

What Happened To The Quants In August 2007?

Amir E. Khandani, MIT
and
Andrew W. Lo, MIT and AlphaSimplex

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Motivation

Quantitative Equity Funds Hit Hard In August 2007

- Specifically, August 7–9, and massive reversal on August 10
- Some of the most consistently profitable funds lost too
- Seemed to affect only quants
- No real market news

Wall Street Journal
September 7, 2007

What Is The Future of Quant?

- Is “Quant Dead”?
- Can “it” happen again?
- What can be done about it?

But Lack of Transparency Is Problematic!



A New Microscope

Use Specific Quantitative Strategy As Research Tool

- Khandani and Lo (2007)
- Lehmann (1990) and Lo and MacKinlay (1990)
- Basic mean-reversion strategy
 - Buy yesterday's losers
(relative to yesterday's average)
 - Sell yesterday's winners
(relative to yesterday's average)
 - Buy/sell in proportion to the
amount of yesterday's gains/losses
 - For \$100MM of capital, hold
\$100MM long, \$100MM short (2:1)

$$\omega_{it} \propto - (R_{it-1} - R_{mt-1})$$

An Example of a Quantitative Market-Neutral Strategy

Ticker	R_{t-1} (%)	$R_{t-1} - R_{mt-1}$ (%)	I_t (\$MM)
CEC	1.55	1.62	-45.53
IBM	-0.89	-0.82	23.15
INTC	-0.97	-0.90	25.32
MCD	-0.18	-0.11	3.03
MRK	-1.79	-1.73	48.50
MSFT	1.87	1.94	-54.47
Average:	-0.07	Sum:	100.00
		Sum:	-100.00

A New Microscope

Basic Leverage Calculations

- Regulation T leverage of 2:1 implies

$$\text{\$100MM of Capital} \Rightarrow \text{Leverage} = \frac{|100| + |-100|}{100} = 2:1$$

- More leverage is available:

$$\text{\$100MM of Capital} \Rightarrow \text{Leverage} = \frac{|500| + |-500|}{100} = 10:1$$

- Leverage magnifies risk and return:

$$\theta:1 \Rightarrow \text{Leveraged Return} \equiv \frac{\theta}{2} R_{pt}$$

A New Microscope

Simulated Historical Performance of Contrarian Strategy

Year	Market Capitalization Deciles										All
	Smallest	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Largest	
	Average Daily Returns										
1995	3.57%	2.75%	1.94%	1.62%	1.07%	0.61%	0.21%	-0.01%	-0.02%	0.04%	1.38%
1996	3.58%	2.47%	1.82%	1.34%	0.84%	0.52%	0.19%	-0.11%	-0.04%	0.02%	1.17%
1997	2.83%	1.94%	1.34%	1.02%	0.62%	0.28%	0.04%	-0.12%	0.06%	0.14%	0.88%
1998	2.38%	1.45%	1.11%	0.62%	0.29%	0.03%	-0.04%	-0.12%	0.03%	0.10%	0.57%
1999	2.56%	1.41%	0.82%	0.38%	-0.01%	-0.11%	-0.21%	-0.35%	-0.01%	0.06%	0.44%
2000	2.58%	1.59%	0.92%	0.14%	0.03%	-0.02%	-0.14%	0.16%	0.00%	0.03%	0.44%
2001	2.15%	1.25%	0.57%	0.24%	-0.01%	0.06%	0.13%	-0.10%	-0.11%	-0.11%	0.31%
2002	1.67%	0.85%	0.53%	0.29%	0.28%	0.26%	0.28%	0.20%	0.11%	0.09%	0.45%
2003	1.00%	0.26%	-0.07%	0.04%	0.11%	0.20%	0.18%	0.15%	0.04%	0.05%	0.21%
2004	1.17%	0.48%	0.31%	0.38%	0.25%	0.29%	0.22%	0.15%	0.05%	-0.01%	0.37%
2005	1.05%	0.39%	0.13%	0.11%	0.09%	0.11%	0.05%	0.08%	0.01%	0.02%	0.26%
2006	0.86%	0.26%	0.11%	0.06%	0.05%	-0.02%	-0.02%	0.05%	0.06%	0.00%	0.15%
2007	0.57%	0.09%	0.08%	0.18%	0.16%	-0.08%	0.04%	-0.04%	0.00%	-0.04%	0.13%

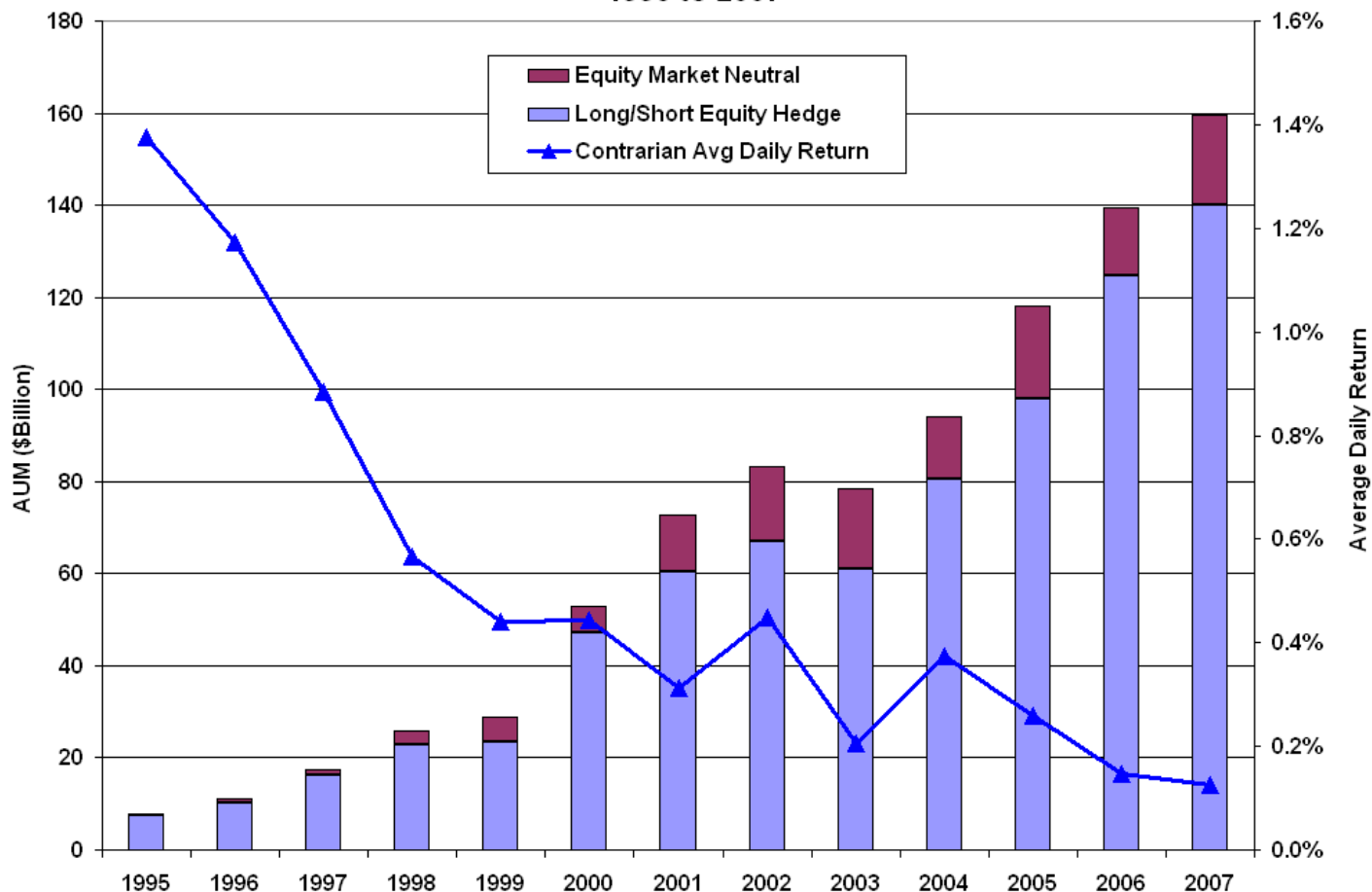
A New Microscope

Simulated Historical Performance of Contrarian Strategy

Year	Market Capitalization Deciles										All
	Smallest	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Largest	
	Standard Deviation of Daily Returns										
1995	0.92%	0.88%	0.81%	0.82%	0.78%	0.77%	0.73%	0.67%	0.63%	0.65%	0.40%
1996	1.07%	1.00%	0.79%	0.81%	0.88%	0.84%	0.90%	0.90%	0.83%	0.73%	0.48%
1997	1.04%	0.98%	0.96%	0.96%	1.12%	1.00%	0.91%	0.99%	0.98%	0.77%	0.68%
1998	1.59%	1.67%	1.23%	1.22%	1.57%	1.25%	1.29%	1.43%	1.08%	1.00%	0.84%
1999	1.66%	1.82%	1.44%	1.44%	1.79%	1.57%	1.71%	1.70%	1.57%	1.07%	1.02%
2000	1.57%	1.69%	2.06%	1.89%	1.76%	2.15%	2.18%	2.29%	2.44%	2.56%	1.68%
2001	1.33%	1.26%	1.46%	1.62%	1.65%	1.64%	1.83%	1.91%	2.28%	2.29%	1.43%
2002	1.17%	0.89%	1.14%	1.07%	1.25%	1.11%	1.30%	1.42%	1.50%	1.50%	0.98%
2003	1.11%	0.81%	0.95%	0.89%	0.86%	0.81%	0.77%	0.76%	0.75%	0.56%	0.54%
2004	1.35%	1.01%	0.87%	0.76%	0.76%	0.78%	0.80%	0.74%	0.69%	0.57%	0.53%
2005	1.35%	0.80%	0.89%	0.70%	0.77%	0.77%	0.65%	0.73%	0.57%	0.56%	0.46%
2006	1.07%	0.90%	0.83%	0.84%	0.70%	1.07%	0.68%	0.68%	0.64%	0.61%	0.52%
2007	0.96%	1.02%	1.00%	0.99%	1.06%	1.44%	1.00%	0.87%	0.67%	0.56%	0.72%

Total Assets, Expected Returns, and Leverage

AUM in TASS Equity Hedge Funds and
the Profitability of the Contrarian Trading Strategy
1995 to 2007



Total Assets, Expected Returns, and Leverage

How Much Leverage Needed To Get 1998 Expected Return Level?

- In 2007, use 2006 multiplier of 4
- 8:1 leverage
- Compute leveraged returns
- How did the contrarian strategy perform during August 2007?

Required Leverage Ratios For Contrarian Strategy
To Yield 1998 Level of Average Daily Return

Year	Average Daily Return	Return Multiplier	Required Leverage Ratio
1998	0.57%	1.00	2.00
1999	0.44%	1.28	2.57
2000	0.44%	1.28	2.56
2001	0.31%	1.81	3.63
2002	0.45%	1.26	2.52
2003	0.21%	2.77	5.53
2004	0.37%	1.52	3.04
2005	0.26%	2.20	4.40
2006	0.15%	3.88	7.76
2007	0.13%	4.48	8.96

What Happened In August 2007?

Daily Returns of the Contrarian Strategy In August 2007

Date	Deciles by Market Capitalization										All
	Smallest	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Largest	
7/30/2007	-0.28%	0.08%	7.85%	-1.43%	0.29%	0.91%	1.04%	1.51%	2.05%	0.71%	1.77%
7/31/2007	0.77%	4.41%	1.12%	2.20%	-2.53%	0.09%	-3.19%	1.94%	-1.23%	0.22%	1.46%
8/1/2007	6.10%	1.78%	-5.55%	1.39%	3.79%	-3.52%	-2.83%	-2.52%	-8.06%	-0.90%	0.43%
8/2/2007	3.54%	-3.04%	-0.46%	-2.68%	-3.77%	-10.79%	8.63%	6.12%	-2.97%	-0.77%	-1.22%
8/3/2007	-3.79%	-2.49%	-3.12%	0.24%	3.52%	0.05%	-2.49%	-4.35%	-2.29%	-2.74%	-0.10%
8/6/2007	-3.33%	-7.06%	-1.57%	-4.12%	5.47%	-5.47%	-4.75%	-2.86%	1.06%	3.08%	2.01%
8/7/2007	3.00%	1.03%	-6.55%	-11.65%	-6.01%	-2.79%	1.42%	-4.08%	-6.86%	-2.67%	-4.64%
8/8/2007	3.52%	-5.30%	-10.36%	-14.58%	-17.07%	-8.65%	-8.94%	-13.85%	-5.06%	-5.91%	-11.33%
8/9/2007	3.66%	-7.42%	-15.46%	-11.08%	-12.72%	-15.78%	-13.06%	-17.33%	-10.32%	-5.22%	-11.43%
8/10/2007	-1.32%	14.62%	24.32%	31.58%	35.08%	30.67%	30.07%	26.79%	18.73%	9.55%	23.67%
8/13/2007	5.42%	-1.24%	-2.53%	-4.26%	-6.20%	-0.88%	-5.15%	-8.04%	-8.58%	-4.99%	-3.05%
8/14/2007	4.65%	3.64%	-1.02%	1.35%	2.23%	-1.12%	2.74%	-1.16%	0.66%	0.67%	0.33%
8/15/2007	3.52%	4.74%	-2.42%	-2.33%	-0.69%	-3.89%	-0.97%	-5.36%	-2.29%	-4.73%	-1.53%
8/16/2007	-5.03%	-2.16%	0.59%	-2.36%	-2.39%	-3.95%	-6.94%	-5.08%	1.08%	-7.31%	-3.24%
8/17/2007	14.30%	9.94%	0.41%	5.04%	5.32%	-2.07%	0.47%	-1.56%	1.24%	0.44%	1.53%
8/20/2007	15.02%	7.02%	1.42%	5.40%	2.03%	1.74%	4.88%	2.22%	1.57%	4.67%	4.58%
8/21/2007	4.98%	0.43%	0.02%	-1.80%	0.09%	-2.54%	-0.33%	-0.20%	0.74%	0.43%	0.24%
8/22/2007	-3.39%	-1.23%	-2.07%	-2.05%	-0.67%	-3.31%	-0.74%	-2.26%	1.57%	0.37%	-1.51%
8/23/2007	-0.14%	2.79%	2.79%	-0.64%	1.51%	4.15%	1.04%	-1.33%	1.28%	1.23%	1.31%
8/24/2007	2.47%	-1.13%	-0.26%	0.92%	3.70%	-0.23%	-0.29%	0.37%	-1.42%	2.43%	1.73%
8/27/2007	4.38%	2.80%	0.46%	0.78%	5.01%	-0.63%	1.58%	2.85%	2.84%	0.10%	2.99%
8/28/2007	1.64%	1.26%	0.34%	-2.45%	-2.56%	-1.99%	-1.33%	-1.77%	-1.88%	0.99%	-3.04%
8/29/2007	5.79%	0.31%	5.07%	8.32%	7.75%	-2.14%	5.67%	6.39%	3.63%	3.94%	7.06%
8/30/2007	4.27%	0.16%	2.46%	1.61%	3.55%	0.41%	-0.11%	-0.16%	0.47%	-0.19%	2.01%
8/31/2007	6.75%	3.86%	3.80%	-2.21%	0.21%	2.08%	-0.32%	-2.68%	0.02%	0.58%	1.46%

What Happened In August 2007?

Daily Returns of Various Indexes In August 2007

Date	S&P 500	S&P Small Cap 600	MSCI Emerging Markets	MSCI World ex. US	Lehman Aggregate US Gov. Index	Lehman US Universal Corp. High-Yield Index	Goldman Sachs Commodity Index	Trade Weighted USD Index	CBOE Volatility Index (VIX) Change
7/30/2007	1.03%	0.94%	0.87%	0.14%	-0.04%	0.18%	0.11%	-0.12%	-3.30
7/31/2007	-1.26%	-0.88%	1.67%	1.36%	0.17%	0.61%	1.18%	-0.10%	2.65
8/1/2007	0.73%	0.19%	-3.42%	-1.70%	0.04%	-0.15%	-1.34%	0.13%	0.15
8/2/2007	0.46%	0.98%	0.61%	0.62%	0.04%	0.53%	0.00%	-0.20%	-2.45
8/3/2007	-2.65%	-3.48%	-0.05%	-0.37%	0.29%	0.08%	-1.10%	-0.66%	3.94
8/6/2007	2.42%	1.35%	-1.99%	-0.57%	-0.14%	-0.29%	-2.76%	0.10%	-2.56
8/7/2007	0.62%	0.71%	0.45%	0.56%	-0.04%	0.38%	0.34%	0.28%	-1.04
8/8/2007	1.44%	1.52%	2.83%	1.88%	-0.48%	0.84%	-0.20%	-0.17%	-0.11
8/9/2007	-2.95%	-1.38%	-1.28%	-1.52%	0.31%	-0.07%	-0.37%	0.54%	5.03
8/10/2007	0.04%	1.01%	-3.30%	-2.85%	0.07%	-0.29%	-0.03%	-0.12%	1.82
8/13/2007	-0.03%	-0.84%	1.01%	1.08%	0.04%	0.34%	0.27%	0.46%	-1.73
8/14/2007	-1.81%	-1.87%	-1.42%	-1.10%	0.23%	-0.10%	0.35%	0.54%	1.11
8/15/2007	-1.36%	-1.45%	-2.39%	-1.52%	0.15%	-0.56%	0.80%	0.41%	2.99
8/16/2007	0.33%	1.70%	-5.63%	-2.91%	0.58%	-0.59%	-3.01%	-0.11%	0.16
8/17/2007	2.46%	2.30%	0.12%	0.96%	-0.28%	0.24%	1.49%	-0.37%	-0.84
8/20/2007	-0.03%	0.30%	3.78%	1.23%	0.23%	0.24%	-1.65%	-0.03%	-3.66
8/21/2007	0.11%	0.21%	-0.18%	0.61%	0.24%	0.19%	-1.14%	0.11%	-1.08
8/22/2007	1.18%	1.19%	2.58%	1.27%	-0.16%	0.37%	0.04%	-0.30%	-2.36
8/23/2007	-0.11%	-1.16%	1.76%	1.16%	-0.01%	0.22%	0.96%	-0.13%	-0.27
8/24/2007	1.16%	1.44%	0.44%	0.51%	-0.10%	0.04%	1.10%	-0.59%	-1.90
8/27/2007	-0.85%	-1.07%	1.90%	0.29%	0.23%	0.17%	0.28%	0.09%	2.00
8/28/2007	-2.34%	-2.70%	-0.85%	-1.26%	0.34%	-0.07%	-0.17%	0.02%	3.58
8/29/2007	2.22%	2.28%	-0.23%	0.04%	-0.09%	-0.06%	1.40%	-0.07%	-2.49
8/30/2007	-0.41%	-0.38%	1.31%	0.80%	0.29%	0.06%	0.15%	0.12%	1.25
8/31/2007	1.12%	1.28%	2.39%	1.58%	-0.16%	0.01%	0.48%	0.00%	-1.68

Comparing August 2007 To August 1998

Daily Returns of the Contrarian Strategy In August and September 1998

Date	Deciles by Market Capitalization										All
	Smallest	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Largest	
8/3/1998	3.35%	1.75%	1.68%	0.15%	3.25%	-0.33%	0.40%	0.06%	0.62%	0.16%	1.01%
8/4/1998	-0.29%	2.16%	1.64%	-1.35%	-1.18%	-0.51%	-0.82%	-0.07%	-1.22%	-0.16%	-0.18%
8/5/1998	2.75%	1.93%	0.68%	2.60%	2.04%	0.93%	-0.57%	0.38%	-0.59%	2.56%	1.27%
8/6/1998	2.25%	1.68%	2.01%	0.36%	0.17%	-0.33%	-1.35%	0.15%	0.85%	1.34%	0.66%
8/7/1998	3.05%	2.99%	0.79%	0.26%	-0.23%	0.03%	0.12%	0.39%	2.93%	-0.10%	0.67%
8/10/1998	3.48%	1.69%	1.53%	0.91%	0.48%	2.23%	1.03%	-0.23%	0.68%	0.27%	1.27%
8/11/1998	2.34%	1.72%	0.81%	-0.24%	0.60%	1.18%	-0.36%	0.79%	-0.29%	-0.14%	0.59%
8/12/1998	4.83%	2.88%	2.71%	1.31%	0.96%	0.58%	2.01%	0.93%	1.00%	0.68%	2.04%
8/13/1998	3.74%	2.24%	0.88%	2.72%	0.37%	0.39%	1.03%	0.48%	-0.11%	0.04%	1.33%
8/14/1998	2.25%	1.64%	3.57%	1.42%	-0.46%	-0.05%	0.66%	-0.07%	0.77%	-0.42%	0.94%
8/17/1998	2.46%	2.48%	1.81%	0.11%	-0.32%	1.66%	-0.01%	-0.80%	0.11%	0.49%	0.96%
8/18/1998	4.31%	1.85%	1.75%	3.86%	0.35%	-0.16%	-2.12%	0.03%	0.29%	0.12%	0.87%
8/19/1998	2.60%	2.15%	1.16%	0.45%	-0.65%	-0.36%	0.34%	-0.80%	0.06%	-0.13%	0.63%
8/20/1998	1.60%	3.04%	1.49%	0.42%	-0.64%	0.55%	0.87%	-0.61%	-0.55%	-1.47%	0.46%
8/21/1998	2.26%	4.06%	2.18%	1.79%	1.03%	-0.06%	-0.28%	-0.51%	0.06%	-0.36%	1.04%
8/24/1998	5.35%	1.84%	4.13%	0.63%	-0.83%	0.13%	-1.57%	-1.02%	-0.68%	0.73%	0.90%
8/25/1998	2.05%	2.19%	1.76%	0.85%	-0.45%	-0.34%	0.91%	-1.46%	-0.48%	-0.56%	0.36%
8/26/1998	4.02%	1.39%	1.78%	0.81%	-0.31%	0.06%	-0.43%	1.03%	-0.65%	-0.26%	0.61%
8/27/1998	1.69%	1.15%	0.24%	-1.16%	-2.02%	-0.47%	-1.54%	-1.91%	-0.63%	-2.20%	-0.78%
8/28/1998	2.52%	2.29%	1.33%	1.35%	0.11%	1.12%	-1.29%	-1.32%	-1.18%	-0.36%	0.39%
8/31/1998	3.31%	1.79%	0.51%	-0.36%	-3.44%	-1.97%	-3.08%	-4.47%	-2.73%	-2.82%	-1.62%
9/1/1998	4.96%	4.42%	6.04%	4.67%	9.06%	6.68%	6.71%	6.67%	4.90%	6.10%	6.59%
9/2/1998	4.43%	2.74%	1.90%	0.82%	-1.33%	0.25%	0.86%	-0.39%	0.45%	0.33%	0.63%
9/3/1998	3.89%	3.78%	2.08%	2.09%	0.23%	-0.03%	0.79%	0.15%	0.51%	0.76%	1.41%
9/4/1998	5.10%	3.95%	2.09%	0.75%	-0.33%	-0.84%	-1.33%	-1.61%	-1.15%	-3.68%	0.26%

Comparing August 2007 To August 1998

Daily Returns of the Contrarian Strategy In August and September 1998

Date	Deciles by Market Capitalization										All
	Smallest	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Largest	
9/8/1998	3.53%	3.40%	3.82%	0.57%	0.60%	0.82%	1.35%	1.05%	0.97%	3.73%	2.08%
9/9/1998	1.99%	3.62%	1.38%	1.15%	1.12%	1.66%	1.70%	2.10%	2.32%	2.92%	2.42%
9/10/1998	4.26%	2.68%	0.08%	2.05%	0.96%	-0.27%	0.64%	-0.86%	-0.67%	-2.16%	0.29%
9/11/1998	3.34%	3.17%	2.15%	0.77%	0.20%	0.50%	-0.95%	1.28%	-0.18%	0.15%	1.24%
9/14/1998	3.53%	3.58%	1.54%	0.83%	-0.20%	-0.42%	-0.47%	-0.50%	0.02%	-0.23%	0.33%
9/15/1998	3.62%	2.36%	1.34%	0.77%	-0.17%	-0.98%	-0.52%	-1.15%	-0.95%	-0.63%	0.14%
9/16/1998	2.71%	3.33%	0.89%	1.48%	0.58%	0.83%	0.00%	0.05%	1.53%	-0.04%	1.01%
9/17/1998	3.70%	2.24%	1.54%	1.56%	-0.95%	0.23%	1.10%	-0.40%	-0.86%	0.38%	0.79%
9/18/1998	4.01%	3.94%	2.67%	1.27%	2.55%	1.20%	-1.17%	-1.41%	-0.51%	-0.45%	1.07%
9/21/1998	3.22%	1.28%	1.86%	-0.61%	-0.87%	-0.09%	-2.22%	1.08%	-0.47%	-0.32%	0.19%
9/22/1998	3.26%	2.15%	1.68%	1.76%	-0.21%	-0.16%	-0.62%	-2.06%	-1.46%	0.16%	0.42%
9/23/1998	4.24%	2.16%	0.78%	-1.66%	-0.34%	-2.33%	-3.08%	-3.27%	-0.60%	-0.42%	-0.71%
9/24/1998	2.54%	1.47%	3.13%	1.60%	0.63%	-0.38%	-0.06%	-0.27%	0.59%	1.63%	1.21%
9/25/1998	2.28%	3.27%	0.16%	0.86%	0.28%	-0.90%	-0.66%	0.67%	1.16%	0.36%	0.61%
9/28/1998	4.24%	1.24%	1.81%	2.64%	0.52%	-1.30%	0.47%	-1.58%	-0.59%	0.16%	0.60%
9/29/1998	2.75%	1.48%	-0.07%	0.81%	-0.83%	-1.61%	-1.58%	-0.83%	-1.19%	-0.83%	-0.29%
9/30/1998	2.98%	0.41%	0.33%	-0.96%	0.01%	-1.00%	-1.78%	-0.41%	-0.10%	-0.74%	-0.33%

The Unwind Hypothesis

What Happened?

- Losses due to rapid and large unwind of quant fund (market-neutral)
- Liquidation is likely forced because of firesale prices (sub-prime?)
- Initial losses caused other funds to reduce risk and de-leverage
- De-leveraging caused further losses across broader set of equity funds
- Friday rebound consistent with liquidity trade, not informed trade
- Rebound due to quant funds, long/short, 130/30, long-only funds

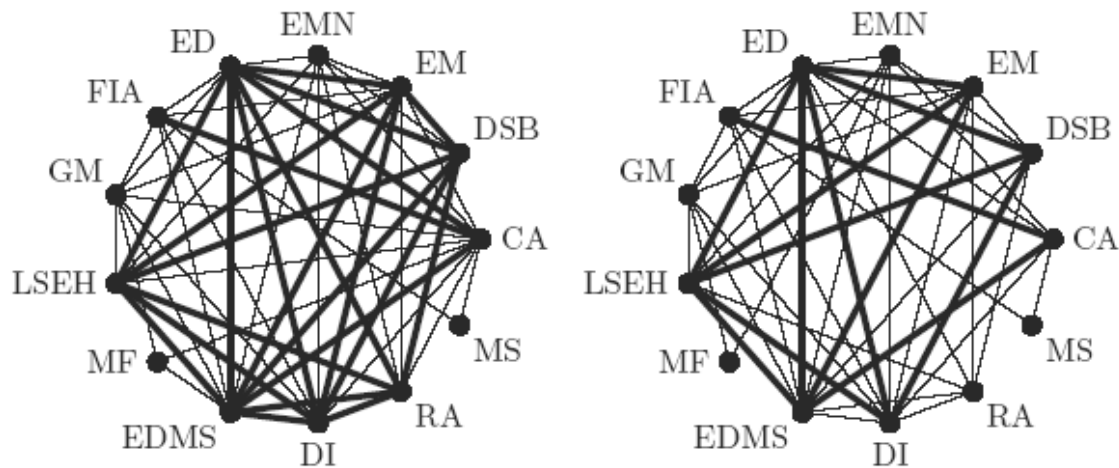
Lessons

- “Quant” is not the issue; liquidity and credit are the issues
- Long/short equity space is more crowded now than in 1998
- Hedge funds provide more significant amounts of liquidity today
- Hedge funds can withdraw liquidity suddenly, unlike banks
- Financial markets are more highly connected ⇒ **new betas**

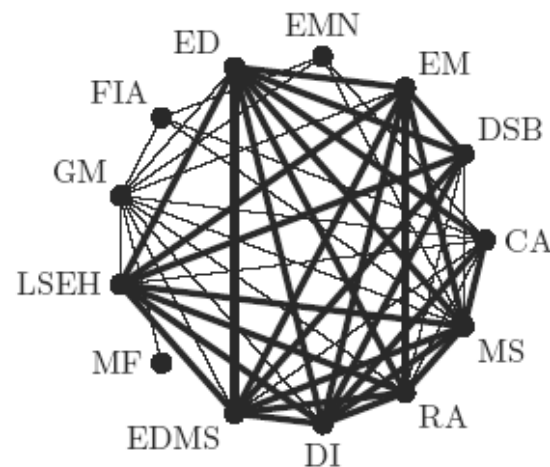
A Network View of the Hedge-Fund Industry

Abbreviations:

CA:	Convertible Arbitrage
DSB:	Dedicated Short Bias
EM:	Emerging Markets
EMN:	Equity Market Neutral
ED:	Event Driven
FIA:	Fixed Income Arbitrage
GM:	Global Macro
LSEH:	Long/Short Equity
MF:	Managed Futures
EDMS:	Event Driven Multi-Strategy
DI:	Distressed
RA:	Risk Arbitrage
MS:	Multi-Strategy



(a) April 1994 to December 2000, with (left) and without (right) August 1998



(b) January 2001 to June 2007

Conclusions

Systemic Risk of Hedge Funds Is Increasing

- Higher Illiquidity Exposure
- Lower Expected-Return Environment
- Large Asset Inflows, Many New Managers
- Greater Proportion of Inexperienced Investors
- Higher Liquidation Probabilities
- Huge Financial Incentives for Brokers

But All These Measures Are Indirect

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