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The Quant Meltdown August 2007

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ABSTRACT

Quantitative hedge funds experienced significant losses during early August 2007. What were the causes behind this event?

CONTENTS

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Introduction

It was the first week of August 2007, and returns of quantitative hedge funds (quant funds) were in a tailspin. The summer of 2007 was a tumultuous one for financial markets. Earlier in the year, the US housing market had started to decline, causing turmoil in mortgage markets and ripple effects through the economy. Financial institutions exposed to subprime lending investments were struggling to expunge these assets and to recapitalize, leading to the failure of two Bear Stearns hedge funds in June 2007. Now, from August 7 to August 9, quant funds were experiencing tremendous, unprecedented losses—for no immediately obvious reason. The poor performance seemed pervasive across all quant funds, and apparently there was no single explanation. On August 15, Matthew Rothman, managing director of US equity quantitative strategies at Lehman Brothers, wrote:

> Indeed, the returns [in early August 2007] were with little precedent—we have never before seen such a combined failure in factors across the board. Yes, we have seen individual factors fail. Yes, we have seen combinations of factors fail. But the violence of the move combined with the wholesale breadth of the move across numerous factors was a historic event.[1]

No one knew what was happening, how long it would last, or who would survive.

Quant Investing

Quant investing strategies seek to apply principles of mathematical finance, econometric analysis, and financial economic theory to investing. Quant investing developed during the late 1960s, when Harry Markowitz, William Sharpe, and Jan Mossin developed the capital asset pricing model (CAPM). There are two main types of quant funds: high-frequency statistical arbitrage (stat arb) funds and longer-term market-neutral funds. Stat arb funds use highly technical strategies involving large amounts of securities, high-frequency trades, and short time horizons (from seconds to days). These quant funds employ a short-term mean reversion strategy dictated by highly sophisticated computer-driven models. Well-known stat arb funds included Renaissance Technologies Corporation's Medallion Fund and D. E. Shaw.

Market-neutral funds operate with longer time horizons (from weeks to months) and rely on economic models and lower-frequency econometric and statistic forecasting methods. These funds tend to use factor-based investment strategies, where the factors are built on several investment styles, and signals are collected from firms' balance sheet data, macroeconomic data, and other sources. High-profile market-neutral funds included AQR Capital Management, Barclay's Global Investors Global Ascent, and Goldman Sachs Asset Management's Global Alpha Fund.

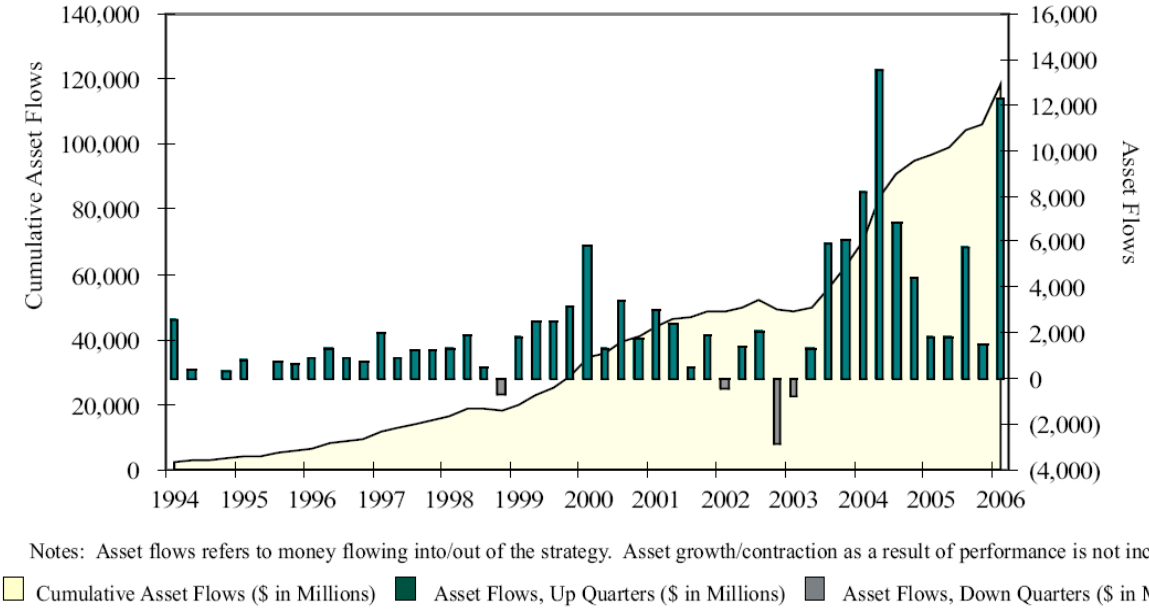
[1]Matthew Rothman, Lehman Brothers Equity Research Report (New York: Lehman Brothers, August 15, 2007).

Both types of quant funds employ leverage and try either to exploit new information that managers do not believe is fully reflected in current prices or to gain exposure to multiple sources of risk that managers believe have an ex-ante expectation of earning premiums.

Quant Fund Flows

The popularity of quant investment strategies was modest through the 1990s but increased rapidly during the 2000s. For example, flows into funds employing the long/short hedge fund investment style recorded by Tremont Capital Management, a firm which had many quant fund managers, were especially large during the latter half of 2003 as well as in 2004.

FIGURE 1
LONG/SHORT EQUITY FLOWS



Source: Tremont Asset Flows Report, First Quarter 2006 (New York: Tremont Capital Management, 2006), 7.

According to Hedge Fund Research Inc., which tracked hedge fund returns and flows, approximately $10 billion was invested in quant hedge funds in 2004. That number quadrupled by June 2007, when $40.7 billion was invested in hedge funds following market-neutral strategies (see Figure 1). Moreover, there was not only rapid growth in the flows to funds using quant strategies, but also a remarkable surge in the number of new quant funds. As Diane Garnick, an investment strategist at

Invesco PLC, commented, "You have this inflow of dollars into quantitative strategy and this inflow of intellect."[2]

The Events of August 7–9, 2007

Hedge funds had been in the news throughout the summer of 2007, and very little of that news had been good. The collapse of the subprime lending market began taking a toll on firms exposed to the US housing market, and well-known hedge funds, both domestic and international, began halting redemptions and closing their doors. (See Exhibit 1 for a time line of events between June and early August 2007.) Then, from August 7 to August 9, in the absence of any significant market news or world events, almost all quant hedge funds incurred tremendous losses, with their models behaving in ways that in many cases exacerbated their funds' declines. All the leading players in the industry disclosed significant deteriorations in value. Amir Khandani, a graduate student, and Professor Andrew Lo, both at the Sloan School of Management, referred to the performance of quant funds over these three days as "the perfect financial storm."[3] Month-to-date losses at some of the historically best-performing quant funds ranged from -5% to -30% (see Exhibit 2).

What was even more surprising during those three days was that only quant funds declined in tandem, while other hedge fund sectors and the overall market were largely unaffected, raising questions about what risks were at play. The losses took virtually everyone on Wall Street by surprise. Khandani and Lo took this as evidence of spillover and contagion. They wrote, "August 2007 is significant because it provides the first piece of evidence that problems in one corner of the financial system—possibly the sub-prime mortgage and related credit markets—can spill over so directly to a completely unrelated corner: long/short equity strategies."[4] Sudhir Chhikara, head of quantitative strategy for Stark Investments, said, "History tells you that you would have made money in equity market-neutral during a credit and volatility shock. With the housing market slowing and the economic worries coming to the fore, value stocks would tend to outperform growth stocks. But it didn't happen this time. The markets behaved in a very perverse way."[5]

Figure 2 compares the day-to-day performance of equity-market neutral funds with the S&P500. The graph shows the value of $1 invested in each index on July 22, 2007. The large declines during August 7–9 are notable because they occurred without the aggregate market moving dramatically. In fact, the S&P500 rose on August 7 and August 8 and declined only slightly on August 9.

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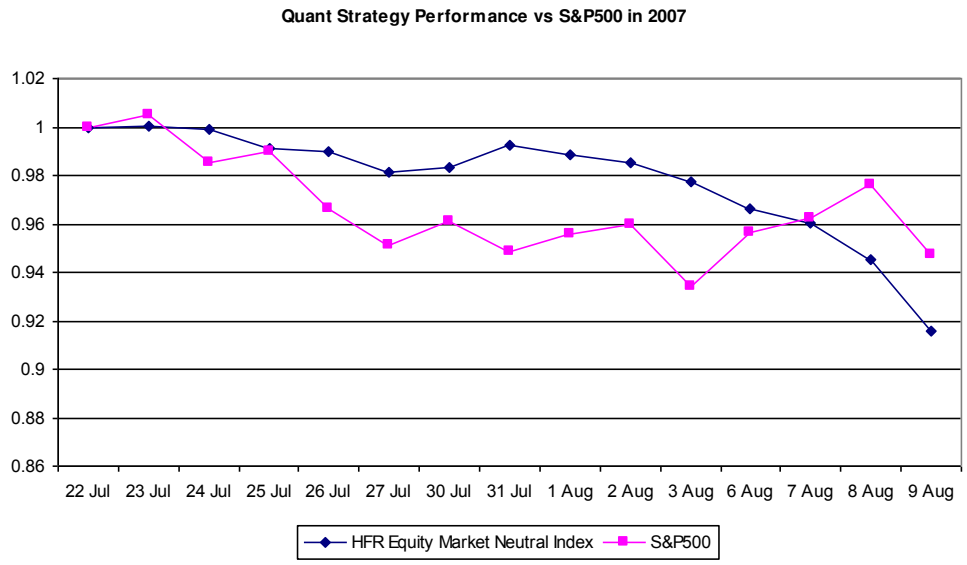
[2] Justin Lahart, "How the 'Quant' Playbook Failed," Wall Street Journal, August 24, 2007.
[3] Amir Khandani and Andrew Lo, "What Happened to the Quants in August 2007?,"Journal of Investment Management 5, no. 4 (2007): 5–54.
[4] Khandani and Lo, "What Happened to the Quants?"
[5] Jayne Jung, "Quants' Tail of Woe," Risk, October 1, 2007.

FIGURE 2
RELATIVE PERFORMANCE OF THE HFR EQUITY-MARKET NEUTRAL HEDGE FUND INDEX AND THE S&P500 INDEX, JULY 22, 2007 TO AUGUST 9, 2007



Source: Hedge Fund Research, http://www.hedgefundresearch.com/

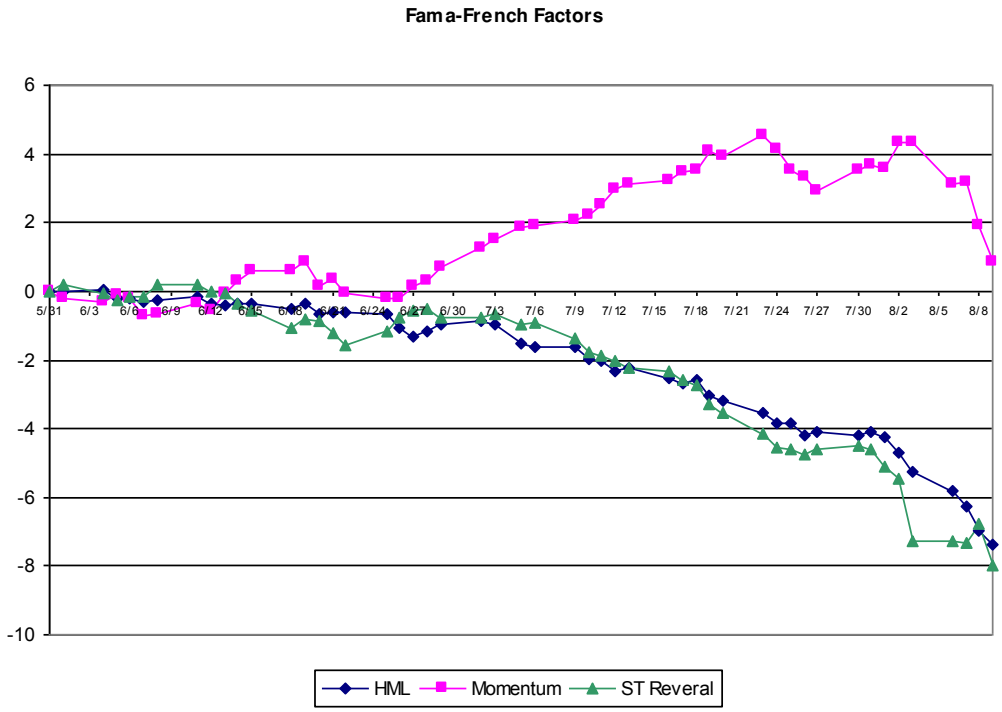
Losses of this magnitude in the absence of direct market forces or significant news were virtually unheard of. David Viniar, Goldman Sachs's CFO, summed up the experience: "We were seeing things that were 25-standard deviation moves, several days in a row. There have been issues in some of the other quantitative spaces. But nothing like what we saw last week."[6] Lehman Brothers's Rothman said, "Events that models only predicted would happen once in 10,000 years happened every day for three days."[7]

It was not only the overall large negative returns that were surprising; it was also startling that many of the investments based on the factors in the quant models yielded ferociously negative returns all at the same time. At Lehman Brothers, Rothman's quant model for large US stocks was based on three broad factors—valuation, quality, and market sentiment—and each factor was based on several individual firm variables. All the factors and almost all the variables experienced very large losses that were much greater than historical experience suggested. Research by Citigroup showed that the 20-day correlation between quality and momentum styles was 20.7% on August 8, 2007, compared to a three-year average of -0.90%.[8] Manolis Liodakis, a strategist at Citigroup, wrote, "Nothing seems to be working. Previously uncorrelated factors have recently been falling with the same pace, leaving

[6] Peter Larsen, "Goldman Pays the Price of Being Big," Financial Times, August 13, 2007.
[7] Kaja Whitehouse, "One 'Quant' Sees Shakeout for the Ages—'10,000 Years,'" Wall Street Journal, August 11, 2007.
[8] Jung, "Quants' Tail of Woe."

investors with very few places to hide."[9] Figure 3 plots the returns of three common zero-cost, long-short trading strategies traditionally used by quant managers: value-growth (HML), momentum, and short-term reversal (ST reversal). The HML strategy is designed to capture the value premium. It goes long value stocks and short growth stocks, defining value and growth stocks as firms with high and low book-to-market ratios, respectively.[10] The momentum strategy forms portfolios based on past-12-month returns, omitting the previous month, and goes long on stocks with past high returns (winners) and short on stocks with past low returns (losers). While the momentum strategy captures the tendency of winners to continue drifting upward in price, the ST reversal strategy is designed to capture short-term mean reversion and constructs portfolios based on prior returns over the previous month. It goes long stocks with low returns over the past month, which means revert to have high returns over the next month, and short stocks with high returns over the past month, which tend to have low returns over the next month.[11]

FIGURE 3
CUMULATIVE RETURNS OF PORTFOLIOS BASED ON THE HML, MOMENTUM, AND SHORT-TERM REVERSAL STRATEGIES, MAY 31, 2007, TO AUGUST 9, 2007



Source: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[9] Alexis Xydias, "Market Turmoil Is 'Perfect Storm' for Quant Funds," Bloomberg.com, August 10, 2007, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aLhRignqoi8Y

[10] Eugene Fama and Kenneth R. French, "Common Risk Factors in the Returns on Stocks and Bonds," Journal of Financial Economics 33, no. 1 (February 1993): 3–56.

[11] The HML, momentum, and ST reversal strategies also control for firm size. Further details can be found at Kenneth R. French's web page, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

In July, value stocks underperformed growth stocks, and returns to the ST reversal and HML strategy were negative. However, the momentum strategy performed strongly over this time. In contrast, returns in early August were negative for all three strategies, with the HML strategy experiencing the largest losses of the three during that period. Figure 4 details the daily percentage returns for each strategy from August 1 to August 9. During that period, the HML strategy lost around -0.5% per day, and returns of the momentum strategy also trended down, with large losses on August 6 and August 8. On August 9 all three strategies lost money.

FIGURE 4
DAILY RETURNS (%) OF THE HML, MOMENTUM, AND SHORT-TERM REVERSAL STRATEGIES, AUGUST 1–9, 2007

	HML	Momentum	ST Reversal
1-Aug-07	-0.12	-0.10	-0.51
2-Aug-07	-0.45	0.73	-0.36
3-Aug-07	-0.60	0.02	-1.82
6-Aug-07	-0.53	-1.24	0.02
7-Aug-07	-0.44	0.06	-0.07
8-Aug-07	-0.71	-1.24	0.57
9-Aug-07	-0.42	-1.09	-1.22

Source: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

What's Behind the Quant Crisis?

Multiple hypotheses were put forth in academic papers, trade journals, and the popular press to explain the unusual performance of quant hedge funds during August 2007. The following are three explanations.

QUANT RETURNS ARE NOT WHAT THEY USED TO BE

In "What Happened to the Quants in August 2007?,"[12] Khandani and Lo review average daily returns for a contrarian strategy often used by quant funds. This zero-cost, long-short strategy is similar to the monthly ST reversal strategy in figures 3 and 4, except that it is applied daily; it was originally proposed by Lo and MacKinlay.[13] The contrarian strategy entails buying yesterday's losers and selling yesterday's winners each day. The weight given to each stock is proportional to the difference between an equally weighted market index and the stock's returns over the past day. This short-term contrarian strategy provides liquidity by buying losers and selling winners, and benefits from short-term mean reversion.

Figure 5 reports average returns and Sharpe ratios from 1995 to 2007 for the contrarian strategy as computed by Khandani and Lo. The strategy is applied to the first, fifth, and tenth market-cap

[12] Khandani and Lo, "What Happened to the Quants?"
[13] Andrew Lo and Craig MacKinlay, "When Are Contrarian Profits Due to Stock Market Overreaction?" Review of Financial Studies 3, no. 2 (1990): 175–206.

deciles; the last column reports results of the strategy applied to all stocks. The contrarian strategy has historically been most profitable in the smallest stocks. Figure 5 clearly shows that average daily returns for all stocks have declined significantly over time, falling from 1.38% per day in 1995 to 0.13% per day in 2007. The Sharpe ratios in the bottom panel of Figure 5 look very high, but they do not take transactions costs into account. The Sharpe ratios have undergone a dramatic decrease, from over 50 in 1995 to 2.8 in 2007 across all stocks, and from over 61 in 1995 to 9.4 in 2007 for stocks in the smallest size decile.

FIGURE 5
AVERAGE DAILY RETURNS AND ANNUALIZED SHARPE RATIOS FOR STOCKS, USING A CONTRARIAN STRATEGY, 1995–2007

	Average Returns (%)				Sharpe Ratios (0% risk-free rate)			
	Market Capitalization Deciles				Market Capitalization Deciles			
Year	Smallest	Decile 5	Largest	All	Smallest	Decile 5	Largest	All
1995	3.57	1.07	0.04	1.38	61.27	21.49	0.87	53.87
1996	3.58	0.84	0.02	1.17	53.08	15.17	0.36	38.26
1997	2.83	0.62	0.14	0.88	43.15	8.67	2.79	20.46
1998	2.38	0.29	0.10	0.57	23.61	2.92	1.58	10.62
1999	2.56	-0.01	0.06	0.44	24.32	-0.11	0.82	6.81
2000	2.58	0.03	0.03	0.44	25.96	0.31	0.21	4.17
2001	2.15	-0.01	-0.11	0.31	25.56	-0.05	-0.73	3.46
2002	1.67	0.28	0.09	0.45	22.54	3.57	0.98	7.25
2003	1.00	0.11	0.05	0.21	14.32	1.94	1.33	5.96
2004	1.17	0.25	-0.01	0.37	13.76	5.11	-0.33	11.07
2005	1.05	0.09	0.02	0.26	12.33	1.95	0.62	8.85
2006	0.86	0.05	0.00	0.15	12.72	1.14	-0.03	4.47
2007	0.57	0.16	-0.04	0.13	9.40	2.40	-1.03	2.79

Source: Khandani and Lo, "What Happened to the Quants in August 2007?" Journal of Investment Management 5, no. 4 (2007): Table 2.

If other common strategies shared this pattern of declining profitability, then for quant funds to maintain the same level of expected returns, they had to increase the leverage they employed. The decay in profitability of the underlying quant strategies did in fact occur while the assets managed by quant funds increased (see Figure 1). According to Sudhir Chhikara, head of quantitative strategies at Stark Investments, average leverage in the strategy had at least doubled between August 2005 and August 2007 as managers tried to generate competitive returns from the small price moves that characterize the market-neutral quant strategy. He estimated that gross leverage among quant funds ranged from 4 to 64 times before August 2007.[14] With more and more capital deployed in these

[14] Jung, "Quants' Tail of Woe."

strategies, accompanied by increasing leverage, the strategies became increasingly exposed to volatility risk.

High leverage also exposed quant funds to "funding liquidity risk"—the risk that increases in margin requirements or shorting costs, increasing borrowing rates and the evaporation of the availability of credit, or shorting costs, forced funds to use more of their own capital and to potentially deleverage. Forced deleveraging can occur from deteriorating market liquidity or funding liquidity conditions. Market liquidity and funding liquidity feed back on each other and mutually reinforce each other, leading to liquidity spirals.[15] Forced deleveraging would cause funds to offload strategies. The selling would exacerbate market declines, and the decline would adversely affect margin requirements and increase borrowing rates. This would lead to more deleveraging and another round of sales. Brian Hayes, head of quantitative research at LBAIM, explained,

> By de-levering together, possibly in response to a re-pricing of credit risk and recent underperformance of value stocks, quant equity funds manufactured the August turbulence. While U.S. equities are a liquid market, the overall size of quant equity funds and their bias towards smaller-cap stocks made it difficult for the market to absorb their rapid de-levering in August. These funds were just too large to get out of their own way.[16]

The leverage of quant funds was likely to be reduced in the future. Marco Battaglia, chief investment officer of Temujin Fund Management (a market-neutral hedge fund with more than $1 billion in assets), forecasted, "In the future, quant hedge funds will probably operate with less leverage. That's a big change—until now, market-neutral funds often traded with leverage of 300% to 1000%."[17]

The quant crisis also exposed the need to look at the underlying returns of quant strategies. Shortly after the episode, Goldman Sachs commented on its efforts to find more proprietary factors:

> A key lesson from this episode is that too many quant managers were using the same factors. Going forward, we believe that successful quant managers will have to rely more on unique factors. . . . We will need to develop even more of these proprietary factors going forward.[18]

Clifford S. Asness, founding principal of the quant firm AQR Capital Management, also vowed that his fund would "look harder for 'unique' factors."[19]

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[15] Marcus Brunnermeier and Lasse Pedersen, "Market Liquidity and Funding Liquidity," Review of Financial Studies 22, no. 6 (2009): 2201-2238.
[16] Steve Johnson, "Fund Management: Quant Funds Blamed for Turbulence," Financial Times, November 26, 2007.
[17] Alistair Barr, "Quant Hedge Fund Rebound Not Enough for Some," MarketWatch, September 13, 2007.
[18] Goldman Sachs, Global Quantitative Equity Report: The Quant Liquidity Crunch, August 2007.
[19] "Heart of Darkness," Economist, October 25, 2007.

SELLING BECAUSE THAT'S THE ONLY THING I CAN SELL

A hypothesis about the quant crisis that garnered consistent support in the popular press and in academic articles is that it began when a large quant player unwound sizeable positions, causing a ripple of panic in a jittery market. Rothman described it this way:

> The most reasonable scenario is that a few large multi-strategy quantitative managers may have experienced significant losses in their credit or fixed income portfolios. In an attempt to lower the risks in their portfolios and being afraid to "mark-to-market" their illiquid credit portfolios, these managers probably sought to raise cash and de-lever in the most liquid market—the U.S. equity market. . . . The situation developing among quantitative fund managers has all the hallmarks of a classic "run on a bank" situation such as the one depicted in the movie "It's a Wonderful Life."[20]

The possibility that the August 7–9 quant hedge fund losses were precipitated by losses in other asset markets provided evidence that quant hedge funds had systemic risk. Possible causes of initial quant fund losses could have been the subprime collapse (which began in the early summer) or losses from foreign exchange carry trades (which began a few weeks earlier). Losses in an area other than quant investing, combined with leverage, would have led firms to raise cash in liquid asset classes. Because quant investing strategies are normally pursued in very liquid markets, quant strategies could be liquidated more easily than other investments.

This initiated a self-reinforcing downward spiral in the quant segment that lasted three days. In this scenario, liquidating quant strategies would have led both to selling long positions (which would then decline in price) and to buying back short positions (which would then increase in price). These actions would contribute to the perverse behavior of quant portfolios, in which quant long positions lost money and short positions gained in value. This would explain why many quant strategies lost money over a few days as many large long and short positions in quant strategies were terminated.

In an environment where leveraged investments were losing value, each manager was tempted to liquidate positions before others did. In this classic prisoner's dilemma situation, if everyone was unwinding trades and these trades exacerbated price movements, then each manager wanted to be the first to unwind. In a letter to investors dated August 10, AQR's Cliff Asness stated, "I occasionally hear broad statements like, 'This just shows computer models don't always work.' That's true, of course, they don't, nothing always works. However, this isn't about models, this is about a strategy getting too crowded, as other successful strategies both quantitative and non-quantitative have gotten many times in the past, and then suffering when too many try to get out the same door."[21]

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[20] Rothman, Lehman Brothers Equity Research Report.
[21] Clifford Asness, letter to investors, August 10, 2007, http://dealbreaker.com/_old/images/pdf/AQRClientLetter_20070810.pdf

QUANT MANAGERS ARE LIKE LEMMINGS

The events of August 7–9 exposed just how correlated the underlying holdings of quant funds were. The similarity of many funds' positions and the leverage many funds took amplified the initial losses. A Chicago-based risk manager at a large hedge fund said, "It was the first time it became obvious that this quant equity strategy was a crowded, run-for-the-exit type of trade. Until it actually happened, no one knew that the cross-ownership was so huge."[22] Amid heavy losses at quant funds, the managers "pointed their fingers at other quant hedge funds, essentially saying they all owned many of the same stocks and their models told them to sell at the same time, driving down share prices, hurting everyone in the process."[23]

The commonality in holdings could have resulted from two sources. First, quant funds could have been using the same models. Many of the long-short strategies, such as value-growth, momentum, and ST reversion, had been in the academic literature for decades and were easy to implement. Second, even if quant funds were trading their own unique strategies, managers were using common models to hedge risk. Most fund managers—of all types of funds, from quant to discretionary—used only a few commercial risk models, and all these models were based on the same factors. As Sebastian Ceria, CEO of Axioma (a company that developed risk analysis and portfolio rebalancing solutions and software for the financial services industry) stated, "When using an optimizer in trying to significantly reduce risk, the risk model is the main driver in the portfolio construction problem. Differences in alphas get overwhelmed by the optimizer's desire to reduce risk. Since the risk model drives the deleveraging, and managers use similar risk models, then they will all trade the same factors."[24] Brad Alford, a portfolio manager at Alpha Capital Management commented, "All these quant funds seem to be running on the same core models."[25]

Richard Bookstaber, a portfolio manager at FrontPoint Partners during the quant crisis, commented, "What catches many investors off guard and leads them to make the '100 year' sort of comment is not the behavior of individual markets, but the concurrent big and unexpected moves among markets."[26] Some, however, suggested that it was not surprising that a ripple effect occurred. Many of the underlying long positions could have been foreseen. Investment managers with over $100 million had to disclose quarterly holdings through 13F filings to the SEC. Although the data could be stale because managers had 45 days after quarter-end to submit the report, and although the report only covered long positions in common shares and a few other equity-related securities, it did provide a snapshot of position-level data of large funds. However, few fund managers were analyzing this information. SEC filings from June 2007 revealed that quant funds often shared large positions in the

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[22] Whitehouse, "One 'Quant' Sees Shakeout for the Ages."
[23] Lahart, "How the 'Quant' Playbook Failed."
[24] Sebastian Ceria, "The Quant Scare" (presentation, October 2007).
[25] Jonathan Keehner, "How a Goldman Hedge Fund Shrank a Third in a Week," Reuters.com, August 14, 2007, http://www.reuters.com/article/2007/08/14/us-goldman-hedgefunds-idUSN1434596720070814
[26] Richard Bookstaber, "The Myth of Noncorrelation," Institutional Investor, September 2007, http://bookstaber.com/rick/RickBookstaber_TheMythOfNonCorrelation.pdf

same stocks.[27] Satya Pradhuman of Cirrus Research found 149 companies with capitalization between $2 billion and $10 billion and 473 companies with capitalization between $250 million and $2 billion, of which "large quant funds owned 5% or more of the shares outstanding." In both cases, the stocks held by the quant funds underperformed similar stocks.[28]

Because returns on many quant funds were so highly correlated on the downside, several experts suggested that a new quant fund risk factor had come into play. For example, Khandani and Lo wrote, "The fact that the entire class of long/short equity strategies moved together so tightly during August 2007 implies the existence of certain common factors within that class."[29] There seemed to be a new "hedge fund beta" risk that future quant risk models had to incorporate. Anne Dinning, a member of D.E. Shaw's executive and risk management committees, commented, "We've historically tried to apply penalties of various sorts for trades or investment models we perceive to be in some way crowded. In the case of quantitative equity strategies, it's been clear for some time that certain forecasting tools were being used by multiple players in the business."[30]

[27] Lahart, "How the 'Quant' Playbook Failed."
[28] Lahart, "How the 'Quant' Playbook Failed."
[29] Khandani and Lo, "What Happened to the Quants?"
[30] Jung, "Quants' Tail of Woe."

Questions

1. Highbridge Statistical Market Neutral Fund (HSKAX) was a quant long-short mutual fund. It sought to "provide long-term absolute (positive) returns in all market environments from a broadly diversified portfolio of stocks while neutralizing the general risks associated with stock market investing."[31] Analyze the daily returns of HSKAX from January 2006 through July 2007. Compute daily standard deviations. Now examine the daily returns over August 2007. How unusually large are the returns of August 2007 in terms of HSKAX's earlier daily volatility?

2. Compare the returns of some traditional quant strategies before August 2007 and during August 2007. What was the comovement among these strategies before August 2007 and during August 2007? (Note: Portfolios tracking common hedge fund strategies—including value/growth, size, momentum, and short-term autocorrelation strategies—have been constructed by Kenneth French and are available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)

3. After three days of tremendous losses from August 7–9, 2007, quant funds rebounded on August 10. A report dated August 15, 2007, stated that "between 25% to 90% of the prior four days worth of losses in factor returns was erased on Friday."[32]

   Discuss why quant funds might still have ended up with severe losses over August 2007 even though a rebound occurred on August 10. Can you find any reasons why quant returns might have reversed?

4. Examine weekly and monthly returns of quant fund strategies in 2007. When analyzed over these longer time horizons, was there a meltdown in quant strategies?

5. How does the fact that the most common quant strategies are widely known and used by many investment managers influence the way you would construct and implement a quant strategy now? How does the knowledge that many of the same factors are used in risk models affect your hedging strategy?

6. How can situations like August 7–10, 2007, be taken into account in estimating risk for a trading strategy?

   Discuss how to evaluate strategies or funds that perform in unexpected ways.

7. Hedge funds routinely limit the withdrawal of capital, often to end-of-quarter periods, and impose redemption notice restrictions. That is, for withdrawal at the end of December, an investor often is required to give notice at the end of September. Sometimes hedge funds

[31] J.P. Morgan, "Highbridge Statistical Market Neutral Funds," www.jpmorganfunds.com/jpmfpages/fundoverview&cusip=4812A2454
[32] Rothman, Lehman Brothers Equity Research Report.

have “gates” restrictions (often to 20% of the fund) that limit the withdrawal of capital if a large number of withdrawal requests are made. In extreme situations, hedge funds can invoke suspension clauses that limit the ability of investors to withdraw from the fund entirely. How should these liquidity restrictions affect your valuation of a fund, especially one with unexpected poor performance?

8. Using 13F data tabulated by a third-party vendor, examine the holdings of several large quant funds. Is there a large overlap? How do these holdings differ from the styles of other managers, such as well-known fundamental deep-value managers?

Exhibits

Exhibit 1

Time Line of Events Surrounding the August 2007 Quant Fund Crisis

June 19	Bear Stearns announces that two of its hedge funds will be closed due to exposure to subprime loans.
June 26	One of UK's biggest hedge funds, Cheyne Capital Management, announces large subprime losses.
June 28	A Cambridge Place Investment Management fund is closed due to the subprime crisis.
July 3	Withdrawals from investors force United Capital, a Florida-based fund with investments in the subprime mortgage market, to halt redemptions.
July 5	Braddock Financial, a Denver-based hedge fund, closes.
July 6	A large Australian hedge fund, Basis Capital, hires advisors to help stem mortgage losses and suspends redemptions after missing margin calls.
July 10	S&P, Moody's, and Fitch downgrade bonds backed by subprime mortgages.
July 19	The Dow Jones Industrial Average (DJIA) closes above 14,000 for the first time.
July 30	IKB Deutsche Industriebank is bailed out by the German state-owned bank KfW due to losses from US mortgage-backed securities.
July 31	Sowood Capital Management LP collapses after declines in the corporate bond and loan markets. It announces that it sold most of its assets to Citadel Investment Group LLC and will unwind its two funds.
August 1	The popular press begins reporting that the mortgage crisis is now a broader credit crisis affecting global markets and nonfinancial firms.
August 3	Germany's third-largest mutual fund manager, Union Investment, is forced to stop withdrawals from one of its funds. The popular press reports on reduction of liquidity in credit markets. "The liquidity in the credit markets was abysmal," said William H. Gross, chief investment officer of the bond management firm Pacific Investment Management Company, known as Pimco. "On Friday afternoon, the brokers were unwilling to make markets in almost anything that didn't have a Treasury or agency sticker attached to it. That's pretty bad."[33]
August 6	DJIA closes at 13,468, up 287 points. American Home Mortgage and Aegis Mortgage file for bankruptcy.

[33] Julie Cresswell and Michael de la Merced, "Even Nonhousing Markets Feel Mortgage Fallout," New York Times, August 7, 2007.

Frankfurt Trust, the mutual fund manager of Germany's BHF Bank, shuts one of its asset-backed securities funds, FT ABS-Plus.

August 7 **Quant hedge funds experience tremendous losses.**

DJIA closes at 13,504, up 36 points.

West LB Mellon, a joint venture owned by the German investment bank West LB and the Bank of New York Mellon, temporarily closes an asset-backed securities fund that had experienced large withdrawals.

The Federal Open Market Committee (FOMC) votes to leave the target Fed funds rate unchanged at 5.25%. The FOMC's postmeeting statement said, "Financial markets have been volatile in recent weeks, credit conditions have become tighter for some households and businesses, and the housing correction is ongoing." Thus, "the downside risks to growth have increased somewhat."[34]

August 8 **Quant funds again experience tremendous losses.**

DJIA closes at 13,657, up 153 points.

August 9 DJIA closes at 13,270, down 387 points (almost 3%), and **quant funds are again battered**.

Central banks around the world intervene in markets, injecting substantial amounts of liquidity to keep overnight rates at their targeted levels. The European Central Bank injects 95 billion euros, exceeding the funds it put into the market during the two days that followed the September 11, 2001, terrorist attack, and the Federal Reserve adds roughly $38 billion in liquidity.

The Wall Street Journal publishes article, "Blind to Trend, 'Quant' Funds Pay Heavy Price," drawing attention to losses at Goldman Sachs and Renaissance Technologies.

Bloomberg.com posts article, "Highbridge, Goldman 'Quant' Hedge Funds Lose Money in August," citing wider credit spreads and volatility as reasons for poor performance of quant models.

Rumors and reports of poor quant fund performance abound. Names mentioned include Goldman Sachs, Tykhe Capital, AQR, Black Mesa Capital, Highbridge Capital Management, and Renaissance Technologies.

French bank BNP Paribas suspends three of its funds due to exposure to US mortgages.

[34] Board of Governors of the Federal Reserve System, press release, August 7, 2007, http://www.federalreserve.gov/newsevents/press/monetary/20070807a.htm

Exhibit 2

August 2007 Results for Selected Quant Hedge Funds

Company Name/Hedge Fund	Early August 2007 Results	August 2007 Monthly Results
ACI Market Neutral Fund	-19.0%	
Alpha Equity Leveraged MKT NTRL Fund		-6.43%
AQR	-13.0%	
Ascend US Market Neutral Fund		-19.17%
Ascend US Market Neutral Mid-Large Cap Fund		-12.69%
Ayrie Golden Eagle Fund		-16.20%
Barclays Global Investors 32 Capital Fund		0.24%
Battenkill Market Neutral Fund		-2.25%
Black Mesa Capital	-7.5%	-10.7%
DE Shaw Composite Fund	-15.0%	
GMN Capital	-19.0%	
Goldman Sachs—Global Alpha Fund	-28.2%	-22.5%
Goldman Sachs—Global Equity Opportunities Fund	-30.0%	
Hampton US Hedge Fund No. 2 Limited		-4.05%
J.P. Morgan—Highbridge Capital Fund		-18.0%
Jasper Partners L.P.		-1.71%
Man Group PLC AHL Fund	-7.0%	
Morgan Stanley's Process Driven Trading (PDT)	-$500M*	
Renaissance Institutional Equities Fund	-9.0%	0.4%
Renaissance Medallion Fund		3.9%
Temujin Fund Management	-4.0%	-0.4%
Tewksbury Investment Fund		-8.0%
Thales Fund Management		-3.72%
Tykhe Capital LLC		-20.0%
Whitebox Statistical Arbitrage Fund		-3.97%

*PDT lost about $500 million between the last week of July and August 9, 2007.

Sources: Barclay Hedge Fund Directory, 2007; Alistair Barr, "Quant Hedge Fund Rebound Not Enough for Some," MarketWatch.com, September 13, 2007, http://www.marketwatch.com/story/quant-hedge-fund-rebound-not-enough-to-stem-big-losses; Katherine Burton and Jenny Strasburg, "Highbridge, Goldman 'Quant' Hedge Funds Lose Money," Bloomberg.com, August 9, 2007, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=arsD8QnMC6zw; "Talking Business: Quant Funds Aren't the Problem," International Herald Tribune, August 19, 2007; Alistair McDonald, "Enough Punishment for Hedge King?," Wall Street Journal, August 28, 2007; Scott Patterson and Anita Raghavan, "August Ambush: How Market Turmoil Waylaid the 'Quants,'" Wall Street Journal, September 7, 2007; "Quants Spoil the Funds," Australian Financial Review Abstracts, August 17, 2007; Jung, "Quants' Tail of Woe"; Richard Teitelbaum, "Simons at Renaissance Cracks Code, Doubling Assets," Bloomberg.com, November 27, 2007, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aq33M3X795vQ