(-0.60)*	*(-5.10)*	*(-2.28)*	*(0.77)*	*(-1.66)*	*(-0.58)*
CSS Liquidity Measure	-0.21***	-0.06	-0.16	-0.12	-0.16	-0.19***	-0.07	-0.18
	(-2.72)	*(-0.53)*	*(-1.33)*	*(-0.72)*	*(-1.51)*	*(-2.35)*	*(-0.36)*	*(-1.52)*
Contemp. Hedge Fund Flows	-0.04	-0.05*	-0.02	-0.01	0.01	-0.03	-0.01	0.00
	(-1.10)	*(-1.67)*	*(-0.54)*	*(-0.38)*	*(0.50)*	*(-0.79)*	*(-0.18)*	*(-0.07)*
Adjusted R^2	74.6	73.5	79.4	78.9	25.0	47.1	37.5	58.7

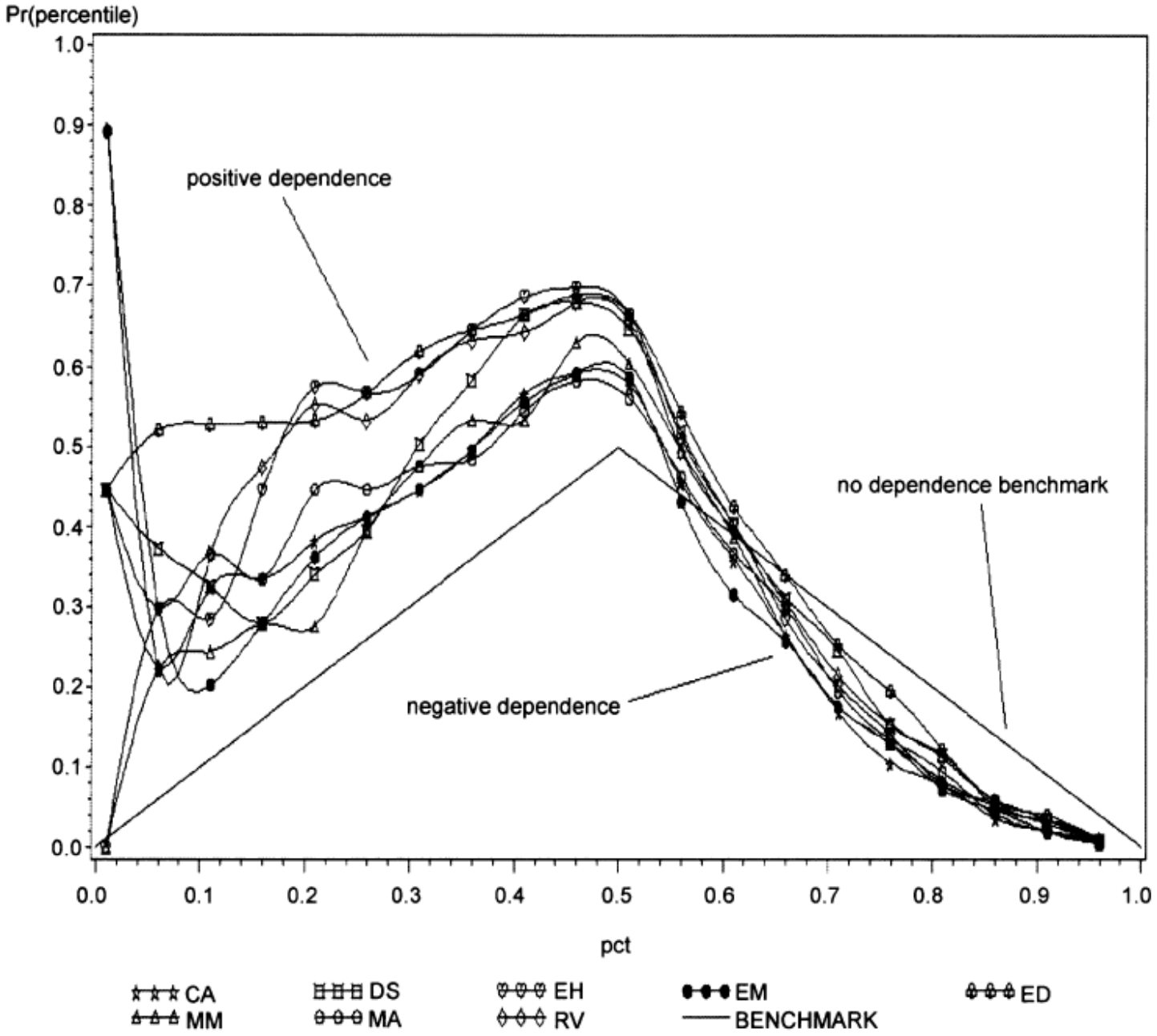


Figure 1. Co-movement box: Relationship between individual hedge fund index performance and average of all other hedge fund indices.

Table II

Contagion Tests Using Filtered Return Data

The event of a worst return in each hedge fund style is separately modeled as the outcome of a binary variable and estimated as a logit regression. The independent variable is *COUNT*, which takes a value from zero to seven and is the number of other hedge fund indices that also have worst returns for the month. Below the coefficients are the *t*-statistics in parentheses. R^2 MAX is the scaled coefficient of determination suggested by Nagelkerke (1991). Coefficients with ***, **, and * are statistically significant at the 1%, 5%, and 10% levels, respectively.

	Convertible Arbitrage	Distressed Securities	Event Driven	Equity Hedge	Equity Market Neutral	Merger Arbitrage	Global Macro	Relative Value
Constant	−2.62***	−2.97***	−3.07***	−2.96***	−2.62***	−2.83***	−2.51***	−3.01***
	(*−7.73*)	(*−7.91*)	(*−7.16*)	(*−5.82*)	(*−8.47*)	(*−7.16*)	(*−6.64*)	(*−8.90*)
Other hedge fund index indicator variable								
COUNT	0.46***	0.73***	0.81***	0.73***	0.45***	0.63***	0.36*	0.77***
	(*2.70*)	(*3.82*)	(*3.71*)	(*2.78*)	(*2.94*)	(*3.19*)	(*1.86*)	(*4.45*)
R^2 MAX	7.7	18.1	20.3	16.4	8.0	13.8	4.5	20.5

Causes of contagion: liquidity, TED, Hedge fund flow, prime broker equity prices….

Coën & Hübner (2009) – Risk and performance estimation in hedge funds revisited: Evidence from errors in variables (Journal of Empirical Finance)

- Undermines the validity of using OLS to study HF returns because of the possibility of measurement errors in independent variables
  - Suggests an alternative method of instrumental variable, more precisely including higher-moments of significant variables in the model
- The authors assume the base model to be the four factor (FF+MOM) model, and add additional factors from a list of factors that include:
  - FH9
  - Agarwal & Naik (2004)
  - Capocci & Hübner (2004)
- For each HF style, factors are added and the F-value of the model evaluated in order to find the best-fitting model
  - The total number of factors is limited to 8
- The model is studied to see whether it exhibits the symptoms of errors-in-variables (EIV)
- Table 3 shows the results for the estimated models
  - Corrections for EIV improve the R^2s for most styles and change the significant risk exposures for several models

This table reports the regression results of hedge fund index returns for the sample period 1994:12–2007:03. The OLS specifications (reported in the first part of each panel) take the form of equation $R_t = \hat{\alpha}^{OLS} + \sum_{k=1}^{K} \hat{\beta}_k^{OLS} \cdot F_{kt} + \varepsilon_t$ with the four Fama–French factors and 2 to 4 additional risk factors chosen by stepwise regression. The HME specifications (reported in the second part of each panel) take the form $R_t = \hat{\alpha}^{HM} + \sum_{k=1}^{K} \hat{\beta}_k^{HM} \cdot F_{kt} + \sum_{k=1}^{K} \hat{\psi}_k \cdot \hat{w}_{kt} + \varepsilon_t$ with the four Fama–French factors, 2 to 4 additional risk factors and the corresponding adjustment variables (in brackets). The alpha is expressed in percents. DWH (acronym for Durbin–Wu–Hausman) is a standard χ_{q^2} where q is the number of adjustment variables to detect EIV by testing $\psi_k = 0$ The DWH test is a heteroskedasticity robust test. Below the DWH statistic is the p-value in brackets. All HME and OLS statistics are computed with White (1980) H_0 heteroskedasticity-consistent covariance matrix estimators (HCCME). *** Significant at the 1% level, ** significant at the 5% level and * significant at the 10% level.
RUS = the Russell 3000 index, SMB = Fama and French size factor, HML = Fama and French book-to-market factor, UMD = Momentum factor (Carhart, 1997), EMB = Emerging Bond Market Index; BAA = Moody's Baa bond yield — US Treasury 10y CM bond yield, MEM = MSCI Emerging Market Index, MLU = ML US high yield total return index, WGB = WD Citigroup WGBI world all mats index, LHM = Lehman global-agg. sec-US MBS, LHC = Lehman global aggregate corporate, SBD = Return of PTFS Bond lookback straddle, SFX = Return of PTFS Currency Lookback Straddle, STK = Return of PTFS Stock Index Lookback Straddle, ACe = return of an artificial ATM index call: underlying index is the MSCI emerging market index, OCm = return of an artificial 5% OTM index call: underlying index is the S&P500, OCe = return of an artificial 5% OTM index call: underlying index is the MSCI emerging market index , APm = return of an artificial ATM index put: underlying index is the S&P500, APe = return of an artificial ATM index put: underlying index is the MSCI emerging market index , APr = return of an artificial ATM index put: the underlying index is the Baa — 10y T-Bond.

Table 3
OLS and HME regressions on hedge fund indices

Panel A.1 Directional Strategies — Dedicated Short Sellers: SHO

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	BAA	EMB	STK	OCe	
0.672	0.202	−0.800***	−0.327***	0.182**	−0.021					
0.685	2.559***	−0.840***	−0.311***	0.170*	−0.039	−1.083***				
0.695	2.268***	−0.708***	−0.257***	0.184**	−0.050	−0.938**	−0.135**			
0.701	2.281***	−0.713***	−0.265***	0.174**	−0.047	−1.015***	−0.154***	−0.035*		
0.729	2.117***	−0.664***	−0.286***	0.190***	−0.005	−0.993**	−0.255***	−0.049***	0.294***	
0.699	1.094*	−1.484***	−0.346	−0.266	−0.119*					17.140
		[0.766***]	[−0.052]	[0.530]	[0.061]					[0.001]
0.720	5.925***	−1.728***	−0.312	−0.344	−0.239***	−2.112***				22.840
		[0.990***]	[−0.046**]	[0.638**]	[0.190]	[1.524*]				[0.000]
0.736	6.022***	−2.059***	−0.484**	−0.494*	−0.220***	−2.108***	0.257			27.919
		[1.454***]	[0.165]	[0.799***]	[0.235***]	[1.980**]	[−0.345]			[0.000]
0.736	4.957***	−1.191***	0.041	0.159	−0.235***	−1.877***	−0.045	0.052		25.875
		[0.547*]	[−0.352***]	[0.115]	[0.229***]	[1.038]	[−0.040]	[−0.118***]		[0.000]
0.740	4.270***	−1.085***	−0.047	0.155	−0.158	−1.646**	−0.062	0.042	0.123	13.511
		[0.453]	[−0.271]	[0.118]	[0.144]	[0.844]	[−0.176]	[−0.114*]	[0.564]	[0.095]

Panel A.2 Directional Strategies — Emerging Markets: EME

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	EMB	SBD	STK	OCm	
0.320	−0.251	0.583***	0.325***	0.120	0.102*					
0.658	−0.374	−0.018	0.056	0.060	0.163***	0.641***				
0.667	−0.394	−0.025	0.048	0.038	0.154***	0.629***	−0.033*			
0.676	−0.237	−0.026	0.055	0.044	0.148***	0.648***	−0.040***	0.036**		
0.685	−0.200	−0.081	0.066	0.054	0.141***	0.651***	−0.044**	0.029*	0.185**	
0.350	−1.191	1.298***	0.606*	0.621	0.124					10.809
		[−0.783*]	[−0.323]	[−0.520]	[0.054]					[0.028]
0.668	−0.370	−0.117	−0.169	−0.194	0.272***	0.794***				9.193
		[0.088]	[0.224]	[0.282]	[−0.183***]	[−0.202]				[0.101]
0.678	−0.393	−0.100	−0.200	−0.217	0.280***	0.741***	−0.045*			10.741
		[0.059]	[0.259]	[0.281]	[−0.224***]	[−0.144]	[0.031]			[0.096]
0.685	−0.246	−0.093	−0.176	−0.215	0.253***	0.760***	−0.056**	0.034		11.296
		[0.074]	[0.247*]	[0.315*]	[−0.178***]	[−0.152]	[0.040]	[0.003]		[0.126]
0.700	−0.230	−0.177	−0.183	−0.213**	0.243***	0.764***	−0.058**	0.017	0.162**	15.022
		[0.133]	[0.258*]	[0.328**]	[−0.186***]	[−0.162]	[0.040]	[0.013]	[−0.534]	[0.058]

Panel A.3 Directional Strategies — Global Macro: GLB

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	LHM	EMB	SFX	OCe	
0.089	0.485*	0.249***	0.088	0.142*	0.154***					
0.112	0.257	0.239***	0.115*	0.143*	0.132**	0.596**				
0.142	0.183	0.097	0.058	0.129	0.141***	0.715***	0.149***			
0.159	0.194	0.080	0.044	0.112	0.134***	0.712***	0.165***	0.024**		
0.185	0.163	0.112	0.035	0.127	0.160***	0.705***	0.105*	0.021	0.184***	
0.116	0.668	0.052	0.371	0.193	0.032					8.368
		[0.230]	[−0.386]	[0.001]	[0.153]					[0.078]
0.122	0.815	−0.059	0.245	−0.004	0.012	0.205				6.687
		[0.347]	[−0.213]	[0.216]	[0.157***]	[0.239]				[0.245]
0.236	1.044***	−1.201***	−0.407***	−0.564***	0.179***	0.664	0.795***			23.495
		[1.394***]	[0.405**]	[0.786***]	[−0.087]	[−0.299]	[−0.725***]			[0.000]
0.238	0.873**	−1.074***	−0.288*	−0.420**	0.162***	0.692	0.758***	0.041*		21.707
		[1.249***]	[0.265]	[0.626***]	[−0.073]	[−0.338]	[−0.672***]	[−0.019]		[0.003]
0.267	0.752*	−0.925***	−0.232	−0.323*	0.179**	0.646	0.691***	0.040*	0.042	23.689
		[1.085***]	[0.238]	[0.515**]	[−0.128]	[−0.082]	[−0.650***]	[−0.025]	[−0.339]	[0.002]

Panel A.4 Directional Strategies — Long/Short Equity: LON

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	EMBI	STK	APm		
0.716	0.251*	0.428***	0.248***	−0.090*	0.215***					
0.756	0.223*	0.289***	0.185***	−0.103***	0.229***	0.149***				
0.772	0.358**	0.290***	0.193***	−0.095**	0.225***	0.167***	0.030***			
0.790	0.477***	0.209***	0.186***	−0.092**	0.211***	0.132***	0.039***	−0.362***		
0.722	−0.129	0.639***	0.473***	0.218	0.219***					7.106
		[−0.226]	[−0.261]	[−0.320]	[0.010]					[0.130]

Panel A.4 Directional Strategies — Long/Short Equity: LON

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	EMBI	STK	APm		
0.757	0.301	0.018	0.169	−0.128	0.255***	0.292***				5.584
		[0.281]	[−0.003]	[0.026]	[−0.057]	[−0.154]				[0.349]
0.781	0.247	0.166	0.280***	0.006	0.246***	0.267***	0.025			11.394
		[0.117]	[−0.138*]	[−0.121]	[−0.041]	[−0.123]	[0.019]			[0.077]
0.793	0.337*	0.244***	0.308***	0.015	0.229***	0.134	0.034*	−0.322		8.623
		[−0.051]	[−0.178**]	[−0.128]	[−0.041]	[−0.007]	[0.011]	[−0.053]		[0.2808]

Panel B.1 Non-Directional Strategies — Convertible Arbitrage: CNV

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	MLU	WGB.			
0.057	0.423***	0.050	0.098***	0.075*	−0.012					
0.148	0.313***	−0.014	0.061*	0.050	0.006	0.253***				
0.167	0.367***	−0.024	0.060*	0.048	0.005	0.270***	−0.104*			
0.111	0.068	0.301*	0.245*	0.276	0.000					12.793
		[−0.272*]	[−0.180]	[−0.200]	[0.008]					[0.012]
0.167	0.114	0.313	0.314	0.333	−0.023	−0.118				8.240
		[−0.350]	[−0.267]	[−0.288]	[0.020]	[0.389]				[0.143]
0.214	0.819***	−0.161	−0.036	−0.184	−0.007	0.291	−0.502***			14.525
		[0.116]	[0.090]	[0.239]	[−0.003]	[0.031]	[0.467***]			[0.024]

Panel B.2 Non-Directional Strategies — Equity Market Neutral: MNE

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	STK	SFX	APe		
0.133	0.498***	0.075***	−0.001	0.003	−0.001					
0.176	0.558***	0.082***	0.005	0.007	−0.004	0.013**				
0.190	0.551***	0.080***	0.002	0.003	−0.005	0.011*	0.006			
0.254	0.601***	0.047***	−0.004	0.003	−0.011	0.016***	0.006**	−0.133***		
0.117	0.548***	0.032	0.010	0.010	−0.024*					1.572
		[0.046]	[−0.009]	[−0.009]	[0.030]					[0.813]
0.164	0.597***	0.058	0.025	0.015	−0.032**	0.014				2.991
		[0.032]	[−0.019]	[−0.002]	[0.044**]	[0.001]				[0.701]
0.195	0.584***	0.034	0.017	0.004	−0.035***	0.006	0.013***			6.892
		[0.055]	[−0.010]	[0.014]	[0.047***]	[0.008]	[−0.013*]			[0.330]
0.241	0.658***	0.001	−0.013	−0.030	−0.029	0.013	0.010**	−0.159***		4.525
		[0.056]	[0.017]	[0.050]	[0.029]	[0.004]	[−0.009]	[0.009]		[0.717]

Panel B.3 Non-Directional Strategies – Fixed Income Arbitrage: FIX

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	MLU	EMB	APr		
0.004	0.202**	0.010	0.047*	0.045	0.010					
0.087	0.116	−0.040	0.019	0.026	0.024	0.198*				
0.101	0.116	−0.071	0.006	0.024	0.027	0.183*	0.037*			
0.184	0.195**	−0.066**	−0.002	0.009	0.026	0.191***	0.025	−0.012***		
0.008	0.004	0.150	0.123	0.151	0.024					4.611
		[−0.151]	[−0.093]	[−0.105]	[−0.006]					[0.329]
0.082	0.129	−0.176	−0.127	−0.127	0.076	0.448				4.201
		[0.142]	[0.147]	[0.156]	[−0.064]	[−0.294]				[0.521]
0.207	0.252**	−0.450*	−0.301*	−0.292*	0.114*	0.445	0.190***			25.190
		[0.389*]	[0.318*]	[0.325*]	[−0.137*]	[−0.312]	[−0.180***]			[0.000]
0.217	0.104	−0.142	−0.097	−0.044	0.096	0.388	0.042	−0.013		13.071
		[0.071]	[0.099]	[0.048]	[−0.118]	[−0.243]	[−0.031]	[0.000]		[0.070]

Panel C.1 Event Driven Strategies – Distressed: DIS

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	MLU	MEM	SBD	ACe	
0.347	0.541***	0.252***	0.159***	0.105**	−0.008					
0.457	0.376*	0.156***	0.105***	0.068*	0.019	0.381***				
0.494	0.425***	0.073**	0.067**	0.058	0.025	0.356***	0.082**			
0.510	0.418***	0.077*	0.067**	0.049	0.019	0.334***	0.074***	−0.018***		
0.519	0.460***	0.075**	0.074**	0.054	0.013	0.331***	0.109**	−0.016	−0.201	
0.530	−0.265	0.776***	0.497***	0.718***	−0.024					59.882
		[−0.578***]	[−0.357***]	[−0.664***]	[0.084*]					[0.000]
0.549	−0.033	0.655**	0.554*	0.709*	−0.092	−0.119				34.463
		[−0.519*]	[−0.431]	[−0.680*]	[0.162*]	[0.422]				[0.000]

Panel C.1 Event Driven Strategies — Distressed: DIS

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	MLU	MEM	SBD	ACe	
0.586	0.328	0.082	0.007	0.232	0.067*	0.102	0.351***			37.522
		[−0.020]	[0.102]	[−0.199]	[−0.045]	[0.190]	[−0.304**]			[0.000]
0.626	0.252	0.213	0.103	0.314***	0.040	−0.055	0.289***	−0.038***		50.775
		[−0.152]	[0.002]	[−0.285*]	[−0.024]	[0.347]	[−0.242***]	[0.043***]		[0.000]
0.585	0.383**	0.142	0.078	0.178	0.019	0.240	0.193***	−0.030*	−0.416*	30.134
		[−0.082]	[0.025]	[−0.150]	[−0.002]	[0.058]	[−0.177*]	[0.035***]	[0.661*]	[0.000]

Panel C.2 Event Driven Strategies — Multi Strategy: MUL

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	MLU	EMB	SBD	APr	
0.404	0.249	0.273***	0.183***	0.142***	0.038*					
0.450	0.142	0.210***	0.148***	0.117***	0.055***	0.247***				
0.530	0.141	0.105***	0.103***	0.111***	0.063***	0.194***	0.126***			
0.576	0.139	0.106***	0.100***	0.096***	0.054***	0.160***	0.119***	−0.027***		
0.586	0.190	0.109***	0.095***	0.088***	0.055***	0.170***	0.112***	−0.024*	−0.008	
0.487	−0.323	0.655***	0.437***	0.520**	0.044*					27.366
		[−0.416*]	[−0.295*]	[−0.392]	[0.030]					[0.000]
0.491	−0.193	0.654*	0.548*	0.593	−0.015	−0.208				16.509
		[−0.459]	[−0.416]	[−0.483]	[0.090]	[0.383]				[0.005]
0.546	0.084	0.097	0.093	0.119	0.093***	0.092	0.227			11.014
		[0.004]	[0.008]	[−0.005]	[−0.068]	[0.061]	[−0.133]			[0.088]
0.618	0.038	0.225*	0.150	0.180	0.076***	−0.083	0.174**	−0.047***		22.408
		[−0.137]	[−0.049]	[−0.085]	[−0.072*]	[0.247]	[−0.083]	[0.036**]		[0.002]
0.641	−0.077	0.406***	0.276***	0.328***	0.061**	−0.148	0.100	−0.049***	−0.001	29.625
		[−0.340**]	[−0.190*]	[−0.262**]	[−0.052]	[0.328*]	[−0.007]	[0.039**]	[0.011]	[0.000]

Panel C.3 Event Driven Strategies — Risk Arbitrage: RIS

		Common factors				Factor 5	Factor 6	Factor 7	Factor 8	DWH
$\bar{R}^2$	α	RUS	SMB	HML	UMD	LHC	SBD			
0.382	0.085	0.174***	0.145***	0.129***	−0.002					
0.398	0.074	0.154***	0.134***	0.123***	0.005	0.102**				
0.456	0.061	0.145***	0.127***	0.109***	−0.001	0.091**	−0.021***			
0.427	−0.228	0.344***	0.341***	0.396***	−0.006					15.136
		[−0.184]	[−0.226***]	[−0.280**]	[0.019]					[0.004]
0.446	−0.397*	0.501***	0.513***	0.582***	−0.025	−0.277				17.219
		[−0.363**]	[−0.396**]	[−0.476**]	[0.026]	[0.325]				[0.004]
0.514	−0.312***	0.402***	0.394***	0.452***	−0.006	−0.237	−0.035***			22.813
		[−0.275***]	[−0.272***]	[−0.358***]	[−0.025]	[0.301*]	[0.029***]			[0.000]

Bollen & Whaley (2009) – Hedge Fund Risk Dynamics: Implications for Performance Appraisal (The Journal of Finance)

- A model that allows risk factor loadings to vary with time explains HF returns better than a constant-beta model
  - Studying individual funds, and allowing each fund have one "structural breakpoint" during the sample period
  - About 40% of HFs exhibit statistically significant switches
- Factors:
  - FF + squared FF
  - change in 10-year Treasury yield
  - credit spread (10-year BAA minus 10-year Treasury)
  - Five FH trend following factors for bonds, FX, commodities, interest rates, and equity indices
- Including time-varying risk exposures increase R^2s (see Table XII, Panels C and D)

Time variation in risk exposures

Table XII

Frequency of Significant Parameter Changes in Factor Models Estimated Using Reported Monthly Returns of 3,013 CISDM Live Funds

See Appendix Table A1 for definitions of fund types. Panel A shows the number of active funds categorized by fund type and history length in months. Panel B shows the percentage of funds for which a constant-beta model can be rejected in favor of a switching-beta model at the 10% probability level using the futures contract factors listed in Appendix Table A1. Panels C and D compare the average adjusted-R^2 of funds with significant switches in factor loadings when loadings are restricted to be constant (Panel C) and when loadings are allowed to vary (Panel D). Data are from January 1994 through December 2005.

	History Length		
Type	All	$36 \le n < 60$	$n \ge 60$
Panel A: Number of Funds			
All	2,481	860	1,621
HF	1,198	422	776
FOF	797	335	462
CTA	271	65	206
CPO	215	38	177
Panel B: Percent of Funds with Significant Switches			
All	39.7%	30.9%	44.3%
HF	42.1%	35.8%	45.5%
FOF	40.4%	25.7%	51.1%
CTA	32.5%	29.2%	33.5%
CPO	32.6%	26.3%	33.9%
Panel C: Adjusted-R^2 Constant Beta			
All	20.7%	21.2%	20.6%
HF	20.4%	19.2%	20.9%
FOF	23.4%	26.3%	22.4%
CTA	14.7%	16.6%	14.2%
CPO	18.4%	15.9%	18.8%
Panel D: Adjusted-R^2 Switching Beta			
All	35.0%	37.4%	34.1%
HF	35.3%	36.1%	35.0%
FOF	37.0%	40.9%	35.6%
CTA	28.6%	35.3%	26.8%
CPO	30.9%	30.3%	31.0%

Agarwal, Bakshi & Huij (2009) – Do Higher-Moment Equity Risks Explain Hedge Fund Returns? (CFR working paper, No. 10-07)

- Creating proxies and tradable portfolios for higher-moments in equity returns
- HFs have significant exposure to higher-moments
    - Especially HFs with distinct exposure to equity markets
- Grouping HFs by their exposures to higher-moments shows that lower exposure HFs produce higher alpha in the future (the following three months)
    - FH7 used as the factor model
    - Applies to both the combined exposure to all higher-moments and exposures to each higher-moment individually
- Exposures vary between different styles:
    - Managed Futures: long volatility, skewness and kurtosis
    - Event Driven: short skewness and kurtosis
    - L/S Equity: long volatility, short skewness and long kurtosis
    - Controlling with FH7 factors
- Volatility and kurtosis tend to be closely correlated (in the sample 0.88)

Patton & Ramadorai (2013) – On the High-Frequency Dynamics of Hedge Fund Risk Exposures (The Journal of Finance)

- Three models to extract intra-month variation in HF exposures:
  - Ferson & Schadt (1996): "daily exposures evolve as a linear function of observable instruments"
  - Day-of-the-month model: intra-month variability allowed
  - Threshold model: allowing variability when a certain threshold in an exposure is crossed
- For each fund style two factor from Fung & Hsieh (2004) are selected based on BIC (see next page)
  - Similar to Bollen & Whaley (2009)
- Conditioning factors for risk exposures (first three adjusted for autocorrelation):
  - TED spread
  - First difference of the constant-maturity three-month US T-bill
  - VIX
  - S&P 500 return
- The models produce on average R^2s 49% higher than the Fung & Hsieh (2004) model
- Intra-month risk exposures high after the end-of-month and then decrease until the subsequent reporting period
- Sample period: 1994-2009

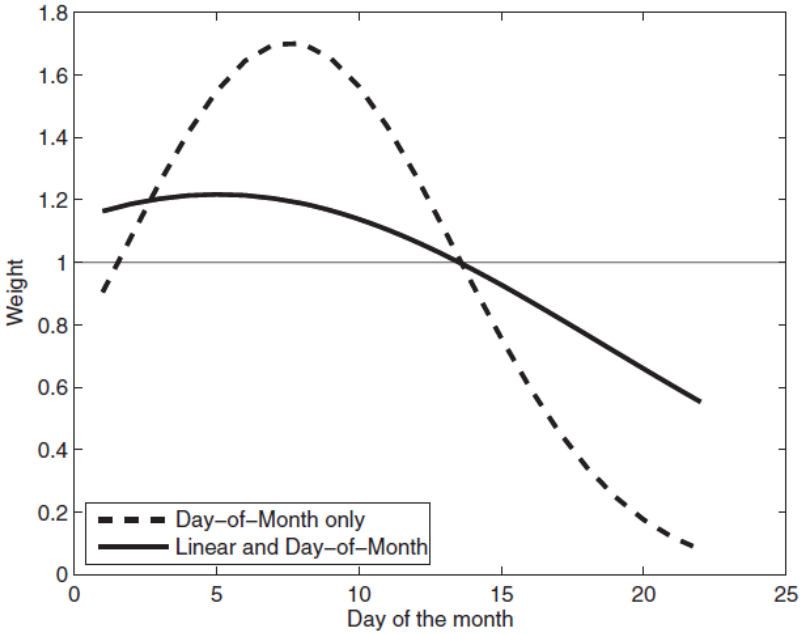


Figure 6. MIDAS weights on factor. This figure depicts day-of-the-month variation in risk exposures from the model with only day-of-the-month effects, and the model including both day-of-the-month effects and variation in risk exposures that is linear in both daily and monthly conditioning variables. The sample consists of funds with significant time-variation in risk exposures.

Patton & Ramadorai (2013) – On the High-Frequency Dynamics of Hedge Fund Risk Exposures (The Journal of Finance)

Table IA.II
Static Factor Models for Daily and Monthly Hedge Fund Style Indexes

This table shows results from a simple two-factor model applied to five hedge fund style index returns, identified in the first row of the table. In all cases a constant is included, and two factors from the set of four daily Fung-Hsieh factors are selected using the Bayesian Information Criterion. The first row presents annualized alpha. Robust t-statistics are reported below the parameter estimates, and the R2 and adjusted R2 are reported in the bottom two rows of the table.

	Equity Hedge		Macro		Directional		Merger Arbitrage		Relative Value	
	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly
Alpha	1.575	1.595	3.738	3.322	3.044	3.709	5.444	5.331	-1.032	-0.473
t-stat	0.781	0.880	0.985	0.985	0.995	1.453	3.376	4.208	-0.422	-0.234
SP500	0.259	0.321			0.270	0.327	0.111	0.063	0.063	0.190
t-stat	15.395	6.070			11.298	4.029	5.181	2.332	1.811	3.935
SMB			0.070	0.111						
t-stat			2.111	0.849						
TCM10Y			-0.905	-0.376						
t-stat			-2.742	-0.405						
BAAMTSY	-2.006	-2.027			-2.720	-3.861	-0.460	-0.579	-2.544	-6.080
t-stat	-4.184	-2.728			-3.847	-3.686	-0.804	-1.935	-3.724	-9.584
R2	0.549	0.681	0.014	0.007	0.454	0.664	0.290	0.182	0.090	0.784
R2adj	0.548	0.672	0.013	-0.021	0.453	0.652	0.289	0.160	0.089	0.778

Patton & Ramadorai (2013) – On the High-Frequency Dynamics of Hedge Fund Risk Exposures (The Journal of Finance)

Table II

The Linear Model for Daily and Monthly Hedge Fund Style Indexes

Table II shows results from a two-factor model applied to five hedge fund style index returns, identified in the first row of the table, allowing for time-variation in the factor exposures as a linear function of conditioning variables (i.e., $g(Z)$ is linear in Z, as in equation (7)). Two factors from the set of four daily Fung–Hsieh (2004a) factors are selected for each style using the Bayesian Information Criterion—these are identified in the Internet Appendix. The first row presents annualized alpha. Robust standard errors are reported below the parameter estimates, and the R^2 and adjusted R^2 are also reported. The p-values are reported for the joint significance of the coefficients on the interaction terms (Gamma1, Gamma2, Delta1, Delta2). The final two rows present the correlations between the time series of daily factor exposures estimated using daily and monthly data, for each of the two factors. For ease of comparison, Z is set to be dLevel for all indexes.

	Equity Hedge		Macro		Directional		Merger Arbitrage		Relative Value	
	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly
alpha	1.406	3.064	3.395	3.200	3.226	7.612	4.792	4.450	0.652	3.980
s.e.	2.217	2.053	3.782	3.859	3.529	3.213	1.417	1.402	2.860	1.820
beta1	0.308	0.327	0.066	0.121	0.318	0.248	0.092	0.104	0.107	0.076
s.e.	0.008	0.051	0.027	0.144	0.012	0.081	0.005	0.035	0.010	0.045
beta2	−1.873	−1.802	−0.748	−0.766	−2.483	−3.293	−0.677	−0.614	−1.900	−5.795
s.e.	0.291	0.698	0.244	1.248	0.470	1.037	0.186	0.477	0.375	0.619
gam1	0.006	0.010	0.001	0.003	0.005	0.002	−0.001	0.009	0.005	−0.010
s.e.	0.001	0.006	0.003	0.025	0.001	0.009	0.000	0.004	0.001	0.005
gam2	−0.009	0.027	0.039	0.069	0.004	−0.025	−0.059	0.027	0.129	0.002
s.e.	0.031	0.113	0.032	0.148	0.048	0.170	0.020	0.077	0.041	0.100
delta1	0.006	0.034	−0.012	−0.022	0.004	0.054	−0.003	−0.003	0.017	0.050
s.e.	0.002	0.012	0.008	0.071	0.003	0.018	0.002	0.008	0.003	0.011
delta2	0.221	0.325	−0.272	1.082	0.295	1.119	−0.006	0.187	0.100	0.099
s.e.	0.072	0.763	0.108	0.763	0.103	1.130	0.046	0.521	0.093	0.676
R2	0.575	0.734	0.019	0.049	0.470	0.715	0.291	0.262	0.131	0.846
R2adj	0.573	0.710	0.016	−0.035	0.468	0.683	0.288	0.197	0.127	0.832
pval	0.000	0.008	0.074	0.557	0.000	0.035	0.010	0.150	0.000	0.000
Corr-b1	0.897		0.985		0.420		−0.492		0.199	
Corr-b2	0.911		−0.776		0.992		−0.523		0.352	

Nucera & Valente (2013) – Carry trades and the performance of currency hedge funds (Journal of International Money and Finance)

- Studying the relationship between a carry trade strategy and currency HF returns
  - Assuming that exchange rates follow a random walk
- A significant proportion of currency HFs exhibit returns in excess of the RW strategy
  - Especially the highest 10% generate significant excess returns
- The performance of the best funds persists over time
- Table 4: currency HFs divided into quintiles based on their alphas in the RW model
- Significant loadings on:
  - Global volatility factor
  - USD level factor
  - Momentum

Table 2
Performance of currency funds.

	Bottom				Top		
	10%	20%	30%	Median	30%	20%	10%
Panel A: currency hedge funds, $\widehat{\alpha}_k$							
$\widehat{\alpha}$	−0.586	−0.222	−0.025	0.260	0.631	1.084	1.960
p-value (boot)	0.99	0.99	0.99	<0.01	<0.01	<0.01	<0.01
p-value (param)	0.44	0.22	0.50	0.21	0.29	0.13	0.01
Panel B: currency hedge funds, $\widehat{t}_{\widehat{\alpha}}$							
$\widehat{t}_{\widehat{\alpha}}$	−0.997	−0.459	−0.047	0.562	1.175	1.542	2.182
p-value (boot)	0.99	0.99	0.99	<0.01	<0.01	< 0.01	< 0.01
p-value (param)	0.16	0.32	0.48	0.28	0.12	0.06	0.02

The table shows the estimated $\widehat{\alpha}_k$ and $\widehat{t}_{\widehat{\alpha}_k}$ for the sample of currency hedge funds over the period January 1999–January 2009. Currency funds are ranked according to their $\widehat{\alpha}_k$ (Panel A) and the $\widehat{t}_{\widehat{\alpha}_k}$ (Panel B) with respect to the RW strategy. The first row of Panel A reports the OLS estimates of $\widehat{\alpha}$ expressed as monthly percentage points, while the first row of Panel B reports the estimates of $\widehat{t}_{\widehat{\alpha}}$. The other two rows show the *p*-value of the null hypothesis that $\widehat{\alpha} = 0$ (or $\widehat{t}_{\widehat{\alpha}} = 0$) based on the cross-sectionally bootstrapped *p*-values of the null hypothesis that $\widehat{\alpha} = 0$ (or $\widehat{t}_{\widehat{\alpha}} = 0$) as described in Section 4.1 of the text and in the online Appendix, section B (*p*-value boot) and the asymptotic *p*-values of the same null hypothesis (*p*-value param), respectively. For each panel the first column reports results for the marginal fund at the bottom 10th percentile, while the last column reports results for the marginal fund at the top 10th percentile of the statistics of interest ($\widehat{\alpha}$ or $\widehat{t}_{\widehat{\alpha}}$). The cross-sectionally bootstrapped *p*-values are computed using 1000 bootstrap replications. $\widehat{\alpha}_k$ and $\widehat{t}_{\widehat{\alpha}_k}$ are computed using heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987).

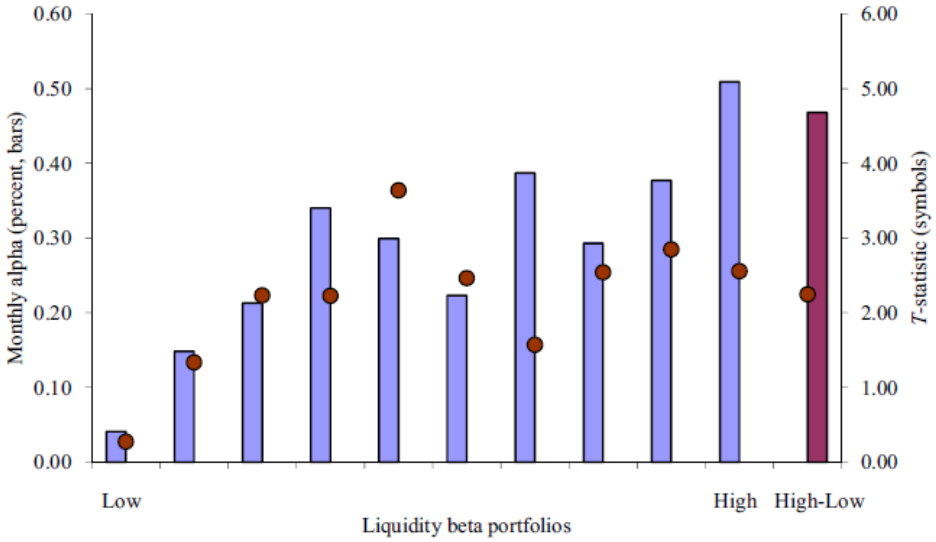
Table 4
Risk/skill attribution.

	$q = 1$		$q = 2$		$q = 3$		$q = 4$		$q = 5$	
$\alpha_{S,q}$	−0.23 [0.27]	(0.16)	−0.15 [0.17]	(0.22)	−0.03 [0.41]	(0.41)	−0.21 [0.21]	(0.13)	0.54 [0.37]	(0.08)
$\Delta\widetilde{\text{GVOL}}_t$	5.59 [0.04]	(0.04)	3.34 [0.06]	(0.05)	4.39 [0.01]	(0.01)	5.39 [0.01]	(0.01)	6.47 [0.06]	(0.05)
$\Delta\widetilde{\text{ILLIQ}}_t$	0.48 [0.35]	(0.35)	0.13 [0.44]	(0.43)	−0.03 [0.47]	(0.48)	−0.80 [0.21]	(0.22)	−0.29 [0.44]	(0.42)
$\Delta\widetilde{\text{LEV}}_t$	1.97 [0.33]	(0.35)	0.34 [0.46]	(0.45)	−0.34 [0.46]	(0.45)	0.73 [0.42]	(0.42)	−1.26 [0.42]	(0.42)
RX_t	0.65 [<0.01]	(<0.01)	0.33 [<0.01]	(<0.01)	0.45 [<0.01]	(<0.01)	0.71 [<0.01]	(<0.01)	0.67 [<0.01]	(<0.01)
HML_t^{FX}	−0.02 [0.39]	(0.37)	0.05 [0.24]	(0.22)	0.02 [0.38]	(0.37)	0.03 [0.36]	(0.35)	0.05 [0.34]	(0.34)
MOM_t	0.39 [<0.01]	(<0.01)	0.17 [<0.01]	(<0.01)	0.21 [<0.01]	(<0.01)	0.19 [0.01]	(0.01)	0.19 [0.07]	(0.09)
$\overline{R}^2$	0.28		0.15		0.28		0.27		0.11	

The table shows the parameter estimates $\widehat{\alpha}_{S,q}$, $\widehat{\beta}_{q,m}$ of the regression $R_{q,t} = \alpha_{S,q} + \sum_{m=1}^{6}\beta_{q,m}F_{m,t} + \varepsilon_{q,t}, q = 1,\ldots 5$ where $R_{q,t}$ has been constructed using the performance of each fund during the past year and tested over the next year. The regressions are estimated over the period January 2000–January 2009. The risk factors included are 1) global volatility factor ($\Delta\widetilde{\text{GVOL}}_t$) of Menkhoff et al. (2012a); 2) an illiquidity factor ($\Delta\widetilde{\text{ILLIQ}}_t$); 3) the USD level ($RX_t$) and slope factor ($\text{HML}_t^{\text{FX}}$) as in Lustig et al. (2011); 3) the currency momentum factor (MOM_t) as in Menkhoff et al. (2012b); and 4) a leverage factor ($\Delta\widetilde{\text{LEV}}_t$) as in Adrian et al. (2009). Data sources and details of the construction of the risk factors are reported in the online Appendix (Section A) and in Subsection 4.3, respectively. $\widehat{\alpha}_{S,q}$ are expressed as monthly percentage points. Values in brackets denote bootstrapped *p*-values computed under the null hypothesis that $\beta_{q,m} = 0$ while values in parentheses denote bootstrapped *p*-values computed under the null hypothesis that $\alpha_{S,q} = \beta_{q,m} = 0$, and $\overline{R}^2$ denotes the adjusted coefficient of determinations. The bootstrapped *p*-values are computed using 1000 bootstrap replications. See also notes to Table 3.

Sadka (2010) – Liquidity risk and the cross-section of hedge fund returns (Journal of Financial Economics)

- Analyzing the impact of liquidity in the returns of individual HFs
- Liquidity factor:
  - Sadka (2006)
  - Utilizing individual tick-by-tick data on individual US stocks and aggregating to market level
  - Applying an AR(3) process since liquidity tends to be persistent
  - The liquidity factor is derived from the shock on the AR(3) process
- Sample period 1/1994-12/2008
- The main study is based on cross-sectional differences between high- and low-exposure funds to the liquidity risk
  - The decile with the highest exposure outperforms the lowest one by approximately 6% annually
  - The relationship is reversed during liquidity crises:
    - 10-12/1998: -4.32%
    - 8-10/2007: -4.15%
    - 10-12/2008: -14.48%
  - Results hold after controlling for investor liquidity factors (lockup periods and redemption notices)
- Liquidity factor adds some additional explanatory power to the Fung & Hsieh (2004) model but due to the infrequent nature of liquidity shocks the impact is rather limited
  - Using the entire cross-section yields a monthly liquidity beta of 0.0143 (t-statistic 2.25)
- Emphasis on the aggregate market liquidity and not the liquidity offered to HF investors
  - For research on the latter see Aragon(2007)



Sadka (2010) – Liquidity risk and the cross-section of hedge fund returns (Journal of Financial Economics)

Table 3

Time-series regressions of hedge-fund returns on different factors.

The table reports the results of time-series regressions of hedge-fund returns portfolios on the Fung-Hsieh factors and the Sadka factor. Hedge funds are sorted monthly into 11 portfolios according to investment style (portfolio returns are equally weighted). The Fung-Hsieh factors are the market portfolio (excess of risk-free rate), SMB of Fama and French (1993), the change in the term spread, the change in the credit spread, and the trend-following factors: PTFSBD (bonds), PTFSFX (currencies), and PTFSCOM (commodities). *T*-statistics are reported in square brackets. The analysis includes the hedge-fund universe on TASS for the period January 1994 to December 2008.

Investment style	Intercept	MKT-RF	SMB	ΔTERM	ΔCREDIT	PTFSBD	PTFSFX	PTFSCOM	Liquidity	R^2/ Adjusted R^2
Convertible Arbitrage	0.0016	0.2094							1.2795	0.41
	[1.46]	[8.50]							[6.08]	0.41
	0.0026	0.1232	0.0232	−0.0274	−0.0564	−0.0069	−0.0058	−0.0053	0.7759	0.61
	[2.80]	[5.40]	[0.92]	[−6.15]	[−8.00]	[−1.09]	[−1.13]	[−0.76]	[4.17]	0.59
Dedicated Short Bias	0.0034	−0.9563							0.3272	0.74
	[1.79]	[−22.23]							[0.89]	0.73
	0.0053	−0.9686	−0.4162	−0.0178	−0.0698	0.0018	0.0040	0.0056	−0.1554	0.85
	[3.54]	[−26.06]	[−10.14]	[−2.45]	[−6.07]	[0.18]	[0.48]	[0.49]	[−0.51]	0.84
Emerging Markets	0.0034	0.6414							1.5267	0.48
	[1.44]	[11.91]							[3.32]	0.48
	0.0039	0.5434	0.1882	−0.0034	−0.0358	−0.0334	−0.0003	0.0016	1.1302	0.54
	[1.67]	[9.45]	[2.96]	[−0.30]	[−2.01]	[−2.08]	[−0.02]	[0.09]	[2.41]	0.52
Equity Market Neutral	0.0044	0.0983							0.7026	0.30
	[6.26]	[6.17]							[5.16]	0.29
	0.0049	0.0659	−0.0173	−0.0160	−0.0313	−0.0011	0.0051	0.0016	0.4686	0.45
	[7.54]	[4.11]	[−0.98]	[−5.11]	[−6.32]	[−0.25]	[1.43]	[0.33]	[3.59]	0.42
Event Driven	0.0042	0.2579							0.8787	0.60
	[5.28]	[14.40]							[5.74]	0.60
	0.0048	0.1901	0.0710	−0.0077	−0.0362	−0.0180	0.0039	−0.0030	0.5316	0.76
	[7.43]	[11.97]	[4.05]	[−2.49]	[−7.37]	[−4.06]	[1.10]	[−0.60]	[4.10]	0.74

Sadka (2010) – Liquidity risk and the cross-section of hedge fund returns (Journal of Financial Economics)

Investment style	Intercept	MKT-RF	SMB	ΔTERM	ΔCREDIT	PTFSBD	PTFSFX	PTFSCOM	Liquidity	R^2/ Adjusted R^2
Fixed Income Arbitrage	0.0026	0.1131							0.9383	0.24
	[2.63]	[5.06]							[4.91]	0.24
	0.0038	0.0303	−0.0176	−0.0269	−0.0631	−0.0042	−0.0047	0.0015	0.3924	0.57
	[4.92]	[1.58]	[−0.83]	[−7.18]	[−10.66]	[−0.78]	[−1.09]	[0.25]	[2.51]	0.55
Fund of Funds	0.0017	0.2394							1.0914	0.43
	[1.54]	[9.50]							[5.07]	0.42
	0.0023	0.1808	0.0726	−0.0203	−0.0462	−0.0058	0.0130	0.0134	0.7393	0.58
	[2.29]	[7.39]	[2.69]	[−4.25]	[−6.11]	[−0.85]	[2.36]	[1.77]	[3.71]	0.56
Global Macro	0.0032	0.1570							0.4228	0.18
	[2.58]	[5.69]							[1.79]	0.17
	0.0030	0.1554	0.0185	−0.0137	−0.0217	−0.0065	0.0337	0.0139	0.3772	0.37
	[2.70]	[5.68]	[0.61]	[−2.56]	[−2.56]	[−0.86]	[5.49]	[1.65]	[1.69]	0.34
Long/Short Equity	0.0065	0.4901							0.9068	0.67
	[5.27]	[17.73]							[3.84]	0.66
	0.0062	0.4472	0.2175	−0.0065	−0.0081	−0.0065	0.0047	0.0100	0.8109	0.76
	[5.73]	[16.75]	[7.38]	[−1.24]	[−0.98]	[−0.87]	[0.78]	[1.21]	[3.73]	0.75
Managed Futures	0.0053	−0.0620							0.3399	0.01
	[2.38]	[−1.24]							[0.79]	0.00
	0.0051	−0.0165	−0.0024	−0.0250	−0.0235	0.0331	0.0397	0.0530	0.3949	0.27
	[2.55]	[−0.34]	[−0.04]	[−2.63]	[−1.56]	[2.43]	[3.64]	[3.53]	[0.99]	0.24
Multi-Strategy	0.0048	0.2702							1.5325	0.35
	[3.05]	[7.65]							[5.08]	0.35
	0.0046	0.2419	0.0787	−0.0401	−0.0261	0.0094	0.0043	0.0139	1.4195	0.49
	[3.19]	[6.80]	[2.00]	[−5.76]	[−2.37]	[0.95]	[0.54]	[1.27]	[4.89]	0.46

Lambert (2012) – Hedge Fund Market Risk Exposures: A Survey

- An overview on the academic literature on risk factors affecting HF returns
- Divides risk factors into four categories:

Distribution-based
- Higher-order risk proxies superior to other non-linear ones as they are not multicollinear with market indices (Kat & Miffre (2006))
- US Equity coskewness and cokurtosis are priced in Equity, Event Driven and Macro HFs (Lambert & Hübner (2012))
- VIX is a dominant factor for analyzing HF returns (Mackey (2006))
- In general, several studies show that higher-order risk factors are significant in explaining HF returns

Option-based
- Many HFs seem to be selling equity volatility, namely OTM and ATM puts (e.g. Agarwal & Naik (2004), Roncalli & Weisang (2011))
- Applies to other asset classes as well (e.g. bond indices)
- De Los Rios & Garcia (2011) show that option-like payoffs do not apply to all HF styles

Market-based
- Equity HFs:
  - Main risk exposures: equity market, SMB, HML, momentum
  - Also higher-order factors and VIX
- Event Driven HFs:
  - Main risk exposures: SMB, HML, momentum
  - Negative kurtosis ans skewness
  - HY bonds (distressed firms) and VIX
  - Short puts
- Global Macro HFs:
  - EM equity and bond indices, US Dollar index, World Gov't and Corp. Bond indices
  - Long exposure on high-yielding currencies, short on low-yielding ones (Teo (2009))
  - Either a short call or a long put (Fung & Hsieh (1999))
- Relative value HFs:
  - Equity markets, SMB, momemtum
  - Mean-reversion strategies (negative exposure to lookback straddles)
  - Gov't and corp. bonds, EM bonds and equity
  - Fixed Income Convertible Arbitrage:
    - BAA – 10-year treasury or yield curve spread
    - Long convertible bond, short the issuer's stock

Non-market based
- Liquidity exposure affects HF returns
  - Sadka (2010)
  - Teo (2011): Studying the liquidity risk of liquid HFs
- Credit risk also significant in several models

Other related papers

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