Alternative Investment Management Cont'd

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Asset Management – November 21st 2019

Outline

⑥ Global Macro

Most
Popular

⑦ Long-Short Equity

Hedge

(Momentum)

$\beta m \neq 0$

⑧ Manage Future

1. Linear Regression Analysis
   - Linear Regression Analysis

2. Linear Clones
   - Linear Clones

① Convertible Arbitrage

Convertible bond + equity

② Dedicated Short Bias

③ Emerging Market

④ Equity Market Neutral

$\beta m \approx 0$

⑤ Event Driven

Ⓧ Market Efficiency Hypothesis

⑤ Fixed Income Arbitrage

Outline

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Linear Regression Analysis

- To explore the full range of possibilities for replicating hedge-fund returns illustrated by the two extremes of CDP and CMP, investigate the characteristics of a sample of individual hedge funds drawn from the TASS Hedge Fund Database.

Summary Statistics of Funds by Categories

Table 4   Summary statistics for TASS Live hedge funds included in our sample from February 1986 to September 2005.

Handwritten annotations: "Most equities have positive return" (pointing to Dedicated short bias mean), "$\frac{S}{P}$ Most 0", "Most common" (pointing to Long/Short equity hedge), "Most smaller than $\alpha(SP) = 18\%$", "Larger than $SR(SP) = 0.4$"

Category	Sample size	Annualized mean (%)		Annualized SD (%)		Annualized Sharpe ratio		ρ_1 (%)		Ljung-Box p-value (%)		Annualized performance of equal-weighted portfolio of funds		
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean (%)	SD (%)	Sharpe
Convertible arbitrage	82	8.41	5.11	6.20	5.28	2.70	5.84	42.2	17.3	11.0	22.2	11.07	5.36	2.07
Dedicated short bias	10	5.98	4.77	28.27	10.05	0.25	0.24	5.5	12.6	24.2	20.3	6.40	23.23	0.28
Emerging markets	102	20.41	13.01	22.92	15.16	1.42	2.11	18.0	12.4	36.3	30.2	22.34	17.71	1.26
Equity market neutral	83	8.09	4.77	7.78	5.84	1.44	1.20	9.1	23.0	32.6	29.7	12.83	6.23	2.06
Event driven	169	13.03	8.65	8.40	8.09	1.99	1.37	22.2	17.6	27.0	29.3	13.47	4.37	3.08
Fixed income arbitrage	62	9.50	4.54	6.56	4.41	2.05	1.48	22.1	17.6	35.9	35.2	10.48	3.58	2.93
Global macro	54	11.38	6.16	11.93	6.10	1.07	0.58	5.8	12.2	43.1	32.5	14.91	8.64	1.73
Long/Short equity hedge	520	14.59	8.14	15.96	9.06	1.06	0.58	12.8	14.9	36.0	30.5	16.35	11.84	1.38
Managed futures	114	13.64	9.35	21.46	12.07	0.67	0.39	2.5	10.2	40.1	31.5	15.96	19.24	0.83
Multi-strategy	59	10.79	5.22	8.72	9.70	1.86	1.03	21.0	20.1	28.2	30.1	14.59	5.78	2.52
Fund of funds	355	8.25	3.73	6.36	4.47	1.66	0.86	23.2	15.0	27.1	26.3	11.93	7.48	1.59

Methodology: Factor Model Specification

- To determine the explanatory power of common risk factors for hedge funds, perform a time-series regression for each hedge fund's monthly returns on a set of risk factors:

$$R_{it} = \alpha_i + \beta_{i1} \text{RiskFactor}_{1t} + ... + \beta_{iK} \text{RiskFactor}_{Kt} + \epsilon_{it}$$

- The above decomposition of a fund's return offers the following characterization of the funds's expected return and variance:

$$E(R_{it}) = \underbrace{\alpha_i}_{\text{manager-specific}} + \underbrace{\beta_{i1} E[\text{RiskFactor}_{1t}] + ... + \beta_{iK} E[\text{RiskFactor}_{Kt}]}_{\text{expected returns associated with identifiable risk factors}}$$

$$\text{Var}(R_{it}) = \beta_{i1}^2 \text{Var}[\text{RiskFactor}_{1t}] + ... + \beta_{iK}^2 \text{Var}[\text{RiskFactor}_{Kt}]$$
$$+ \beta_{i1} \beta_{iK} \text{Cov}[\text{RiskFactor}_{1t}, \text{RiskFactor}_{Kt}] + ...$$
$$+ \text{Var}(\epsilon_{it})$$

Choice of Risk Factors

1. USD: the US Dollar Index Return   *RX factor*
2. BOND: the return on the corporate AA Intermediate Bond Index   *interest risk*
3. CREDIT: the spread between the BAA Corporate Bond Index and the Treasury Index   *default risk*
4. SP500: the $S\&P500$ total return   *equity market risk*
5. CMDTY: the Goldman Sachs Commodity Index total return   *future risk*
6. DVIX: the first-difference of the end-of-month value of the CBOE Volatility Index (VIX).   *volatility risk (option)*

Factor Exposures

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.

Category	Sample size	Statistic	Intercept					R_{sp500}					R_{lb}					R_{usd}				
			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	−1.07	−0.88	−0.11	0.50	−0.60	0.28	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	6.38	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	−0.05	−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

Factor Exposures cont'd

Table 5 (*Continued*)

Category	Sample size	Statistic	R_{ea} Min	Med	Mean	Max	SD	ΔVIX Min	Med	Mean	Max	SD	R_{gsci} Min	Med	Mean	Max	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	4.4	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	0.4	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	6.2	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

not high R^2.

Decomposition of Total Returns

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. $E[R]$	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

(Header spanning: "Average of percentage contribution of factors to total expected return (%)" covers CREDIT, USD, SP500, BOND, DVIX, CMDTY, ALPHA)

⇒ positive return

all very high

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Outline

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Linear Clones

- To construct a linear clone for fund i, regress the fund's returns $R_{i,t}$ on the factors, omitting the intercept and constraining the beta coefficients to sum to one:

$$R_{it} = \beta_{i1}\text{SP500}_t + \beta_{i2}\text{BOND}_t + \beta_{i3}\text{USD}_t + \beta_{i4}\text{CREDIT}_t + \beta_{i5}\text{CMDTY}_t + \epsilon_{it}$$

$$t = 1, 2, ..., T$$

$$\text{subject to } \beta_{i1} + \beta_{i2} + \beta_{i3} + \beta_{i4} + \beta_{i5} = 1$$

- The estimated regression coefficients are then used as portfolio weights for the five factors $\Rightarrow$ the portfolio returns are equivalent to the fitted values of the regression equation.
- Implement an additional renormalization so that the resulting portfolio return has the same volatility as the original fund's return series:

$$R_{it}^* = \beta_{i1}^*\text{SP500}_t + \beta_{i2}^*\text{BOND}_t + \beta_{i3}^*\text{USD}_t + \beta_{i4}^*\text{CREDIT}_t + \beta_{i5}^*\text{CMDTY}_t$$

$$\widehat{R}_{it} \equiv \gamma_i R_{it}^*, \ \gamma_i \equiv \frac{\sqrt{\sum_{t=1}^{T}\left(R_{it} - \overline{R}_i\right)^2}}{\sqrt{\sum_{t=1}^{T}\left(R_{it}^* - \overline{R}_i^*\right)^2}}$$

Linear Clones cont'd

Note: Renormalization is equivalent to changing the leverage of the clone portfolio, since the sum of the renormalized betas will equal the renormalization factor γ_i, not one.

- If γ_i exceeds one, then positive leverage is required; and if less than one, the portfolio is not fully invested in the factors.

- A more complete description of portfolio weights of clone i is obtained by introducing an additional asset that represents leverage, in which case the weights of the five factors and this additional asset must sum to one:

$$1 = \gamma_i \left(\beta_{i1}^* + \beta_{i2}^* + \beta_{i3}^* + \beta_{i4}^* + \beta_{i5}^* \right) + \delta_i$$

- The clone return is then given by

$$\widehat{R}_{it} = \gamma_i \left(\beta_{i1}^* \mathsf{SP500}_t + ... + \beta_{i5}^* \mathsf{CMDTY}_t \right) + \delta_i R_l$$
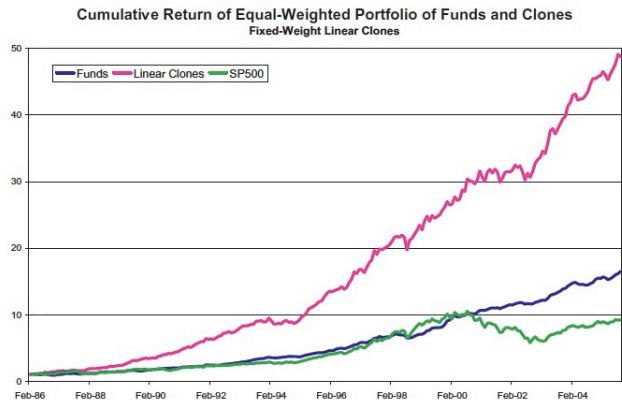
Hedge Funds vs Linear Clones

Table 7   Performance comparison of fixed-weight and rolling-window linear clones of hedge funds in the TASS Live database and their corresponding funds, from February 1986 to September 2005. The category "Dedicated Short Bias*" excludes Fund 33735.

Category description	Sample size	Fixed-weight linear clones																				24-month rolling-window linear clones																			
		Annual mean return (%)		Annual SD (%)		Annual Sharpe		ρ_1(%)		p-value(Q_{12})(%)		Annual mean return (%)		Annual SD (%)		Annual Sharpe		ρ_1(%)		p-value(Q_6)(%)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Funds																					
Convertible arbitrage	82	8.41	5.11	6.20	5.28	2.70	5.84	42.2	17.3	11.0	22.2	4.04	7.83	5.76	4.55	2.31	8.96	42.3	16.2	12.4	19.4
Dedicated short bias	10	5.98	4.77	28.27	10.05	0.25	0.24	5.5	12.6	24.2	20.3	2.58	7.19	25.91	14.20	0.02	0.42	8.3	5.5	31.9	19.0
Dedicated short bias*	9	4.92	3.58	28.75	10.53	0.20	0.20	3.4	11.3	25.5	21.1	1.42	6.55	26.21	15.03	-0.04	0.39	7.4	4.9	35.2	16.8
Emerging markets	102	20.41	13.01	22.92	15.16	1.42	2.11	18.0	12.4	36.3	30.2	21.12	13.86	19.95	14.06	1.74	2.57	16.0	14.3	39.2	28.1
Equity market neutral	83	8.09	4.77	7.78	5.84	1.44	1.20	9.1	23.0	32.6	29.7	5.71	4.14	6.60	5.91	1.44	1.68	5.3	24.0	40.2	33.9
Event driven	169	13.03	8.65	8.40	8.09	1.99	1.37	22.2	17.6	27.0	29.3	11.65	10.45	7.62	7.68	2.01	1.43	17.2	17.8	31.1	29.8
Fixed income arbitrage	62	9.50	4.54	6.56	4.41	2.05	1.48	22.1	17.6	35.9	35.2	7.80	7.59	5.73	4.52	2.17	1.81	23.3	21.4	30.1	32.4
Global macro	54	11.38	6.16	11.93	6.10	1.07	0.58	5.8	12.2	43.1	32.5	9.01	6.72	11.16	6.50	0.91	0.73	6.6	18.9	44.7	31.2
Long/Short equity hedge	520	14.59	8.14	15.96	9.06	1.06	0.58	12.8	14.9	36.0	30.5	11.90	8.93	13.90	8.69	1.04	0.77	9.8	16.7	42.0	28.5
Managed futures	114	13.64	9.35	21.46	12.07	0.67	0.39	2.5	10.2	40.1	31.5	11.84	8.82	20.19	10.94	0.66	0.52	4.0	14.9	37.0	28.3
Multi-strategy	59	10.79	5.22	8.72	9.70	1.86	1.03	21.0	20.1	28.2	30.1	8.97	6.13	7.65	10.10	1.86	1.25	18.3	22.5	29.1	28.6
Fund of funds	355	8.25	3.73	6.36	4.47	1.66	0.86	23.2	15.0	27.1	26.3	7.34	3.95	5.68	4.29	1.67	0.97	22.6	16.3	24.0	26.5
All except fund of funds	1255	13.29	8.71	13.95	10.76	1.39	1.88	15.7	18.3	33.2	30.9	11.15	9.86	12.38	10.12	1.38	2.64	13.5	19.8	36.6	29.8
Linear clones																					
Convertible arbitrage	82	7.40	3.17	6.20	5.28	1.52	0.62	10.7	10.5	55.6	24.9	2.78	4.95	6.20	6.57	0.71	0.77	6.4	12.7	43.8	29.1
Dedicated short bias	10	6.70	11.59	28.27	10.05	0.32	0.48	2.8	5.9	73.6	17.5	6.83	16.18	29.31	15.61	0.09	0.45	0.4	8.8	36.7	28.7
Dedicated short bias*	9	3.61	6.61	28.75	10.53	0.19	0.29	3.7	5.6	77.3	14.0	9.08	15.41	30.00	16.39	0.17	0.40	-0.7	8.5	36.8	30.4
Emerging markets	102	14.77	11.47	22.92	15.16	0.88	0.58	0.0	9.6	62.7	27.6	5.17	14.70	25.04	17.94	0.47	0.66	-7.7	12.4	42.5	27.3
Equity market neutral	83	10.00	7.00	7.78	5.84	1.42	0.58	1.8	9.6	57.0	24.7	4.43	4.90	7.91	6.49	0.64	0.68	4.2	12.7	47.8	27.0
Event driven	169	9.84	6.69	8.40	8.09	1.43	0.52	4.3	11.0	55.8	24.1	6.96	8.33	7.79	7.10	1.05	0.56	3.0	13.3	39.6	27.3
Fixed income arbitrage	62	8.35	5.20	6.56	4.41	1.48	0.59	4.1	8.4	64.4	29.8	4.47	4.63	6.85	5.17	0.84	0.71	4.3	9.9	40.8	30.0
Global macro	54	15.54	8.35	11.93	6.10	1.41	0.55	2.6	8.3	52.2	23.8	12.97	8.90	12.48	7.38	1.08	0.59	4.1	11.1	45.3	28.2
Long/Short equity hedge	520	13.12	8.68	15.96	9.06	0.98	0.57	-0.1	10.0	59.7	26.3	9.08	11.03	15.83	10.64	0.76	0.68	0.3	15.6	42.5	29.1
Managed futures	114	27.97	16.32	21.46	12.07	1.36	0.40	4.7	8.1	61.4	29.0	19.24	13.32	22.96	13.71	0.91	0.57	5.5	10.9	46.5	27.7
Multi-strategy	59	10.32	7.21	8.72	9.70	1.51	0.62	2.3	10.1	59.7	28.8	5.33	7.52	9.16	9.59	0.71	0.60	0.8	13.0	35.9	28.2
Fund of funds	355	9.29	5.62	6.36	4.47	1.59	0.44	-0.1	11.1	50.5	24.7	5.67	4.57	6.22	5.40	1.11	0.54	0.0	13.0	39.8	28.5
All except fund of funds	1255	13.27	10.48	13.95	10.76	1.19	0.61	2.2	10.2	59.2	26.4	8.42	11.06	14.20	12.14	0.79	0.67	2.8	13.9	42.6	28.4

Hedge Funds vs Linear Clones cont'd

in-sample

Cumulative Return of Equal-Weighted Portfolio of Funds and Clones
Fixed-Weight Linear Clones

Hedge Funds vs Linear Clones cont'd

out-of-sample

Cumulative Return of Equal-Weighted Portfolio of Funds and Clones
24-Month Rolling-Window Linear Clones

Ghosh (2019)   Asset Management