The Quant Liquidity Crunch

- Over the last week (August 3-10), there has been a massive deleveraging (reduction of active positions) in quantitative equity strategies.
- This deleveraging had only a minor effect on overall market returns and volatility. Without quant-goggles, this was not a particularly unusual market – especially up until Thursday, August 9. However, quant investors observed severe dislocations of their strategies.
- The deleveraging began in the US, became severe starting on Friday, August 3, and spread to non-US regions beginning on Wednesday, August 8. This deleveraging resulted in unprecedented negative returns to all standard quant factors in the US over the period from August 3 through August 9, and outside the US on August 8-10.
- The cause of the initial deleveraging is unclear, but could be related to a combination of a need for cash by multi-strategy quant funds, closing down positions at sell-side prop desks, tight credit markets, and real and perceived increases in volatility.
- The large price effects associated with this deleveraging are likely related to a temporary lack of liquidity in equity markets. In fact, the deleveraging may have been exacerbated by this lack of liquidity.
- There appears to have been no fundamental information which drove the extreme returns experienced by quant managers over this period. Rather, the extreme returns appear to have been a response to temporary supply/demand imbalances and therefore likely to reverse when these pressures abate.
- We are optimistic that this deleveraging, and the ensuing price dislocations, have resulted in good investment opportunities in the near term. However, substantial risks still accompany these opportunities.
- Longer term, successful quant managers will have to rely more on unique factors. While we have developed a number of these factors over the last several years, in hindsight we did not put sufficient weight on these relative to more popular quant factors. We will work to develop even more of these proprietary factors in the future, with an emphasis on industry specific metrics and data sources.
- A key lesson from this episode is that too many quant managers were using the same quantitative factors. This has a couple of implications for us. First, going forward we need to develop better measures to assess the popularity of certain quant factors. Second, to protect our investors, we will need to make more of an effort to make sure that our proprietary factors remain proprietary.

The Markets in Review: Has August Been Unusual?

Last week virtually all quant managers and investors in their products experienced painful dramatic underperformance. Generally, however, markets as a whole held up rather well.

From Friday-close to Friday-close, (August 3-10), the Dow rose slightly from 13,182 to 13,240. It hit a midweek high on Wednesday of 13,696 – up about 3.8% from Friday's close, and then fell 3.1% over the remainder of the week (from 13,658 – 13,240) – a strong drop, but not extraordinary.[1]

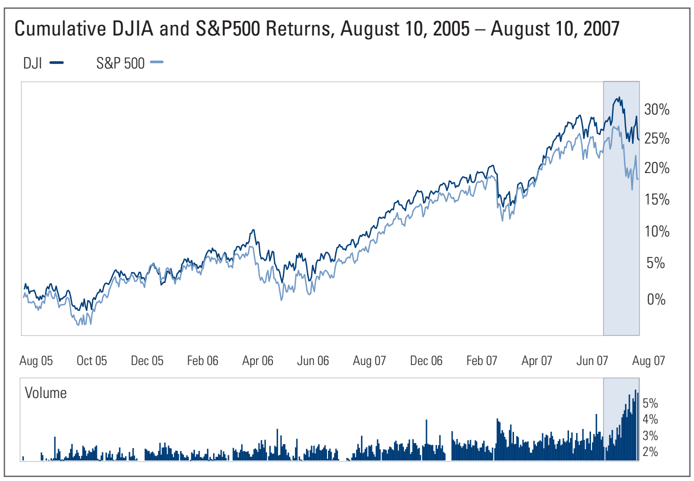
Looking just at market prices, there is not a lot of evidence of increased volatility. *Exhibit 1* shows that both market volatility and trading volume were up slightly. *Exhibit 2* shows that industry returns were also a bit more volatile, but not extraordinarily so.

However, while these seem unremarkable, some less-followed market measures revealed just how turbulent and complex the week had been.

As you can see in *Exhibit 3,* in slightly less than one month, the market's assessment of future volatility more than doubled, rising from 14.8%/year (low on July 13) to 29.8% (the high on Friday August 10). Note that this is still well below the high of 44% achieved in August 1998 after the LTCM collapse and the Russian debt crisis, but higher than any time since March 2003.

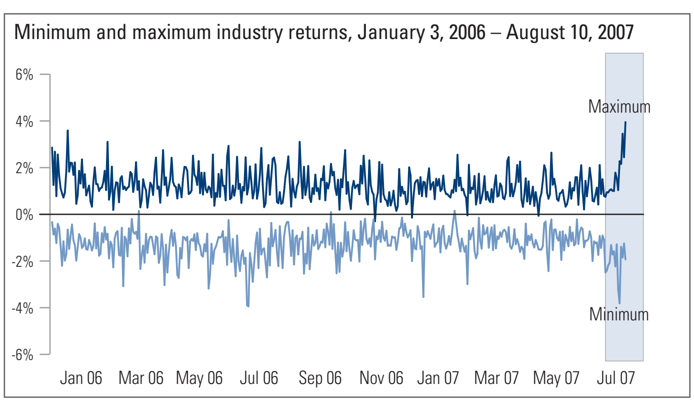
A rise in cross-sectional volatility – a measure of the dispersion of equity returns across securities – shows a pattern like that of implied volatility. There was a strong rise over the last week, but still well below the levels experienced in 1987 and 2000 (see *Exhibit 4*).

Exhibit 1: Market Volatility and Trading Volume Were Up Only Slightly Last Week



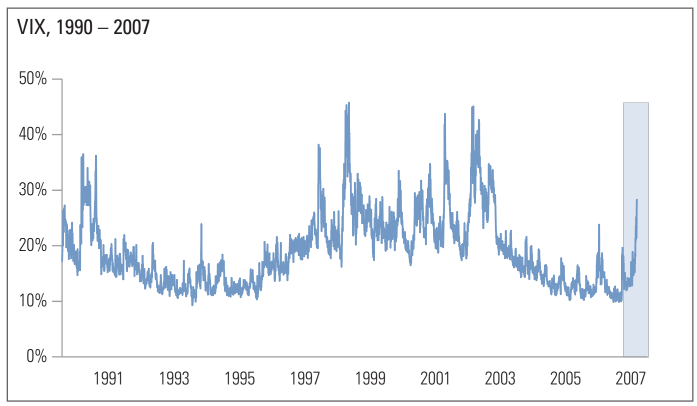
Source: Yahoo

Exhibit 2: Industry Dispersion Was Also Slightly Volatile



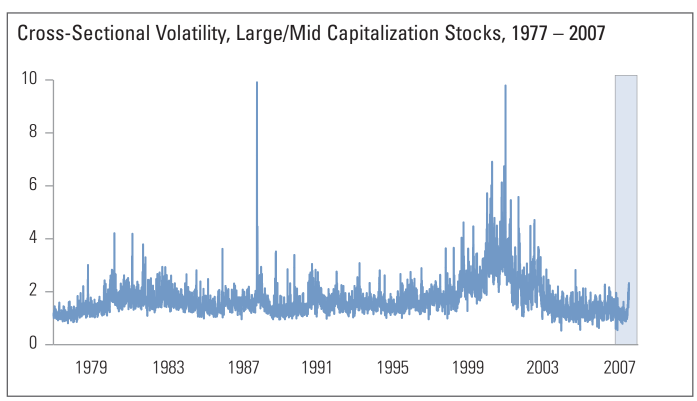
Source: Goldman Sachs Asset Management

Exhibit 3: Volatility Expectations Doubled in Less Than One Month…



Source: Yahoo

Exhibit 4: …and Cross-Sectional Volatility Also Increased.



Source: Goldman Sachs Asset Management

[1] Moves outside the US on Friday were slightly larger

We believe that these heightened measures of volatility reflect concerns related to money markets. In response to a perceived lack of liquidity, on Thursday and Friday of last week, the Federal Reserve pumped $24 and $38 billion, respectively, into the financial system. This move was presumably in response to a perceived lack of liquidity in the financial system and, more specifically, to a (somewhat more remarkable) increase in overnight rates early Friday morning to more than 6% – well above the Fed target rate of 5.25%. At the same time, the European central bank took even stronger action, injecting $130.6 and $83.6 billion on Thursday and Friday, respectively. As a result, the Fed Funds rate dropped to below 1% on Friday afternoon, coinciding with the sharp positive move in US quant factors (see *Exhibits 5* and 6).

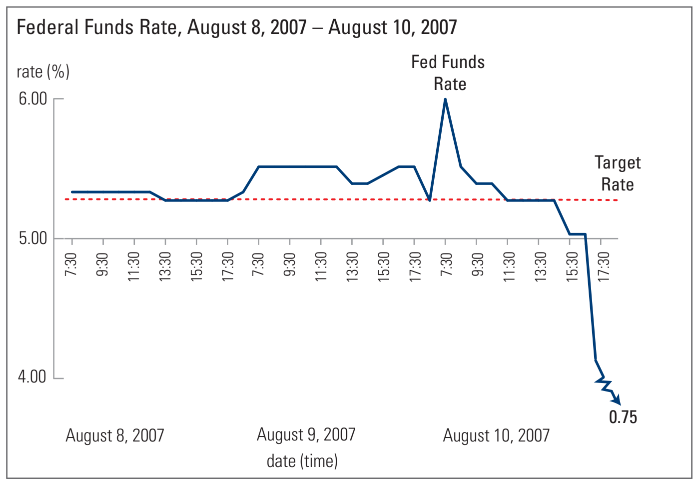
The real dislocation of the market becomes apparent when we examine the returns of long-short portfolios formed on the basis of standard quantitative metrics. Over this same week, quantitative portfolios fell (and rose) by unprecedented amounts – far more than at any time in the history of our data.

Beginning on Friday August 3, we began seeing extraordinary moves in each of our factors. Between that Friday and the following Wednesday, every one of our factors but one hit new lows, and several factors continued to hit new lows on the three subsequent trading days.

Exhibit 6 plots the return to each of our six investment themes, over the period from July 30 through August 10, for the US, Japan, the UK and Europe ex-UK. The units on the y-axis of each chart are the returns to each theme, relative to the historical standard deviation. The dotted lines of +/- 2 indicates larger than normal returns. The charts clearly show the extreme negative returns of each of the themes, and perhaps more importantly, the strong correlation across themes. The plots also show the strong bounce-back starting on August 10 in the US.[2]

Exhibit 7 plots a measure of the volatility-adjusted rolling weekly return, aggregated across all of our factors. Because almost all of the factors in our model fell by large amounts, the aggregate returns in the US were -28 standard deviations (!) more than 5 times more negative than any previous return. Results in other regions were equally extreme.

Exhibit 5: In 2 Days, the Fed Funds Rate Was Notably Volatile



Source: Bloomberg

[2] As we went to press, on August 13, there was a strong rebound in other global regions as well.

Exhibit 6: Quant Themes Globally Had Extreme Negative Returns

Normalized Theme Returns, July 30, 2007 – August 10, 2007

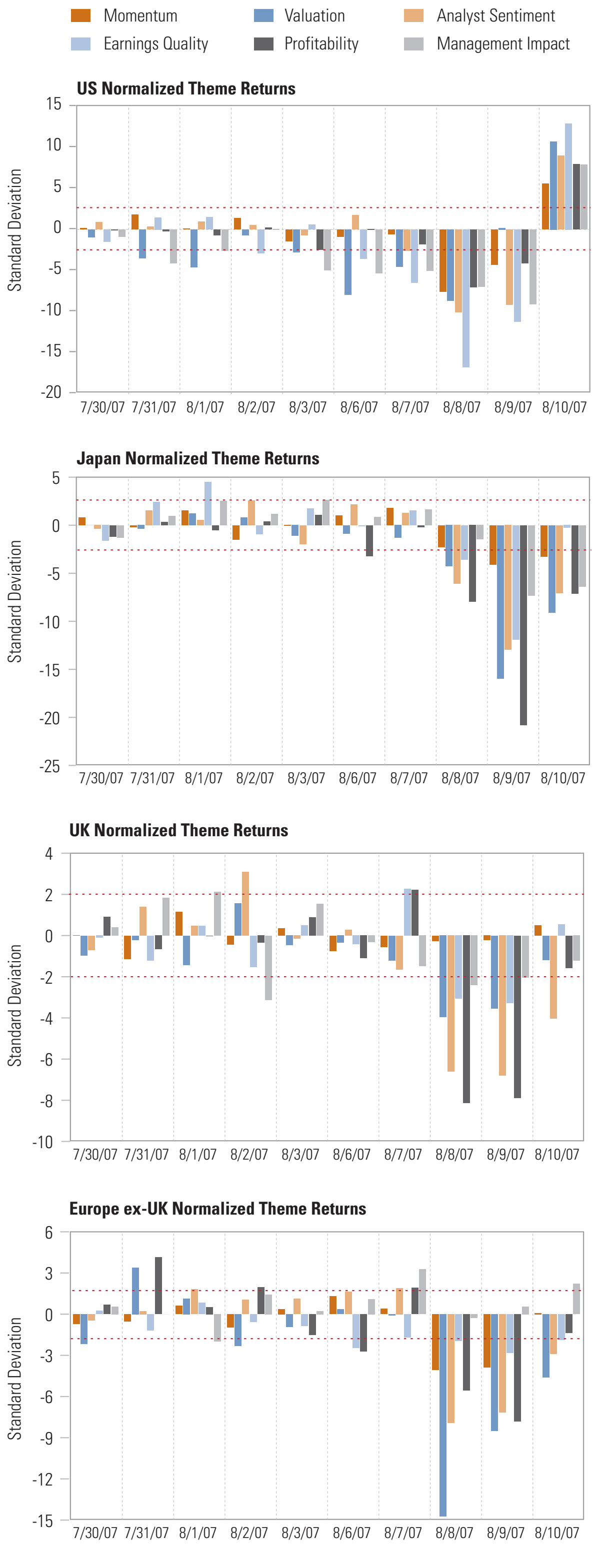
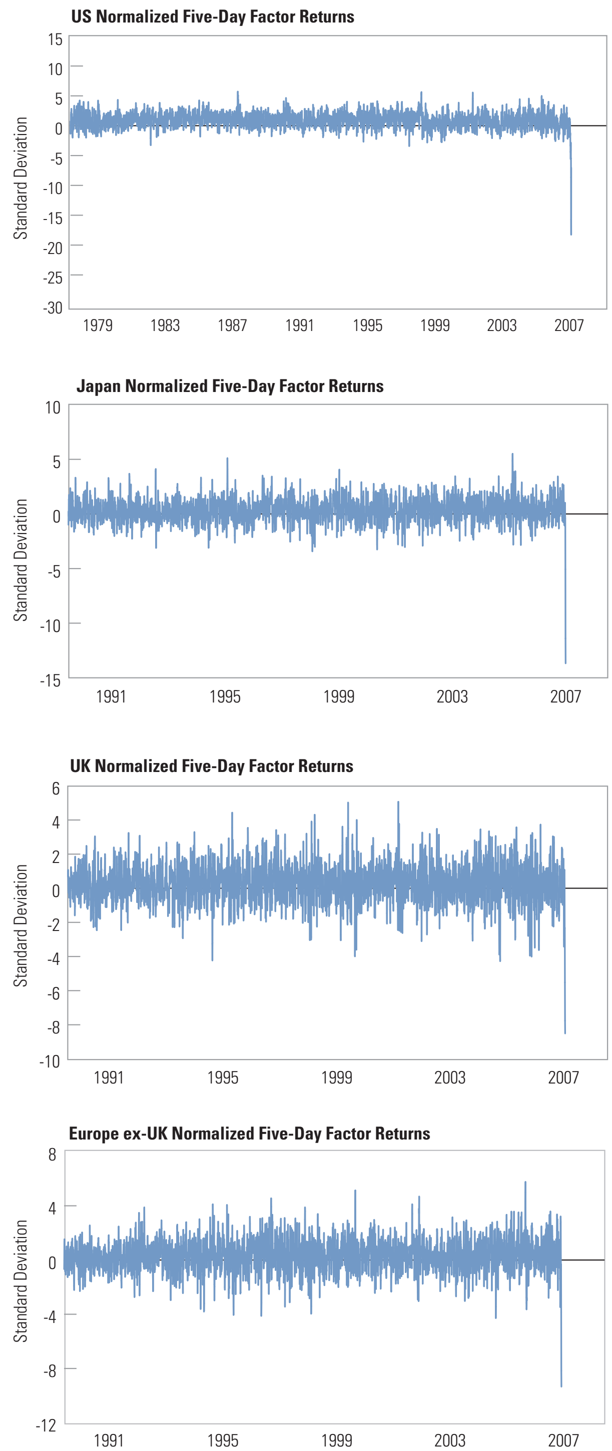


Exhibit 7: Last Week's Aggregate Returns Marked Severe Dislocations

Normalized Five-Day Factor Returns



Source: Goldman Sachs Asset Management
Past performance is not indicative of future results, which may vary.

What Caused the Anomaly?

Was It Fundamentals?

We don't believe so. The magnitude of this move alone argues that fundamental economic news could not be responsible for the extreme returns we see here.

To verify this, we calculated earnings surprises over this period for our positive and negative alpha stocks. What we find is that the positive alpha stocks – which we buy long – actually experienced more positive earnings surprises than did our negative alpha stocks – which we sell short. Thus, this and other evidence confirms that earnings and fundamental news are not responsible for the poor performance of our models over this week, and points to the liquidity/price-pressure explanation of recent returns.

Was it Quant Concentration?

Generally, there is a perception in the market that there is a high correlation among quant positions. The implication is that quants are all holding exactly the same positions. The evidence goes against this hypothesis. While we do not yet have reliable data on the performance of other quant funds during this period, the correlation of the returns of quant managers prior to this market event was relatively low – on the order of 20-30%. Nonetheless, the press coverage seems to suggest that nearly every quant manager was hit hard. How could this happen?

The answer appears to be that, even though the position correlations across the various quant hedge funds were not extremely large, there was some correlation. Because the moves in the factors were so extreme, it appears that virtually every quant manager was affected by the meltdown. In essence, the overlap between any two managers was low, but the aggregate overlap of all quant managers was considerably higher.

One other interesting characteristic of these data is that the different quantitative factors do not uniformly decline through this period. Our short-term reversal factor experienced its most severe decline on Friday, August 3, implying that the meltdown may have started with the stat arb players. For most others, the worst day was August 8, but for three of the factors, the worst day was August 9. Moreover, on August 6-7, when overall portfolio performed very poorly, several of our factors actually posted slightly positive returns.

Outside the US we see even more variability. For example, in Europe ex-UK on August 10, three factors exhibited a *positive* 4-sigma day, while another was *down* by more than four standard deviations.[3] These data are consistent with the hypothesis that, while the quant selloff was broad in nature, different firms with different strategies were unwinding at different points in time.

Our conclusion is that there was a major supply/demand imbalance caused by many quant managers unwinding simultaneously, which caused outsized negative factor returns despite modest overlap between managers.

[3] The theme charts presented in Exhibit 6 do not show this but the underlying factors do show this movement.

Conclusions and Implications for Future Research

All of the evidence suggests that the price dislocations experienced over this period were a result of deleveraging and limited market liquidity, as opposed to any fundamental news about the stocks in our portfolios. Given this, we do not believe that current prices reflect fundamental values. If so, the current environment may represent a significant investment opportunity.

The speed in which the market reacted to the dislocation was unprecedented and it is not clear that there were any obvious early warning signs. With the benefit of hindsight, there were a few clues before last week that might have hinted at problems to come, including the dramatic rise in implied volatilities and the disruption in other markets and the related potential for contagion. No one, however, could possibly have forecasted the extent of deleveraging or the magnitude of last week's factor returns.

Risk management is based on historical precedent; but what the market experienced in recent days has been completely unprecedented. Nonetheless, it is crucial that we work hard to determine if there are indicators that can help us better assess the possibility of such an event in the future. In particular, we believe that going forward we need to develop better measures to assess the popularity of our factors and the related possibility of liquidity events such as last week's affecting these 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. In fact, to protect our investors, we will need to make more of an effort to make sure that our proprietary factors remain proprietary. While we have developed a number of these factors over the last several years, in hindsight we did not put sufficient weight on these relative to more popular quant factors. We will need to develop even more of these proprietary factors going forward.

In the coming weeks, we will continue to analyze this extraordinary period. We will also re-evaluate and re-prioritize our research agenda in light of recent events. Stay tuned. As we continue to study these events, we hope to gain additional insights that will help us avoid similar problems in the future. In the meantime, however, we remain confident that a portfolio with exposure to signals such as better valuations, higher profitability, better earnings quality, shareholder-friendly management, strong momentum and improving analyst sentiment will perform well – that is, our process should continue to add value under normal market conditions.

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