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Systemic Risk and Hedge Funds

Nicholas Chan, Mila Getmansky,
Shane M. Haas, and Andrew W. Lo

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Motivation

Hedge Funds and Systemic Risk:

- Currently $1.5 Trillion In Assets and Growing
- About 8,000 Funds Worldwide
- Hedge Funds Are Hyperactive Investors
- Hedge Funds Provide Liquidity
- Banks Are Related To Hedge Funds
- August 1998 and LTCM

Motivation

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Lessons From August 1998:

- Liquidity and Credit are Important
- Multiplier/Accelerator Effect of Leverage
- Correlations Can Change Quickly
- Nonlinearities in Risk and Expected Return
- Systemic Risk Involves Hedge Funds

Motivation

Four Topics In This Talk:

1. Liquidity Risk
2. Risk Models for Hedge Funds
3. Industry Dynamics
4. Hedge-Fund Liquidations

For More Details, See:

- Chan et al. (2005)
- Getmansky, Lo, and Makarov (2005)
- Lo (2005)

The Data

Aggregate and Individual Data:

- CSFB/Tremont Hedge-Fund Indexes
  - 14 Indexes (13 Style Categories)
  - Jan 1994 to August 2004
- TASS Individual Hedge-Fund Returns
  - Feb 1977 to August 2004
  - Monthly Returns, AUM, Style, Fund Info

CSFB/Tremont Data

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14 Categories:

Hedge Funds	Event-Driven Multi-Strategy
Convertible Arbitrage	Risk Arbitrage
Dedicated Shortseller	Fixed Income Arbitrage
Emerging Markets	Global Macro
Equity Market Neutral	Long/Short Equity
Event Driven	Managed Futures
Distressed	Multi-Strategy

- Risk Models, Bank Index Regressions
- Regime-Switching Process
- Note: Indexes Are Averages

CSFB/Tremont Data

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Variable	Sample Size	Ann. Mean	Ann. SD	Corr. with S&P 500	Min	Med	Max	Skew	Kurt	ρ_1	ρ_2	ρ_3	p-value of LB-Q
CSFB/Tremont Indexes:													
Hedge Funds	128	10.51	8.25	45.9	-7.55	0.78	8.53	0.12	1.95	12.0	4.0	-0.5	54.8
Convert Arb	128	9.55	4.72	11.0	-4.68	1.09	3.57	-1.47	3.78	55.8	41.1	14.4	0.0
Dedicated Shortseller	128	-0.69	17.71	-75.6	-8.69	-0.39	22.71	0.90	2.16	9.2	-3.6	0.9	73.1
Emerging Markets	128	8.25	17.28	47.2	-23.03	1.17	16.42	-0.58	4.01	30.5	1.6	-1.4	0.7
Equity Market Neutral	128	10.01	3.05	39.6	-1.15	0.81	3.26	0.25	0.23	29.8	20.2	9.3	0.0
Event Driven	128	10.86	5.87	54.3	-11.77	1.01	3.68	-3.49	23.95	35.0	15.3	4.0	0.0
Distressed	128	12.73	6.79	53.5	-12.45	1.18	4.10	-2.79	17.02	29.3	13.4	2.0	0.3
Event-Driven Multi-Strategy	128	9.87	6.19	46.6	-11.52	0.90	4.66	-2.70	17.63	35.3	16.7	7.8	0.0
Risk Arb	128	7.78	4.39	44.7	-6.15	0.62	3.81	-1.27	6.14	27.3	-1.9	-9.7	1.2
Fixed Income Arb	128	6.69	3.86	-1.3	-6.96	0.77	2.02	-3.27	17.05	39.2	8.2	2.0	0.0
Global Macro	128	13.85	11.75	20.9	-11.55	1.19	10.60	0.00	2.26	5.5	4.0	8.8	65.0
Long/Short Equity	128	11.51	10.72	57.2	-11.43	0.78	13.01	0.26	3.61	16.9	6.0	-4.6	21.3
Managed Futures	128	6.48	12.21	-22.6	-9.35	0.18	9.95	0.07	0.49	5.8	-9.6	-0.7	64.5
Multi-Strategy	125	9.10	4.43	5.6	-4.76	0.83	3.61	-1.30	3.59	-0.9	7.6	18.0	17.2

TASS Data

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11 Categories:

Convertible Arbitrage
Dedicated Shortseller
Emerging Markets
Equity Market Neutral
Event Driven
Fixed Income Arbitrage
Global Macro
Long/Short Equity
Managed Futures
Multi-Strategy
Fund of Funds

- 1,837 Funds with Minimum 5-Year History
- Individual Estimates of Illiquidity
- Weighted Smoothing Coefficients
- Weighted Autocorrelations

TASS Data

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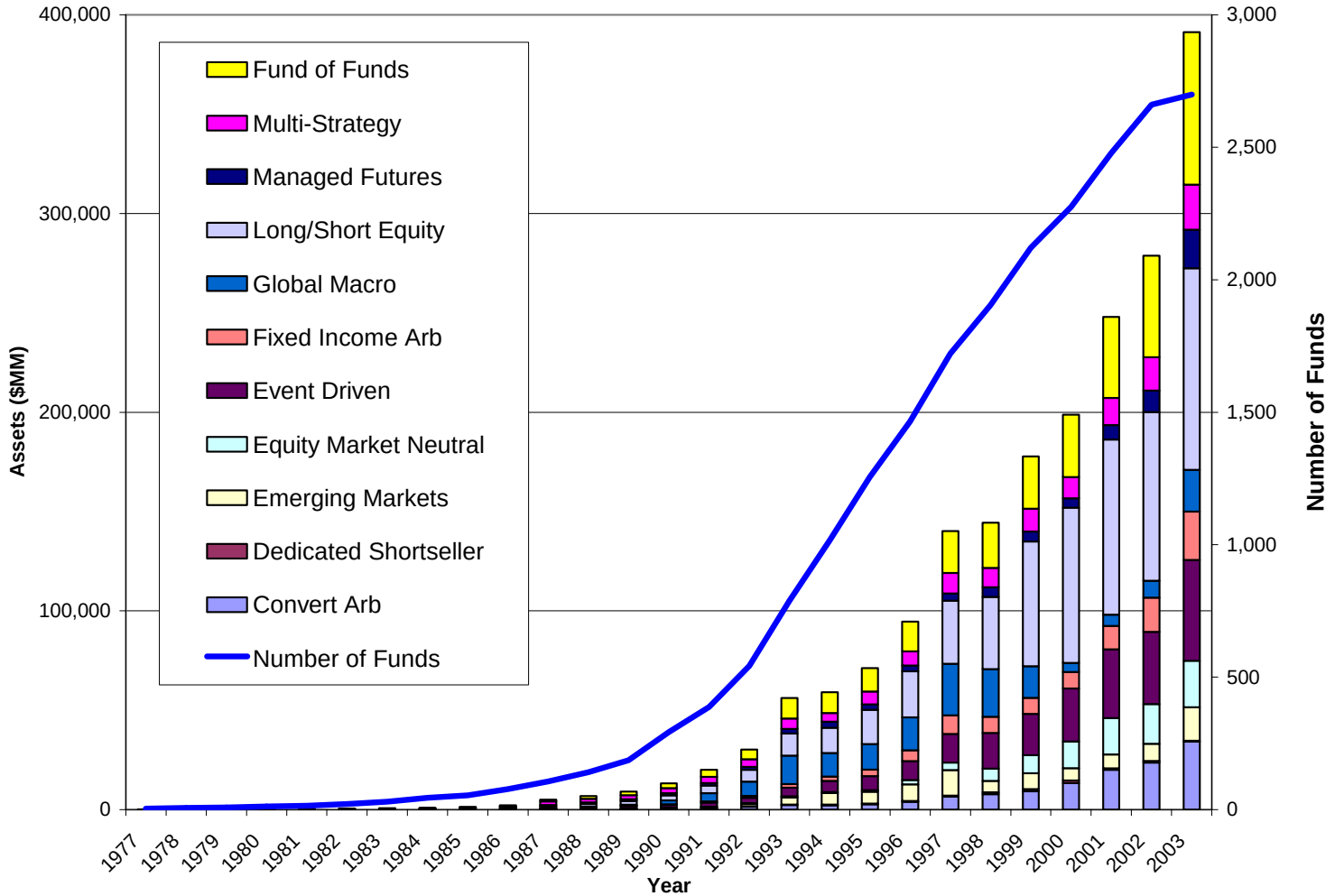

Liquidity Risk

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Definition of Liquidity:

- Price, Time, and Size
- Many Hedge Funds Are Not “Liquid”
- Liquidity Risk Has Multiple Dimensions
  - Valuation, Correlation, Timing
- Nothing Wrong With Illiquidity, If Fully Disclosed
- Problems When Illiquidity Is Not Recognized
- Simple Indicator of Illiquidity:

$$\rho_k \equiv \text{Corr}[R_t, R_{t-k}]$$

Liquidity Risk

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Summary Statistics for Individual Mutual Funds and Hedge Funds

Fund	Start Date	End Date	Sample Size	Mean (%)	SD (%)	ρ_1 (%)	ρ_2 (%)	ρ_3 (%)	$p(Q_{11})$ (%)
Mutual Funds									
Vanguard 500 Index	Oct-76	Jun-00	286	1.30	4.27	**-4.0**	-6.6	-4.9	**64.5**
Fidelity Magellan	Jan-67	Jun-00	402	1.73	6.23	**12.4**	-2.3	-0.4	**28.6**
Investment Company of America	Jan-63	Jun-00	450	1.17	4.01	**1.8**	-3.2	-4.5	**80.2**
Janus	Mar-70	Jun-00	364	1.52	4.75	**10.5**	0.0	-3.7	**58.1**
Fidelity Contrafund	May-67	Jun-00	397	1.29	4.97	**7.4**	-2.5	-6.8	**58.2**
Washington Mutual Investors	Jan-63	Jun-00	450	1.13	4.09	**-0.1**	-7.2	-2.6	**22.8**
Janus Worldwide	Jan-92	Jun-00	102	1.81	4.36	**11.4**	3.4	-3.8	**13.2**
Fidelity Growth and Income	Jan-86	Jun-00	174	1.54	4.13	**5.1**	-1.6	-8.2	**60.9**
American Century Ultra	Dec-81	Jun-00	223	1.72	7.11	**2.3**	3.4	1.4	**54.5**
Growth Fund of America	Jul-64	Jun-00	431	1.18	5.35	**8.5**	-2.7	-4.1	**45.4**
Hedge Funds									
Convertible/Option Arbitrage	May-92	Dec-00	104	1.63	0.97	**42.7**	29.0	21.4	**0.0**
Relative Value	Dec-92	Dec-00	97	0.66	0.21	**25.9**	19.2	-2.1	**4.5**
Mortgage-Backed Securities	Jan-93	Dec-00	96	1.33	0.79	**42.0**	22.1	16.7	**0.1**
High Yield Debt	Jun-94	Dec-00	79	1.30	0.87	**33.7**	21.8	13.1	**5.2**
Risk Arbitrage A	Jul-93	Dec-00	90	1.06	0.69	**-4.9**	-10.8	6.9	**30.6**
Long/Short Equities	Jul-89	Dec-00	138	1.18	0.83	**-20.2**	24.6	8.7	**0.1**
Multi-Strategy A	Jan-95	Dec-00	72	1.08	0.75	**48.9**	23.4	3.3	**0.3**
Risk Arbitrage B	Nov-94	Dec-00	74	0.90	0.77	**-4.9**	2.5	-8.3	**96.1**
Convertible Arbitrage A	Sep-92	Dec-00	100	1.38	1.60	**33.8**	30.8	7.9	**0.8**
Convertible Arbitrage B	Jul-94	Dec-00	78	0.78	0.62	**32.4**	9.7	-4.5	**23.4**
Multi-Strategy B	Jun-89	Dec-00	139	1.34	1.63	**49.0**	24.6	10.6	**0.0**
Fund of Funds	Oct-94	Dec-00	75	1.68	2.29	**29.7**	21.1	0.9	**23.4**

Liquidity Risk

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Summary Statistics for CSFB/Tremont Hedge-Fund Indexes

January 1994 to August 2004

Variable	Sample Size	Ann. Mean	Ann. SD	Corr. with S&P 500	Min	Med	Max	Skew	Kurt	ρ_1	ρ_2	ρ_3	p-value of LB-Q
CSFB/Tremont Indexes:													
Hedge Funds	128	10.51	8.25	**45.9**	-7.55	0.78	8.53	0.12	1.95	**12.0**	4.0	-0.5	54.8
Convert Arb	128	9.55	4.72	**11.0**	-4.68	1.09	3.57	-1.47	3.78	**55.8**	41.1	14.4	0.0
Dedicated Shortseller	128	-0.69	17.71	**-75.6**	-8.69	-0.39	22.71	0.90	2.16	**9.2**	-3.6	0.9	73.1
Emerging Markets	128	8.25	17.28	**47.2**	-23.03	1.17	16.42	-0.58	4.01	**30.5**	1.6	-1.4	0.7
Equity Market Neutral	128	10.01	3.05	**39.6**	-1.15	0.81	3.26	0.25	0.23	**29.8**	20.2	9.3	0.0
Event Driven	128	10.86	5.87	**54.3**	-11.77	1.01	3.68	-3.49	23.95	**35.0**	15.3	4.0	0.0
Distressed	128	12.73	6.79	**53.5**	-12.45	1.18	4.10	-2.79	17.02	**29.3**	13.4	2.0	0.3
Event-Driven Multi-Strategy	128	9.87	6.19	**46.6**	-11.52	0.90	4.66	-2.70	17.63	**35.3**	16.7	7.8	0.0
Risk Arb	128	7.78	4.39	**44.7**	-6.15	0.62	3.81	-1.27	6.14	**27.3**	-1.9	-9.7	1.2
Fixed Income Arb	128	6.69	3.86	**-1.3**	-6.96	0.77	2.02	-3.27	17.05	**39.2**	8.2	2.0	0.0
Global Macro	128	13.85	11.75	**20.9**	-11.55	1.19	10.60	0.00	2.26	**5.5**	4.0	8.8	65.0
Long/Short Equity	128	11.51	10.72	**57.2**	-11.43	0.78	13.01	0.26	3.61	**16.9**	6.0	-4.6	21.3
Managed Futures	128	6.48	12.21	**-22.6**	-9.35	0.18	9.95	0.07	0.49	**5.8**	-9.6	-0.7	64.5
Multi-Strategy	125	9.10	4.43	**5.6**	-4.76	0.83	3.61	-1.30	3.59	**-0.9**	7.6	18.0	17.2

Liquidity Risk

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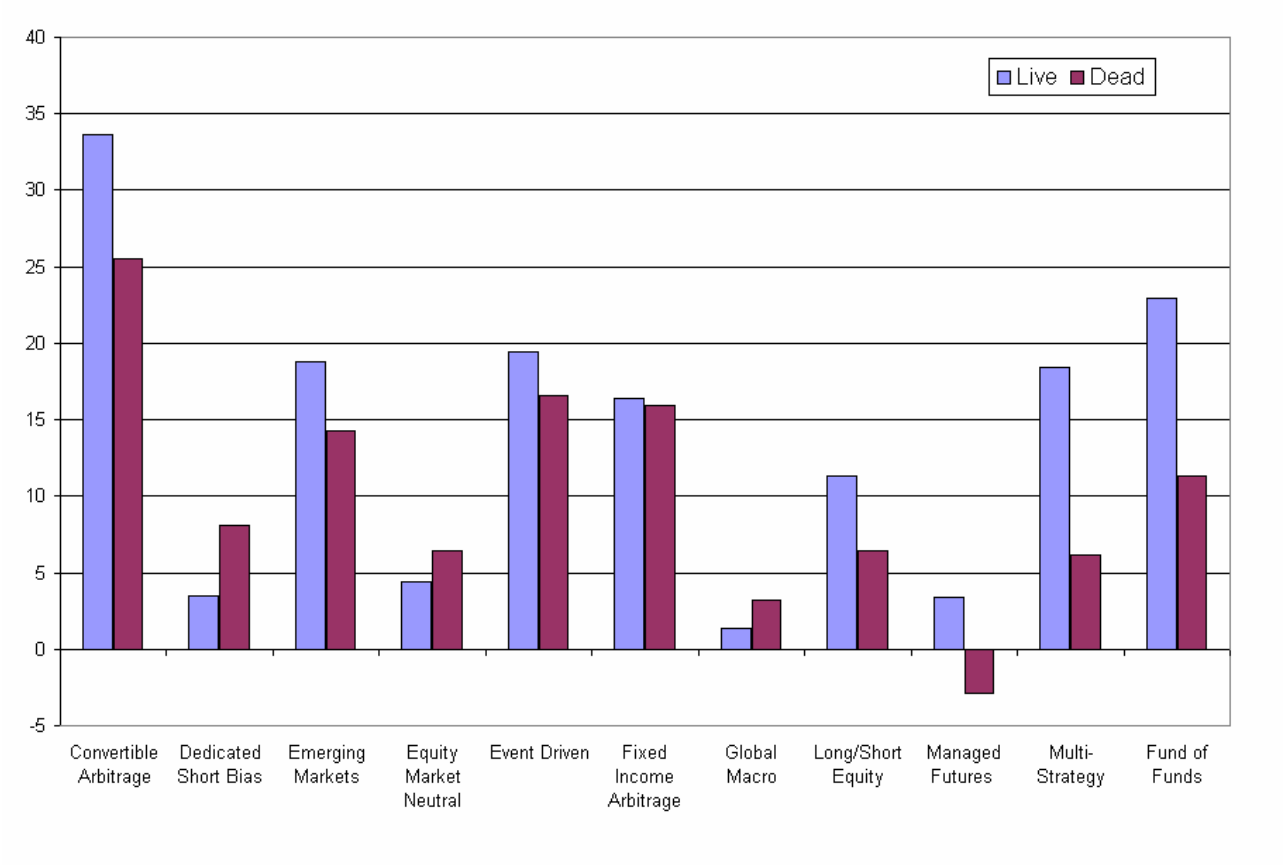
Average ρ_1 for Funds in the TASS Live and Graveyard Databases

February 1977 to August 2004



Liquidity Risk

Individual Hedge-Fund Data:

$$\rho_{1t,j} = \text{Rolling First-Order Serial Correlation of Fund } j, \text{ Month } t$$

$$\rho^*_{1t} \equiv \sum_{j=1}^{N_t} \omega_{jt}\rho_{1t,j} \quad \text{Aggregate Measure}$$

Liquidity Risk

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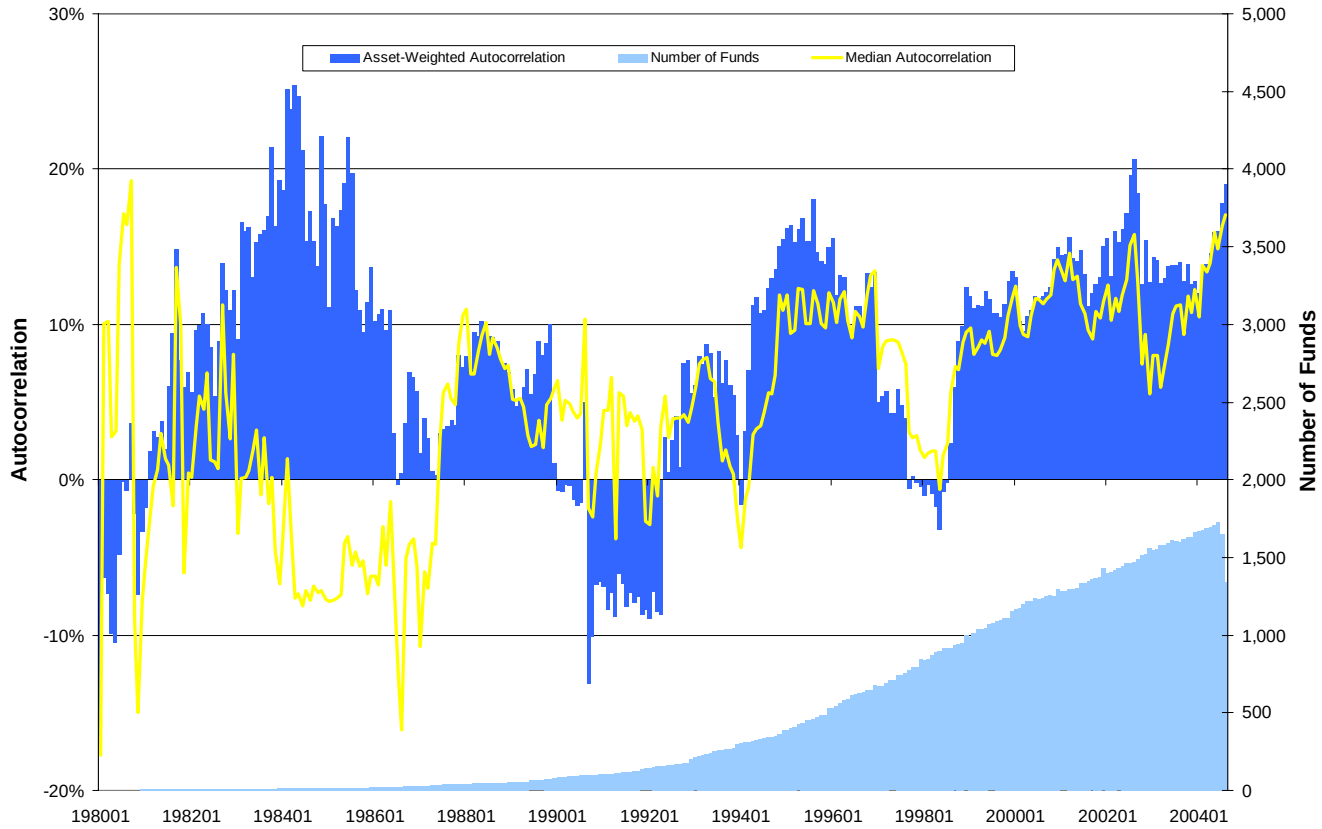
ρ^*_{1t} Indicator for Funds in the TASS Live and Graveyard Databases

February 1977 to August 2004



Risk Models

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Hedge Fund Risk Exposures are Different:

- Heterogeneity of Hedge-Fund Styles

Long/Short Equity Fund
- Market Beta
- Industry/Sector Exposure
- Value/Growth
- Stock-Loan Constraints
- Execution Costs

Fixed-Income Arb Fund
- Yield Curve Model
- Credit Exposure
- Liquidity Exposure
- Leverage Constraints
- Macroeconomic Factors

- Phase-Locking Regime Shifts
- Nonlinearities

Risk Models

Two-State Markov Regime-Switching Model:

State 1 State 0

$$R_t = I_t R_{1t} + (1 - I_t) R_{0t}$$

$$R_{it} \sim \text{IID } \mathcal{N}(\mu_i, \sigma_i^2) \quad i = 0, 1$$

$$P \equiv \begin{array}{c} \\ I_t = 1 \\ I_t = 0 \end{array} \begin{array}{c} \begin{array}{cc} I_{t+1}=1 & I_{t+1}=0 \end{array} \\ \begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix} \end{array}$$

Risk Models

Aggregate Hedge-Fund Indexes:

- Estimate Parameters Via MLE
- Estimate Unconditional State Probabilities
- Aggregate Probabilities Across Indexes

$$\widehat{p}_{dt} \equiv \sum_{k=1}^{10} \text{Prob(Low-Mean State for Index } k\text{)}$$

Risk Models

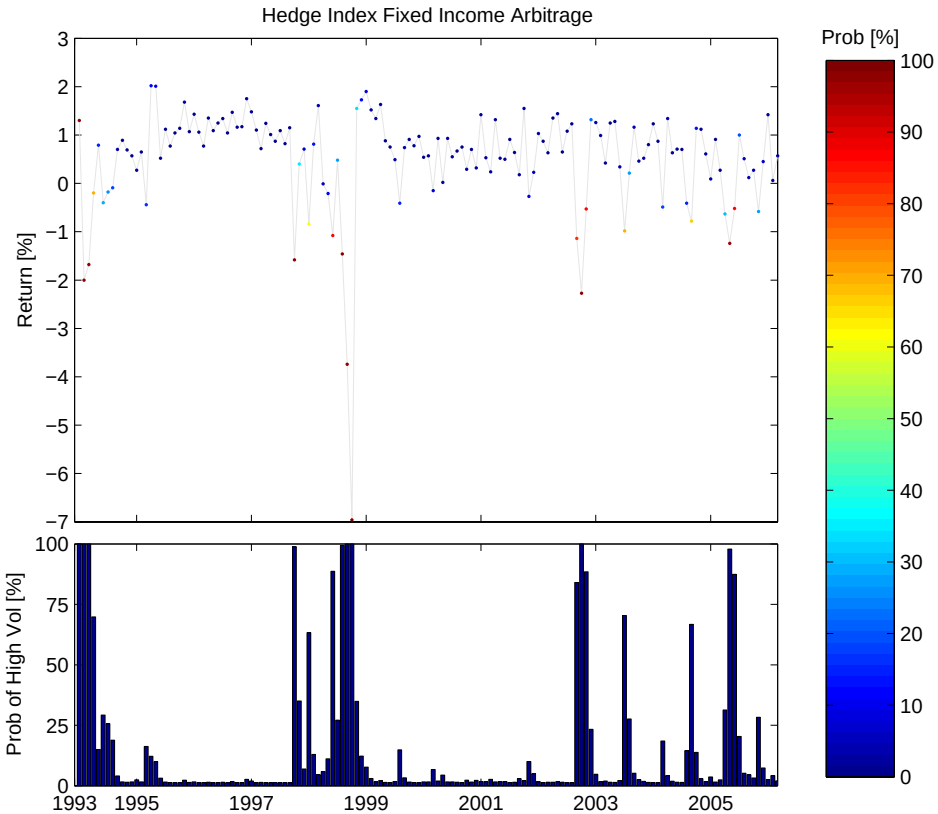
Regime-Switching Probability Estimates for CSFB/Tremont Hedge-Fund Indexes

January 1994 to March 2006

Index	p_{11}	p_{21}	p_{12}	p_{22}	Annualized Mean		Annualized SD	
					State 1	State 2	State 1	State 2
CSFB/Tremont Hedge Fund Index	100.0%	1.2%	0.0%	98.8%	8.4%	12.5%	3.4%	9.9%
Convertible Arbitrage	94.2%	14.8%	5.8%	85.2%	16.3%	-8.1%	2.5%	4.8%
Dedicated Short	23.1%	11.4%	76.9%	88.6%	-76.4%	10.1%	2.4%	16.0%
Emerging Markets	100.0%	1.2%	0.0%	98.8%	14.9%	6.4%	7.7%	20.2%
Equity Mkt Neutral	100.0%	1.2%	0.0%	98.8%	7.1%	11.4%	1.8%	3.4%
Event Driven	98.3%	45.7%	1.7%	54.3%	13.4%	-46.7%	3.9%	13.9%
Distressed	98.2%	57.3%	1.8%	42.7%	15.2%	-56.6%	4.6%	15.5%
E.D. Multi-Strategy	98.8%	43.0%	1.2%	57.0%	12.1%	-56.8%	4.6%	15.0%
Risk Arbitrage	91.7%	27.4%	8.3%	72.6%	8.9%	3.4%	2.6%	7.1%
Fixed Income Arb	94.6%	34.9%	5.4%	65.1%	9.4%	-11.8%	2.0%	6.2%
Global Macro	100.0%	1.2%	0.0%	98.8%	13.0%	14.0%	3.3%	14.2%
Long/Short Equity	98.8%	2.5%	1.2%	97.5%	8.1%	20.8%	6.3%	15.3%
Managed Futures	0.0%	1.0%	100.0%	99.0%	2.5%	7.2%	0.0%	12.1%
Multi-Strategy	98.7%	23.6%	1.3%	76.4%	10.8%	-7.6%	3.3%	9.2%

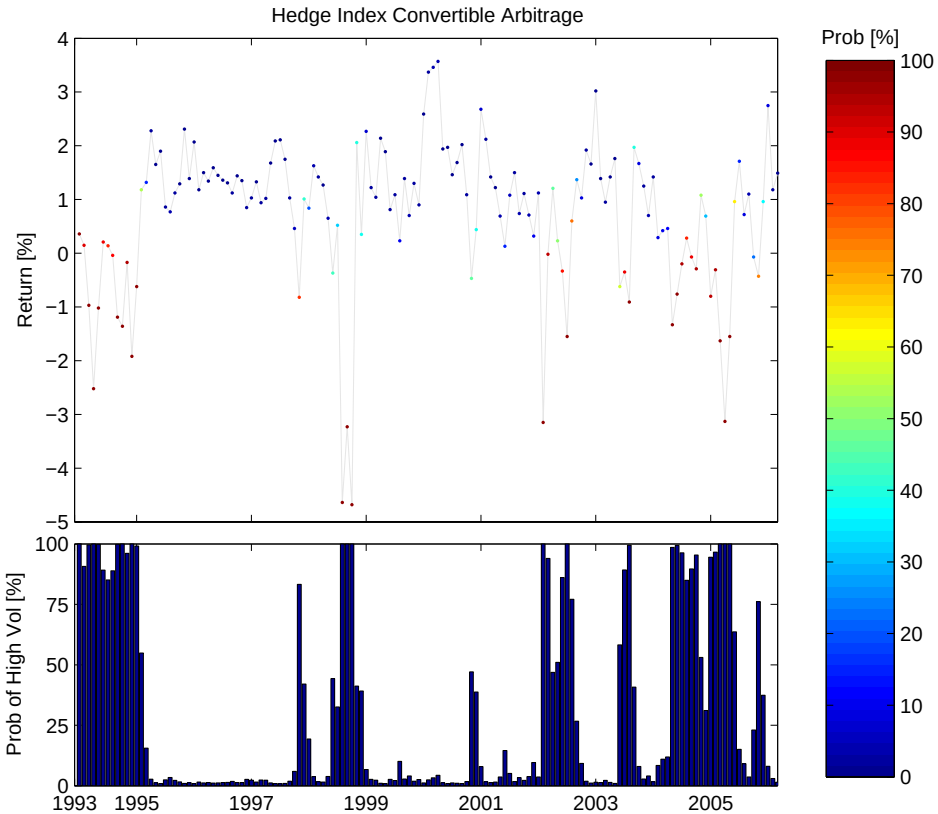
Regime-Switching Probability Estimates for CSFB/Tremont Fixed-Income Arbitrage Index

January 1994 to March 2006



Regime-Switching Probability Estimates for CSFB/Tremont Convertible Arbitrage Index

January 1994 to March 2006



Risk Models

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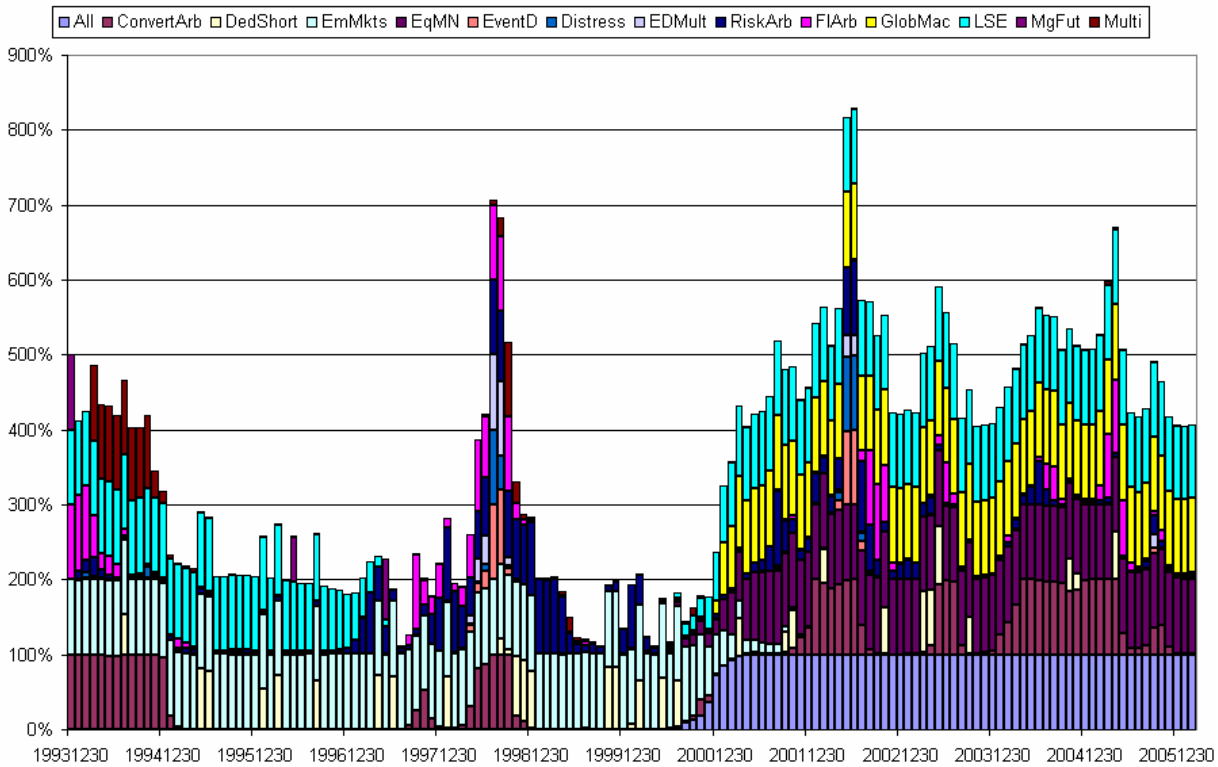
Summed Probabilities of Low-Mean States for Subset of CSFB/Tremont Hedge-Fund Indexes

January 1994 to March 2006



Risk Models

Aggregate Hedge-Fund Indexes:

- Risk Models and Bank-Index Regressions

$$R_{it} = \alpha_i + \sum_{j=1}^{k} \beta_{ij} \Lambda_{jt} + \epsilon_{it}$$

$$\text{Banks}_t = \alpha + \sum_{j=1}^{k_1} \beta j \Lambda_{jt} + \sum_{j=1}^{k_2} \gamma_j R_{jt} + \zeta_t$$

Risk Models

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Aggregate Hedge-Fund Indexes:

- Risk Model Factors (Current and Lagged)

S&P500	Banks	Oil	MarketCap	Credit Spread
$S\&P500^2$	LIBOR	Gold	Value/Growth	Term Spread
$S\&P500^3$	USD	VIX	Lehman Bond	

- Bank Index Regressors

S&P500	14 CSFB/Tremont Indexes

Risk Models

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Regressor	Hedge Funds	Convert Arb	Dedicated Shortseller	Emerging Markets	Equity Market Neutral	Event Driven	Distressed	Event-Driven Multi-Strategy	Risk Arb	Fixed Income Arb	Global Macro	Long/Short Equity	Managed Futures	Multi-Strategy
Sample Size:	118	118	118	118	118	118	118	118	118	118	118	118	118	117
R^2:	25.9%	7.3%	57.2%	22.5%	14.6%	38.4%	35.0%	30.1%	24.3%	8.4%	7.2%	35.0%	6.8%	1.2%
Constant	0.54	0.70	0.73	-0.05	0.78	0.55	0.68	0.48	0.49	0.46	0.94	0.47	0.95	0.70
	(2.62)	(5.37)	(2.15)	(-0.10)	(9.67)	(4.14)	(4.25)	(3.21)	(4.45)	(4.40)	(2.86)	(1.87)	(2.83)	(5.44)
SP500	0.25	0.04	-0.87	0.53	0.08	0.21	0.24	0.19	0.12	0.00	0.17	0.40	-0.18	0.02
	(5.95)	(1.42)	(-12.53)	(5.88)	(4.73)	(7.62)	(7.31)	(6.14)	(5.42)	(0.17)	(2.54)	(7.81)	(-2.59)	(0.65)
SP500{1}	0.06	0.08	-0.06	0.14	0.01	0.11	0.11	0.12	0.08	0.04	-0.01	0.06	-0.15	0.02
	(1.34)	(2.85)	(-0.90)	(1.58)	(0.89)	(4.12)	(3.39)	(3.87)	(3.36)	(1.83)	(-0.08)	(1.20)	(-2.21)	(0.89)
SP500{2}	0.12	0.04	0.06	0.02	0.00	0.04	0.04	0.04	0.01	0.07	0.16	0.11	0.00	0.05
	(2.75)	(1.53)	(0.87)	(0.23)	(0.07)	(1.38)	(1.31)	(1.21)	(0.38)	(3.25)	(2.43)	(2.10)	(0.06)	(1.81)
Sample Size:	126	126	126	126	126	126	126	126	126	126	126	126	126	125
R^2:	25.2%	6.2%	57.5%	21.9%	15.1%	42.1%	39.1%	32.5%	23.4%	13.1%	6.3%	34.1%	8.4%	0.4%
Constant	0.91	0.56	1.59	0.90	0.46	0.95	1.05	0.89	0.64	1.02	1.50	0.29	-0.71	0.58
	(2.15)	(2.05)	(2.29)	(1.00)	(2.75)	(3.56)	(3.31)	(2.93)	(2.78)	(4.80)	(2.22)	(0.55)	(-1.00)	(2.20)
SP500POS	0.22	0.04	-0.68	0.34	0.11	0.07	0.07	0.06	0.08	-0.03	0.19	0.39	0.02	0.03
	(2.72)	(0.83)	(-5.09)	(1.92)	(3.31)	(1.36)	(1.09)	(1.11)	(1.79)	(-0.74)	(1.43)	(3.85)	(0.17)	(0.59)
SP500NEG	0.29	0.04	-1.01	0.73	0.04	0.35	0.41	0.31	0.17	0.05	0.18	0.42	-0.40	0.01
	(3.59)	(0.67)	(-7.59)	(4.23)	(1.35)	(6.79)	(6.70)	(5.40)	(3.85)	(1.30)	(1.39)	(4.18)	(-2.95)	(0.14)
SP500POS{1}	0.04	0.12	-0.30	0.08	0.05	0.09	0.10	0.09	0.07	0.00	-0.07	0.15	-0.03	0.07
	(0.48)	(2.28)	(-2.30)	(0.45)	(1.57)	(1.86)	(1.76)	(1.51)	(1.63)	(0.03)	(-0.54)	(1.50)	(-0.20)	(1.46)
SP500NEG{1}	0.08	0.04	0.20	0.19	-0.02	0.12	0.10	0.14	0.08	0.08	0.07	-0.02	-0.25	-0.02
	(1.02)	(0.83)	(1.51)	(1.13)	(-0.56)	(2.36)	(1.63)	(2.44)	(1.82)	(2.06)	(0.57)	(-0.15)	(-1.89)	(-0.33)
SP500POS{2}	0.06	0.03	-0.09	0.01	0.02	0.07	0.10	0.07	0.01	0.00	0.06	0.09	0.13	0.02
	(0.77)	(0.55)	(-0.70)	(0.06)	(0.73)	(1.48)	(1.69)	(1.23)	(0.17)	(-0.12)	(0.49)	(0.92)	(1.01)	(0.39)
SP500NEG{2}	0.17	0.06	0.21	0.00	-0.01	-0.02	-0.04	-0.02	0.00	0.14	0.26	0.14	-0.05	0.08
	(1.99)	(1.12)	(1.52)	(-0.02)	(-0.32)	(-0.44)	(-0.71)	(-0.30)	(0.10)	(3.23)	(1.95)	(1.35)	(-0.33)	(1.60)

Risk Models

Laboratory for Financial Engineering

Regressor	Hedge Funds	Convert Arb	Dedicated Shortseller	Emerging Markets	Equity Market Neutral	Event Driven	Distressed	Event-Driven Multi-Strategy	Risk Arb	Fixed Income Arb	Global Macro	Long/Short Equity	Managed Futures	Multi-Strategy	Factor Selection Count
Sample Size:	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**117**	
R^2:	**54.5%**	**45.1%**	**79.7%**	**44.1%**	**25.5%**	**75.1%**	**65.0%**	**66.4%**	**58.0%**	**54.3%**	**34.3%**	**73.2%**	**21.4%**	**16.3%**	
Constant	0.30	0.08	1.90	-0.58	0.98	0.29	0.94	0.75	1.14	0.06	0.31	1.09	0.19	0.58	14
	(1.22)	(0.22)	(4.25)	(-0.81)	(7.00)	(0.84)	(4.65)	(4.93)	(7.34)	(0.20)	(0.78)	(3.35)	(0.59)	(3.97)	
SP500	0.23		-0.63	0.44			0.13					0.28			5
	(5.81)		(-7.11)	(3.29)			(3.17)					(4.29)			
SP500(Lag 1)						0.06	0.06			-0.05					3
						(2.39)	(1.82)			(-1.80)					
SP500^2					0.07		-0.10			-0.06					3
					(2.49)		(-2.03)			(-2.08)					
SP500^2(Lag 1)	-0.12		-0.14	-0.30		-0.12	-0.09	-0.10	-0.06		-0.16	-0.09		0.09	10
	(-2.12)		(-1.60)	(-2.44)		(-3.70)	(-2.09)	(-2.68)	(-1.89)		(-1.76)	(-1.74)		(2.07)	
SP500^3		0.21	-0.24	0.44	0.07	0.26	0.21	0.32	0.15			0.15	-0.26		10
		(5.92)	(-2.49)	(2.82)	(2.80)	(8.22)	(3.63)	(12.00)	(5.57)			(2.10)	(-3.15)		
SP500^3(Lag 1)		0.15	-0.15					0.08	0.05	0.19			-0.17	0.08	7
		(5.21)	(-2.27)					(2.31)	(2.32)	(5.82)			(-2.09)	(2.36)	
SP500^3(Lag 2)	0.09	0.13								0.12	0.15			0.14	5
	(1.74)	(4.34)								(4.79)	(1.75)			(4.39)	
Banks					0.06	0.10			0.07	0.10	0.24				5
					(2.47)	(2.94)			(2.65)	(3.76)	(3.43)				
Banks(Lag 1)	0.08					0.07	0.08	0.07		-0.06					5
	(1.85)					(2.16)	(1.80)	(2.19)		(-2.14)					
Banks(Lag 2)	0.09					0.05	0.07			0.05	0.18	0.10			6
	(1.71)					(1.98)	(2.05)			(1.78)	(2.04)	(2.33)			
USD	0.42	0.13		0.65		0.15	0.11	0.21		0.11	0.68			-0.15	9
	(4.86)	(2.21)		(3.74)		(3.00)	(2.06)	(3.95)		(2.97)	(4.85)			(-2.78)	
Gold	0.08			0.17		0.05	0.08							-0.05	5
	(1.62)			(1.50)		(2.14)	(2.33)							(-1.39)	
Lehman Bond	0.59	0.18				0.13		0.22		0.24	0.98	0.38	0.79		8
	(3.77)	(1.56)				(1.32)		(2.16)		(3.17)	(3.69)	(2.82)	(3.08)		
Large Minus Small Cap	-0.19	-0.07	0.34	-0.40		-0.10	-0.11	-0.17	-0.13			-0.36			9
	(-4.30)	(-2.98)	(5.55)	(-4.35)		(-3.98)	(-3.89)	(-6.69)	(-6.24)			(-8.38)			
Value Minus Growth	-0.08		0.23			-0.04				-0.03	-0.08	-0.21	0.08	-0.05	8
	(-2.09)		(4.59)			(-2.29)				(-2.10)	(-1.71)	(-5.76)	(1.47)	(-2.35)	
LIBOR		-1.09	2.26				-2.02								3
		(-1.93)	(2.16)				(-3.55)								
Credit Spread		0.20				0.14				0.09					3
		(2.26)				(1.68)				(1.42)					
Term Spread		-0.20	-0.65	0.89	-0.24	-0.20			-0.31			-0.38			7
		(-1.99)	(-3.26)	(2.66)	(-3.86)	(-2.14)			(-4.51)			(-2.69)			
VIX		0.08		0.22						0.07		0.12			4
		(2.37)		(1.69)						(2.80)		(2.11)			
Number of Factors Selected:	10	10	8	8	4	13	11	7	6	12	7	9	4	6	

Risk Models

Laboratory for Financial Engineering

Regression of Equal-Weighted Bank Index on S&P 500 and Single Hedge Fund Index:

Regressors	Market Model	Hedge Fun ds	Convert Arb	Dedicated Shortseller	Emerging Markets	Equity Market Neutral	Event Driven	Distressed	Event Driven Multi-Strategy	Risk Arb	Fixed Income Arb	Global Macro	Long/Short Equity	Managed Futures	Multi-Strategy	Multiple Hedge-Fund Indexes
Sample Size:	118	118	118	118	118	118	118	118	118	118	118	118	118	118	115	115
R^2	32.8%	35.2%	38.9%	33.0%	35.9%	32.1%	48.4%	47.3%	42.4%	40.8%	36.6%	35.8%	35.7%	31.2%	31.5%	63.7%
Constant	1.30 (4.22)	1.21 (3.61)	0.99 (2.82)	1.41 (4.38)	1.29 (4.24)	0.81 (1.64)	0.70 (2.21)	0.61 (1.88)	0.93 (2.92)	0.70 (2.00)	0.76 (2.14)	0.96 (2.85)	1.43 (4.50)	1.35 (3.92)	1.08 (2.50)	0.38 (1.20)
SP500	0.47 (7.42)	0.37 (5.19)	0.42 (6.76)	0.34 (3.40)	0.37 (4.89)	0.45 (6.32)	0.22 (3.06)	0.25 (3.56)	0.31 (4.32)	0.34 (5.14)	0.47 (7.58)	0.44 (6.83)	0.39 (5.02)	0.47 (7.15)	0.46 (7.14)	0.24 (3.21)
SP500(1)	0.13 (2.05)	0.14 (1.92)	0.09 (1.41)	0.11 (1.08)	0.17 (2.28)	0.11 (1.52)	0.05 (0.67)	0.04 (0.57)	0.08 (1.13)	0.04 (0.54)	0.12 (1.84)	0.14 (2.15)	0.19 (2.46)	0.12 (1.83)	0.12 (1.88)	0.10 (1.56)
SP500(2)	-0.05 (-0.86)	-0.08 (-1.14)	-0.05 (-0.82)	-0.03 (-0.28)	-0.09 (-1.25)	-0.06 (-0.92)	-0.10 (-1.48)	-0.12 (-1.76)	-0.08 (-1.24)	-0.08 (-1.20)	-0.11 (-1.64)	-0.11 (-1.65)	0.01 (0.17)	-0.07 (-0.98)	-0.06 (-0.86)	
CSFBHEDGE		0.36 (2.61)														-1.66 (-5.52)
CSFBHEDGE(1)		-0.11 (-0.85)														
CSFBHEDGE(2)		-0.03 (-0.24)														
CSFBCONVERT			0.89 (3.50)													0.83 (2.51)
CSFBCONVERT(1)			-0.63 (-2.28)													-0.59 (-1.79)
CSFBCONVERT(2)			0.20 (0.79)													
CSFBSHORT				-0.15 (-1.77)												0.28 (2.53)
CSFBSHORT(1)				-0.02 (-0.19)												
CSFBSHORT(2)				0.02 (0.25)												-0.14 (-1.58)
CSFBEMKTS					0.19 (2.70)											
CSFBEMKTS(1)					-0.11 (-1.39)											
CSFBEMKTS(2)					0.08 (1.21)											
CSFBEQMKTNEUT						0.32 (0.82)										
CSFBEQMKTNEUT(1)						0.23 (0.58)										
CSFBEQMKTNEUT(2)						0.08 (0.22)										
CSFBED							1.19 (5.85)									0.91 (3.83)
CSFBED(1)							-0.24 (-1.12)									-0.27 (-1.30)
CSFBED(2)							0.13 (0.67)									0.62 (2.60)
CSFBDST								0.93 (5.55)								
CSFBDST(1)								-0.04 (-0.26)								
CSFBDST(2)								0.12 (0.77)								
CSFBEDM									0.85 (4.41)							
CSFBEDM(1)									-0.25 (-1.24)							
CSFBEDM(2)									0.14 (0.79)							
CSFBRISKARB										1.02 (4.11)						0.74 (3.05)
CSFBRISKARB(1)										0.11 (0.42)						
CSFBRISKARB(2)										0.08 (0.33)						
CSFBFIARB											0.68 (2.33)					
CSFBFIARB(1)											0.03 (0.10)					0.57 (2.23)
CSFBFIARB(2)											0.35 (1.27)					
CSFBGMACRO												0.22 (2.60)				
CSFBGMACRO(1)												0.01 (0.08)				
CSFBGMACRO(2)												0.10 (1.15)				0.99 (5.68)
CSFBLSE													0.19 (1.66)			-0.24 (-2.18)
CSFBLSE(1)													-0.16 (-1.45)			
CSFBLSE(2)													-0.19 (-1.75)			
CSFBMF														0.01 (0.11)		
CSFBMF(1)														-0.02 (-0.20)		
CSFBMF(2)														-0.05 (-0.57)		
CSFBMULT															0.27 (1.09)	
CSFBMULT(1)															-0.13 (-0.57)	
CSFBMULT(2)															0.14 (0.62)	

Regression of Value-Weighted Bank Index on S&P 500 and Single Hedge Fund Index:

Regressors	Market Model	Hedge Fun ds	Convert Arb	Dedicated Shortseller	Emerging Markets	Equity Market Neutral	Event Driven	Distressed	Event Driven Multi-Strategy	Risk Arb	Fixed Income Arb	Global Macro	Long/Short Equity	Managed Futures	Multi-Strategy	Multiple Hedge-Fund Indexes
Sample Size:	118	118	118	118	118	118	118	118	118	118	118	118	118	118	115	115
R^2	55.7%	55.8%	55.6%	57.1%	54.9%	55.0%	56.1%	55.6%	55.5%	58.2%	54.7%	55.1%	58.2%	54.6%	55.5%	64.2%
Constant	0.73 (2.05)	1.02 (2.60)	0.60 (1.41)	0.57 (1.54)	0.76 (2.11)	0.30 (0.53)	0.69 (1.67)	0.67 (1.59)	0.72 (1.82)	0.48 (1.15)	0.71 (1.66)	0.80 (2.00)	1.04 (2.85)	0.75 (1.90)	0.65 (1.31)	0.47 (1.00)
SP500	0.89 (12.24)	0.91 (10.76)	0.87 (11.53)	1.10 (9.84)	0.89 (9.98)	0.87 (10.65)	0.81 (8.68)	0.83 (9.17)	0.84 (9.46)	0.81 (10.19)	0.90 (11.95)	0.87 (11.20)	0.99 (11.21)	0.90 (11.76)	0.90 (12.09)	1.09 (10.27)
SP500(1)	0.02 (0.31)	0.04 (0.47)	0.01 (0.08)	-0.03 (-0.23)	0.02 (0.19)	0.02 (0.22)	-0.06 (-0.60)	-0.03 (-0.34)	-0.04 (-0.40)	-0.08 (-0.93)	0.01 (0.15)	0.03 (0.43)	0.05 (0.53)	0.02 (0.25)	0.03 (0.46)	-0.02 (-0.34)
SP500(2)	-0.02 (-0.25)	0.06 (0.70)	-0.01 (-0.17)	0.01 (0.12)	0.02 (0.26)	-0.04 (-0.45)	0.02 (0.28)	0.01 (0.16)	0.01 (0.10)	0.00 (-0.05)	-0.03 (-0.36)	-0.02 (-0.32)	0.12 (1.40)	-0.03 (-0.38)	0.00 (-0.00)	
CSFBHEDGE		-0.12 (-0.72)														
CSFBHEDGE(1)		-0.07 (-0.47)														
CSFBHEDGE(2)		-0.24 (-1.53)														
CSFBCONVERT			0.45 (1.46)													0.83 (2.51)
CSFBCONVERT(1)			-0.38 (-1.14)													-0.59 (-1.79)
CSFBCONVERT(2)			0.12 (0.40)													
CSFBSHORT				0.24 (2.47)												0.28 (2.53)
CSFBSHORT(1)				-0.07 (-0.73)												
CSFBSHORT(2)				0.06 (0.60)												-0.14 (-1.58)
CSFBEMKTS					-0.01 (-0.11)											
CSFBEMKTS(1)					-0.01 (-0.07)											
CSFBEMKTS(2)					-0.07 (-0.89)											
CSFBEQMKTNEUT						0.33 (0.74)										
CSFBEQMKTNEUT(1)						-0.01 (-0.02)										
CSFBEQMKTNEUT(2)						0.23 (0.52)										
CSFBED							0.40 (1.51)									
CSFBED(1)							0.11 (0.41)									
CSFBED(2)							-0.34 (-1.36)									
CSFBDST								0.29 (1.32)								
CSFBDST(1)								0.07 (0.32)								
CSFBDST(2)								-0.22 (-1.05)								
CSFBEDM									0.29 (1.19)							
CSFBEDM(1)									0.08 (0.32)							
CSFBEDM(2)									-0.25 (-1.09)							
CSFBRISKARB										0.53 (1.79)						0.86 (2.69)
CSFBRISKARB(1)										0.53 (1.76)						
CSFBRISKARB(2)										-0.48 (-1.67)						
CSFBFIARB											0.06 (0.17)					
CSFBFIARB(1)											0.19 (0.52)					0.46 (1.32)
CSFBFIARB(2)											-0.18 (-0.55)					
CSFBGMACRO												0.09 (0.83)				
CSFBGMACRO(1)												-0.08 (-0.81)				
CSFBGMACRO(2)												-0.05 (-0.50)				
CSFBLSE													-0.28 (-2.19)			-0.23 (-1.56)
CSFBLSE(1)													0.00 (-0.01)			
CSFBLSE(2)													-0.28 (-2.17)			-0.34 (-2.38)
CSFBMF														0.03 (0.32)		
CSFBMF(1)														-0.03 (-0.28)		
CSFBMF(2)														-0.04 (-0.37)		
CSFBMULT															-0.33 (-1.18)	-0.49 (-1.73)
CSFBMULT(1)															0.00 (0.00)	
CSFBMULT(2)															0.35 (1.33)	

Industry Dynamics

Laboratory for Financial Engineering

Hedge Funds Are "Galapagos Islands" of Finance

- Relatively Low Barriers to Entry and Exit
- High Levels of Compensation
- Competition and Adaptation Are Extreme
- New "Species" Are Coming and Going Constantly
- Strategies Wax and Wane Over Time:
  - Risk Arbitrage Waxing
  - Statistical Arbitrage Waning
- Supports Adaptive Markets Hypothesis

Industry Dynamics

Laboratory for Financial Engineering

Hedge Fund Entry/Exit Dynamics, 1977-2003							
Global Macro							
Data Source: TASS, CSFB/Tremont							
Year	**Start**	**Entries**	**Exits**	**Intrayear Entries and Exits**	**Funds at Year End**	**Attrition Rate**	**Index Return**
1994	56	12	4	0	64	7.1%	**-5.7%**
1995	64	17	6	0	75	9.4%	**30.7%**
1996	75	15	15	4	75	20.0%	**25.6%**
1997	75	19	6	1	88	8.0%	**37.1%**
1998	88	19	7	2	100	8.0%	**-3.6%**
1999	100	10	15	1	95	15.0%	**5.8%**
2000	95	13	33	0	75	34.7%	**11.7%**
2001	75	13	10	0	78	13.3%	**18.4%**
2002	78	15	11	0	82	14.1%	**14.7%**
2003	82	0	8	3	74	9.8%	**5.5%**

Hedge-Fund Liquidations

Laboratory for Financial Engineering

TASS Data Contains "Graveyard" Database

- Since 1994, Exiting Funds Placed In Graveyard
- Attrition Rates Can Be Measured
- Exit Codes:

Exit Code	Explanation
1	Fund Liquidated
2	Fund No Longer Reporting to TASS
3	TASS Has Been Unable to Contact The Manager for Updated Information
4	Fund Closed to New Investment
5	Fund Has Merged Into Another Entity
7	Fund Dormant
9	Unknown

Hedge-Fund Liquidations

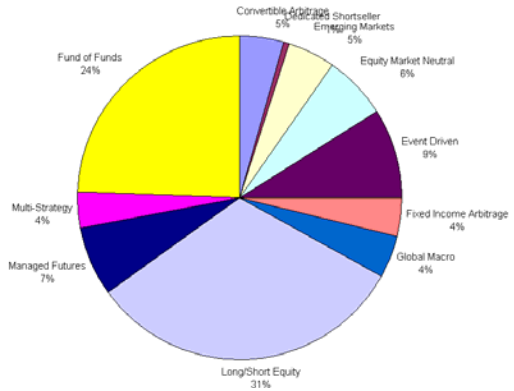
Laboratory for Financial Engineering

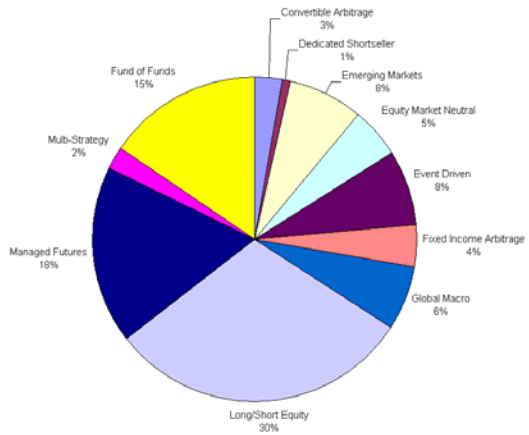
Number of Funds in TASS Live and Graveyard Database

February 1977/January 1994 to August 2004

Category	Definition	Number of TASS Funds in:		
		Live	Graveyard	Combined
1	Convertible Arbitrage	127	49	176
2	Dedicated Shortseller	14	15	29
3	Emerging Markets	130	133	263
4	Equity Market Neutral	173	87	260
5	Event Driven	250	134	384
6	Fixed-Income Arbitrage	104	71	175
7	Global Macro	118	114	232
8	Long/Short Equity	883	532	1,415
9	Managed Futures	195	316	511
10	Multi-Strategy	98	41	139
11	Fund of Funds	679	273	952
	Total	2,771	1,765	4,536

Live Funds





Graveyard Funds

Hedge-Fund Liquidations

Laboratory for Financial Engineering

Attrition Rates by Category in TASS Combined Database

January 1994 to August 2004

Category	Attrition Rate (%)	Category	Attrition Rate (%)
Convertible Arbitrage	5.2	Global Macro	12.6
Dedicated Shortseller	8.0	Long/Short Equity	7.6
Emerging Markets	9.2	Managed Futures	14.4
Equity Market Neutral	8.0	Multi-Strategy	8.2
Event Driven	5.4	Fund of Funds	6.9
Fixed Income Arbitrage	10.6		

Hedge-Fund Liquidations

Logit Model for Estimating Liquidation Status:

- Dependent Variable *Z*: 1=Liquidated, 0=Live
- Independent Variables **X**: AGE, RETURN, FLOWS

$$Z = \begin{cases} 0 & \text{if } Z^* = \mathbf{X}'\boldsymbol{\beta} + \epsilon \leq 0 \\ 1 & \text{if } Z^* = \mathbf{X}'\boldsymbol{\beta} + \epsilon > 0 \end{cases}$$

- Assume ϵ Logistic, Estimate Via Maximum Likelihood

Hedge-Fund Liquidations

Laboratory for Financial Engineering

Five Specifications:

1. Contemporaneous and Lagged Regressors:

$$Z_{it} = \mathrm{G}(\beta_0 + \beta_1 \mathrm{AGE}_{it} + \beta_2 \mathrm{ASSETS}_{it-1} + \beta_3 \mathrm{RETURN}_{it} + \beta_4 \mathrm{RETURN}_{it-1} + \beta_5 \mathrm{RETURN}_{it-2} + \beta_6 \mathrm{FLOW}_{it} + \beta_7 \mathrm{FLOW}_{it-1} + \beta_8 \mathrm{FLOW}_{it-2} + \epsilon_{it})$$

2. Fixed Effects (Year, Style)
3. Standardized Regressors
4. Omit “Merged” and “Closed” Graveyard Funds
5. Omit All But “Liquidated” Graveyard Funds

Hedge-Fund Liquidations

MIT Sloan Management — Laboratory for Financial Engineering

Variable	Model 1			Model 2			Model 3			Model 4			Model 5		
	β	SE(β)	p-Value (%)	β	SE(β)	p-Value (%)	β	SE(β)	p-Value (%)	β	SE(β)	p-Value (%)	β	SE(β)	p-Value (%)
Sample Size	12,895			12,895			12,895			12,846			12,310		
R^2 (%)	29.3			34.2			34.2			34.5			35.4		
Constant	4.73	0.34	<.01	2.31	0.41	<.01	-5.62	0.18	<.01	-5.67	0.18	<.01	-7.04	0.26	<.01
AGE	-0.03	0.00	<.01	-0.03	0.00	<.01	-1.62	0.07	<.01	-1.66	0.07	<.01	-2.08	0.10	<.01
$ASSETS_{-1}$	-0.26	0.02	<.01	-0.19	0.02	<.01	-0.34	0.04	<.01	-0.36	0.04	<.01	-0.38	0.06	<.01
RETURN	-2.81	0.19	<.01	-2.86	0.20	<.01	-0.67	0.05	<.01	-0.67	0.05	<.01	-0.61	0.06	<.01
$RETURN_{-1}$	-1.39	0.16	<.01	-1.40	0.17	<.01	-0.36	0.04	<.01	-0.36	0.04	<.01	-0.44	0.06	<.01
$RETURN_{-2}$	-0.04	0.09	67.5	-0.38	0.14	0.7	-0.12	0.04	0.7	-0.12	0.05	1.1	-0.17	0.07	1.3
FLOW	-0.63	0.08	<.01	-0.49	0.07	<.01	-32.72	4.91	<.01	-33.27	5.04	<.01	-32.93	6.74	<.01
$FLOW_{-1}$	-0.13	0.04	0.0	-0.11	0.03	0.1	-7.53	2.33	0.1	-7.60	2.37	0.1	-19.26	4.71	<.01
$FLOW_{-2}$	-0.09	0.02	<.01	-0.11	0.02	<.01	-1.74	0.36	<.01	-1.64	0.36	<.01	-1.83	0.51	0.0
I(1994)				0.79	0.38	3.9	0.79	0.38	3.9	0.82	0.39	3.4	1.01	0.54	5.9
I(1995)				1.24	0.27	<.01	1.24	0.27	<.01	1.18	0.28	<.01	1.37	0.37	0.0
I(1996)				1.83	0.20	<.01	1.83	0.20	<.01	1.83	0.21	<.01	1.92	0.28	<.01
I(1997)				1.53	0.21	<.01	1.53	0.21	<.01	1.52	0.21	<.01	2.03	0.27	<.01
I(1998)				1.81	0.18	<.01	1.81	0.18	<.01	1.80	0.19	<.01	2.29	0.24	<.01
I(1999)				2.10	0.18	<.01	2.10	0.18	<.01	2.05	0.18	<.01	2.25	0.24	<.01
I(2000)				2.25	0.17	<.01	2.25	0.17	<.01	2.19	0.17	<.01	2.08	0.24	<.01
I(2001)				1.97	0.17	<.01	1.97	0.17	<.01	1.96	0.17	<.01	1.80	0.25	<.01
I(2002)				1.46	0.16	<.01	1.46	0.16	<.01	1.41	0.16	<.01	1.50	0.22	<.01
I(2003)				1.55	0.16	<.01	1.55	0.16	<.01	1.53	0.16	<.01	1.71	0.22	<.01
I(ConvertArb)				0.44	0.20	2.9	0.44	0.20	2.9	0.43	0.20	3.4	0.16	0.34	62.5
I(DedShort)				0.05	0.37	88.9	0.05	0.37	88.9	-0.03	0.39	94.3	0.20	0.49	68.0
I(EmrgMkt)				0.25	0.15	10.2	0.25	0.15	10.2	0.24	0.15	11.7	0.54	0.20	0.7
I(EqMktNeut)				0.12	0.20	54.7	0.12	0.20	54.7	0.15	0.20	46.7	0.53	0.25	3.4
I(EventDr)				0.33	0.15	3.0	0.33	0.15	3.0	0.31	0.15	4.7	-0.01	0.24	97.4
I(FixedInc)				0.50	0.19	1.1	0.50	0.19	1.1	0.45	0.20	2.3	0.33	0.30	26.8
I(GlobMac)				0.32	0.18	7.4	0.32	0.18	7.4	0.24	0.18	20.2	0.33	0.25	17.9
I(LongShortEq)				0.18	0.11	10.2	0.18	0.11	10.2	0.15	0.11	16.6	0.14	0.15	36.4
I(MgFut)				0.49	0.12	<.01	0.49	0.12	<.01	0.49	0.13	0.0	0.71	0.16	<.01
I(MultiStrat)				0.17	0.25	49.4	0.17	0.25	49.4	0.18	0.25	48.5	0.85	0.29	0.3

Hedge-Fund Liquidations

Liquidation Probabilities Can Be Forecasted:

$$p_{it} \equiv \text{Prob}(Z_{it} = 1) = \text{Prob}(Z_{it}^* > 0)$$
$$= \text{Prob}(\mathbf{X}_{it}'\boldsymbol{\beta} + \epsilon_{it} > 0) = \frac{\exp(\mathbf{X}_{it}'\boldsymbol{\beta})}{1 + \exp(\mathbf{X}_{it}'\boldsymbol{\beta})}$$

$$\widehat{p}_{it} = \frac{\exp(\mathbf{X}_{it}'\widehat{\boldsymbol{\beta}})}{1 + \exp(\mathbf{X}_{it}'\widehat{\boldsymbol{\beta}})}$$

- Liquidation Elasticities May Be Derived From $\widehat{\boldsymbol{\beta}}$
- Scenario Analysis Using Different Values of $\mathbf{X}_{it}$
- Hedge-Fund Ratings Model

Hedge-Fund Liquidations

MIT Sloan Management — Laboratory for Financial Engineering

Estimated Liquidation Probabilities of TASS Hedge Funds

January 1994 to August 2004

Statistic	Model 5										
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Live Funds										
Mean	1.06	2.22	4.30	3.43	4.70	4.05	3.80	3.40	4.07	4.45	1.76
SD	3.28	6.01	10.97	8.70	9.51	8.87	7.72	6.76	6.58	6.33	2.70
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.00	0.01	0.02	0.02	0.06	0.04	0.07	0.07	0.09	0.07	0.03
0.25	0.02	0.04	0.09	0.10	0.27	0.23	0.33	0.33	0.44	0.43	0.15
0.50	0.07	0.16	0.36	0.45	1.03	0.96	1.18	1.26	1.74	2.04	0.72
0.75	0.52	1.25	2.61	2.26	4.03	3.22	3.49	3.63	4.75	6.01	2.31
0.90	2.61	5.85	11.24	9.12	14.21	10.09	9.88	8.10	10.52	12.03	4.71
Max	35.62	42.56	76.54	86.91	77.72	80.45	75.95	91.82	73.06	81.10	29.28
Count	357	483	629	773	924	1,083	1,207	1,317	1,480	1,595	1,898
	Graveyard Funds										
Mean	24.23	23.50	34.07	42.30	36.17	31.46	32.55	22.82	20.68	20.18	4.60
SD	24.12	20.12	25.19	26.95	25.12	21.96	22.47	19.84	18.94	16.27	6.20
Min	1.00	4.92	1.88	1.49	0.00	0.11	0.02	0.51	0.03	0.03	0.04
0.10	5.31	5.53	5.25	8.61	4.49	2.12	3.95	2.00	2.61	3.02	0.13
0.25	11.79	7.99	11.28	21.29	15.56	12.66	15.91	6.43	5.29	6.42	0.97
0.50	18.02	17.66	33.94	37.54	28.92	30.16	27.57	19.11	14.32	14.03	3.16
0.75	26.24	32.58	54.36	64.53	60.14	46.31	48.38	33.10	33.19	30.61	5.51
0.90	48.95	51.10	68.87	80.97	69.54	64.68	61.91	55.75	46.84	43.06	10.17
Max	64.10	69.64	82.29	93.17	87.67	89.00	90.90	76.34	90.02	67.86	33.31
Count	5	14	41	46	68	64	68	58	76	89	35

Policy Implications

Laboratory for Financial Engineering

The NTSB Model:

- No Regulatory Authority
- Investigates Accidents and Issues Reports
- Investigative Teams Include Industry Reps
- Conducts Forensic Examinations
- Publicly Available Searchable Database
- http://www.ntsb.gov/ntsb/query.asp
- Example: USAir Flight 405

Policy Implications

NTSB Report AAR–93/02, p. *vi*:

> The National Transportation Safety Board determines that the probable cause of this accident were the failure of the airline industry and the Federal Aviation Administration to provide flightcrews with procedures, requirements, and criteria compatible with departure delays in conditions conducive to airframe icing and the decision by the flightcrew to take off without positive assurance that the airplane's wings were free of ice accumulation after 35 minutes of exposure to precipitation following de-icing. The ice contamination on the wings resulted in an aerodynamic stall and loss of control after liftoff. Contributing to the cause of the accident were the inappropriate procedures used by, and inadequate coordination between, the flightcrew that led to a takeoff rotation at a lower than prescribed air speed.

Conclusions

Laboratory for Financial Engineering

Hedge Funds Affect Systemic Risk:

- Volatile Mix of Illiquidity and Leverage
- Network Effects (Credit Relationships)
- Heterogeneity and Nonlinear Risks
- Requires More Sophisticated Risk Analytics
- Both Qualitative and Quantitative Analysis
- More Data Is Needed!
- The CMSB May Be One Solution

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