



28 January 2011

Quant Commentary

Quant crisis? What crisis?

Recent commentary has suggested a 'mini' quant crisis. We disagree.**Is this August 2007 all over again?**

Recent commentary has suggested that we are seeing a miniature reprisal of the August 2007 'quant crisis'. The evidence being cited is a dramatic reversal in factor performance. Similar to August 2007, this extreme factor activity has occurred against the backdrop of a relatively flat market, leading some to conclude that the driving force is a quant-specific event, for example more quant deleveraging or a quant style rotation trade.

We disagree for two reasons

We do not subscribe to this view for two reasons. First, we show that January was not particularly abnormal in terms of factor performance or factor volatility. In fact, factor performance in December was actually far worse than in January in the U.S., which leads us to conclude that crises are often in the eye of the beholder.

Second, we believe cause and effect are being confused. The driver of the rapid reversal in factor performance was not quants herding in unison; rather, the factor performance was the result of a savage de-risking episode that was transmitted to quant factors via their inherent risk exposures.

Two potential solutions to the risk reversal problem

Quant is often accused of being backwards looking, and this recent episode is a classic example of why that criticism is sometimes justified. Much has been written about what happened, but little has been written about what we should do about it.

We try to be different. Instead of just reporting on the past, our focus is on how we can mitigate the impact that these risk reversals have on our models. We do so in two ways. First, we show how a factor neutralization technique – which we introduced last year – would have helped to reduce the negative impact of the most recent quant turmoil. Second, we show that using a simple, structured factor covariance matrix can help steer quant models towards the factors that are better suited to each risk regime.

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What's going on?

Did we just see a 'mini' quant crisis?

There has recently been a good deal of commentary suggesting that January 2011 represented a miniature reprisal of the August 2007 'quant crisis'. The evidence being cited is a rapid reversal in factor performance, with a dramatic shift away from Momentum and towards Value. Like in August 2007, this sharp reversal in factor performance has taken place against the backdrop of a relatively flat market, which has led to concerns that the movements in factor performance are being driven by quant-specific events – perhaps a major style rotation trade or more quant deleveraging.

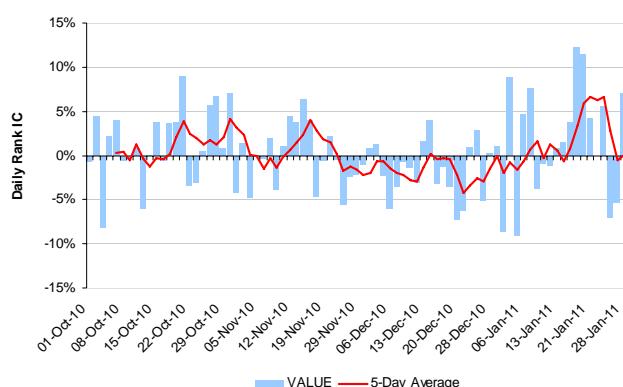
We disagree with this conclusion for two reasons. First, we don't believe the factor performance in January has been particularly abnormal. In fact, based on our calculations December was actually much worse than January in terms of factor performance. Second, we believe that many commentators have the cause and effect the wrong way round. We believe that the reversal in quant factors was driven by an exogenous event – a vicious change in market-wide risk appetite – and not by quant managers themselves.

December was actually worse than January

Let's drill down into these two points in more detail. Our first argument is that December was actually a much worse month for factor performance than January. This is of course cold comfort for quant investors – does it really matter which month was worse? That's true, but we do think it is important because it illustrates the fallacy of trying to "call out" a particular period of time and call it a crisis. Everyone sees a crisis where they want to see it.

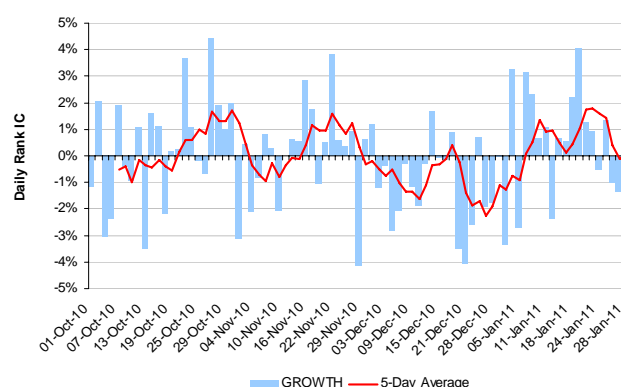
If we look at the daily performance of our six broad styles (Value, Growth, Momentum/Reversal, Sentiment, Quality, Technicals) we can see quite clearly that on average the performance through December was significantly worse than January.

Figure 1: Average daily Value factor performance (rank IC)



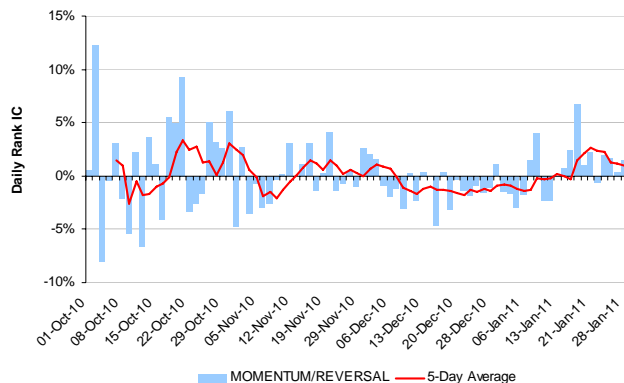
Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 2: Average daily Growth factor performance (rank IC)

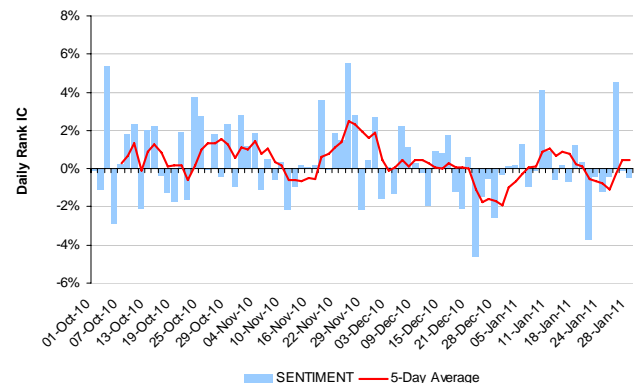


Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

For example, the performance of Value (Figure 1) and Growth (Figure 2) was woeful through December, and then reversed course in January.

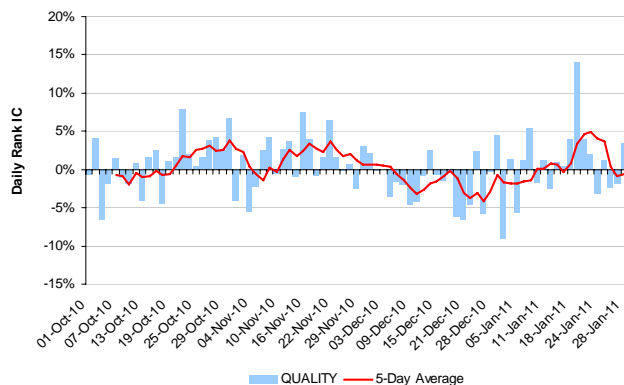
Figure 3: Average daily Momentum/Reversal factor performance (rank IC)

Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

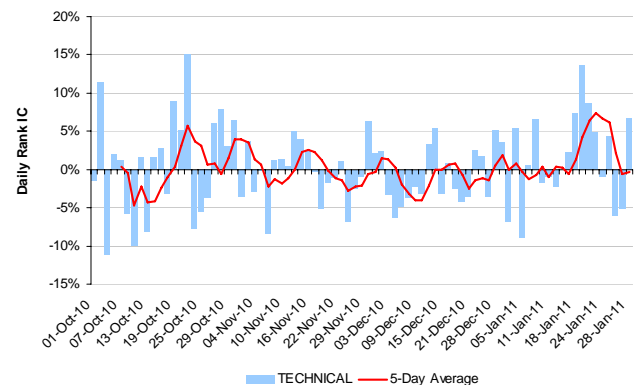
Figure 4: Average daily Sentiment factor performance (rank IC)

Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Momentum/Reversal was also consistently negative through December, before showing signs of revival in the latter half of January (Figure 3). In contrast, Sentiment has struggled for most of the last two months (Figure 4).

Figure 5: Average daily Quality factor performance (rank IC)

Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 6: Average daily Technical factor performance (rank IC)

Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

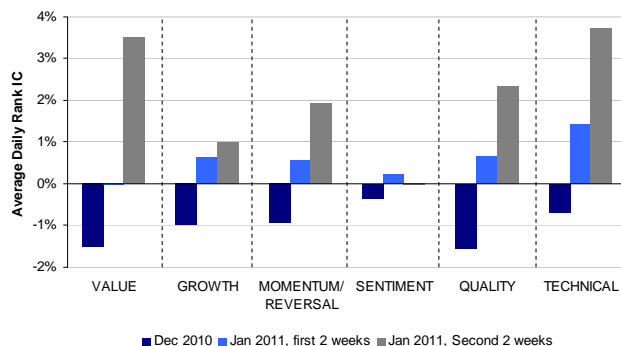
Quality (Figure 5) and Technicals (Figure 6) have also shown something of a recovery in recent weeks after a very difficult December.

So what does this tell us? If nothing else we think it shows that a crisis is in the eye of the beholder. We don't think there was anything special about January in terms of either factor performance or factor volatility. Even in the short period we examine in the charts above, there are plenty of other periods where factors have experienced sharp reversals in performance or extended stints of underperformance.

Figure 7 strengthens this argument. In the chart we show the average daily performance – measured as a daily rank information coefficient (IC) – of each quant style in three periods: (1) the month of December, (2) the first two weeks of January, and (3) the second two weeks of January. What we find is that across all the styles, performance has actually steadily improved on average over time. We also find, in Figure 8, that the breadth of the underperformance has also diminished over time. By this we mean that the percent of factors with negative performance has declined steadily. In December over 60% of the

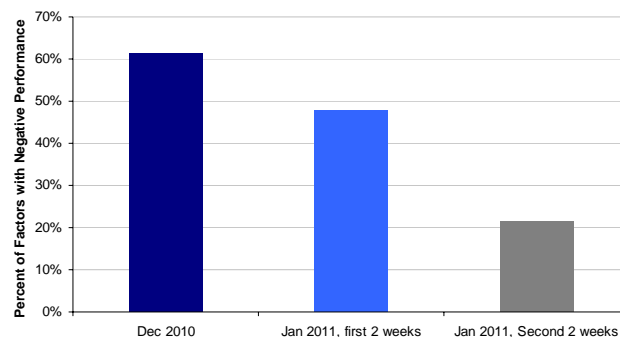
approximately 80 factors that we track regularly had negative performance. By the most recent two weeks of January that had fallen to around 20%.

Figure 7: Average daily factor performance, by time period



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 8: Percent of common factors which generated negative performance, by time period



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

So we think we can make the argument that, while things certainly aren't rosy for quantitative investors right now, they also haven't suddenly hit 'crisis' levels.

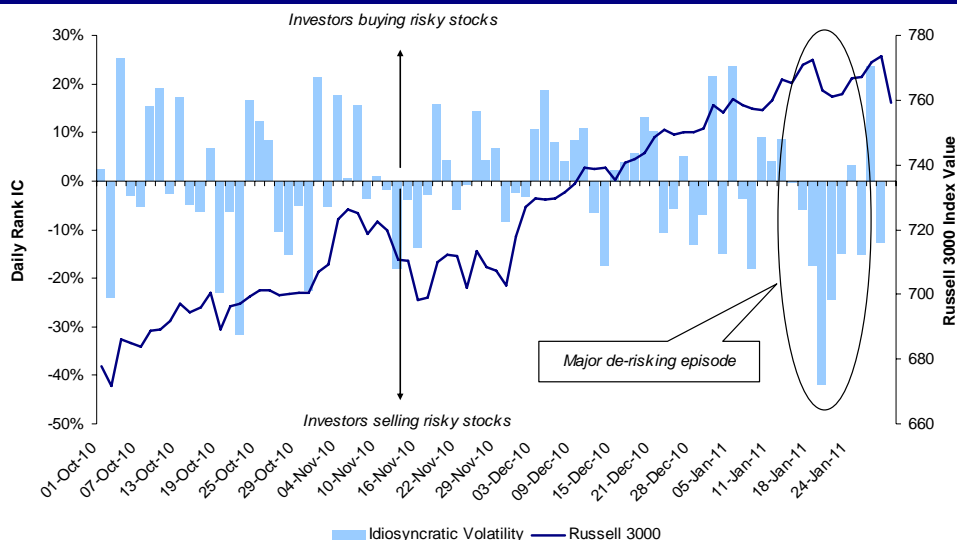
Quants are not the cause of the topsy-turvy factor performance

Our second argument is that, unlike August 2007, quant investors are unlikely to be the cause of the current factor reversal. We come to this conclusion for two reasons. First, we have done a lot of research recently looking at the inherent exposure of quant factors to risk, or volatility.¹ What we found was that most quant factors have a built-in tilt towards either high volatility stocks or low volatility stocks. For example, Value has a consistent negative exposure to volatility on average. This means when one buys "cheap" stocks, one also on average buys low volatility stocks. So when an investor follows a value strategy he or she is also implicitly assuming that low volatility stocks will outperform. Most of the time this is a safe assumption, but sometimes – like December 2010 – the market's risk aversion suddenly shifts from risk averse to risk seeking. When this happens, higher volatility stocks suddenly outperform, and quant factors with an implicit negative volatility exposure – like Value or Quality – get hurt badly.

We think it is just such a market-wide shift in risk aversion that has been driving factor performance over the last two months. In December we saw a decrease in risk aversion, while January showed a strong reversal in the middle of the month. Figure 9, shows the daily performance of a simple strategy that buys high risk stocks and sells low risk stocks. Note that the aggregate performance for this factor in December was positive indicating an increase in risk appetite. This coincided with a steady shift towards risk in the market, and significant underperformance for factors with low-volatility exposure such as Value and Quality (see Figure 1 and Figure 5). However, the recent behavior explains much of the recent commotion in the quant-sphere. In the most recent weeks there was a very sharp de-risking in the market, where investors suddenly began shying away from high risk stocks and moving into low risk stocks. This rapid shift in risk aversion occurred more at a stock-selection level rather than an asset class level. We can see in the chart that the market pulled back only a little, so the risk reversal we are talking about was more a reallocation from high risk to low risk equities, rather than a wholesale flight away from equities in general.

¹ Luo, Y., R. Cahan, J. Jussa, and M. Alvarez, 2010, "Portfolios Under Construction: Volatility = 1/N", *Deutsche Bank Quantitative Strategy*, 16 June 2010

Figure 9: Market risk appetite, as measured by performance of a strategy that goes long high volatility stocks and short low volatility stocks

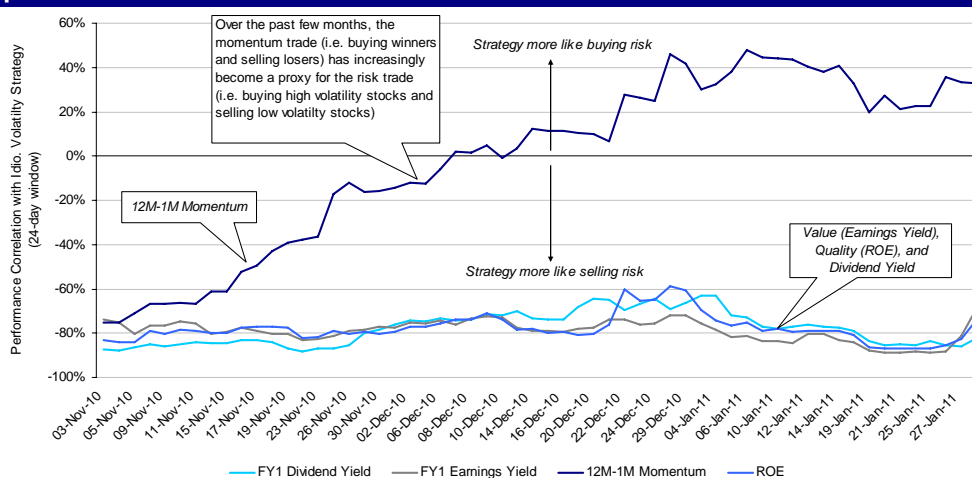


Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

We think that it is this sharp de-risking event that is driving the reversal of quant factors, rather than any quant-specific style rotation or idiosyncratic event. In other words, we think that calling recent factor behavior a style reversal misses the point. The real reversal is a reversal in risk appetite, and it is this market-wide reversal that has in turn led to the factor performance reversal that we are witnessing.

This means that the key determinant of which factors worked and which didn't is tied to each factor's implicit exposure to volatility. Figure 10 expands on this point. Here we are looking at the performance correlation (computed over a rolling 24 days) between common quant strategies and a volatility strategy that goes long high risk stocks and short low risk stocks.

Figure 10: Performance correlation of select factors with Idiosyncratic Volatility performance



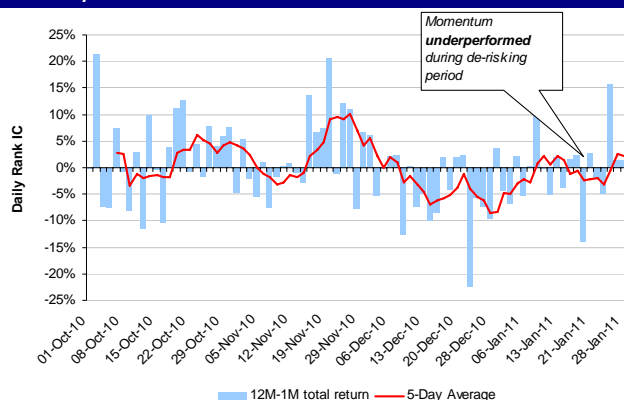
Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

What we find is that Value, Quality, and Dividend Yield strategies have had a consistent negative correlation with the volatility strategy over recent months. This means that following a Value, Quality, or Yield strategy is akin to buying low volatility stocks and selling high volatility stocks. In other words, if investors de-risk, we would expect these strategies to

outperform. This, of course, will not come as a surprise to anyone. What is more interesting is the result for Momentum. We find that a strategy of buying winners and selling losers has migrated from being an anti-risk strategy to a risk-seeking strategy in recent months. In other words, back in November buying past winners was the same as buying low volatility stocks; now buying past winners is more like buying risk.

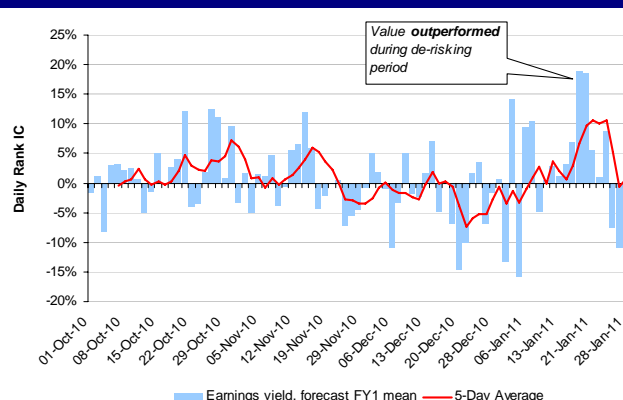
Based on these results the implications are clear. In the January de-risking episode we would expect Value, Quality, and Yield to outperform, and Momentum to underperform. Was this the case? If we look at time-series charts of these factors, we can see confirmation. In each case we see performance in the direction we expect based on the direction of the risk exposure for each factor.

Figure 11: Daily performance of 12M-1M Momentum (rank IC)



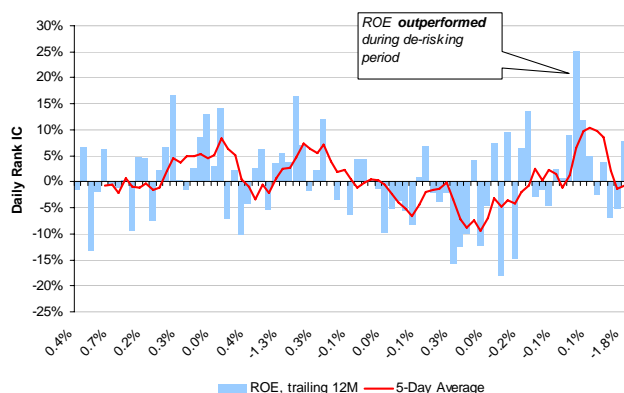
Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 12: Daily performance of Earnings Yield (rank IC)



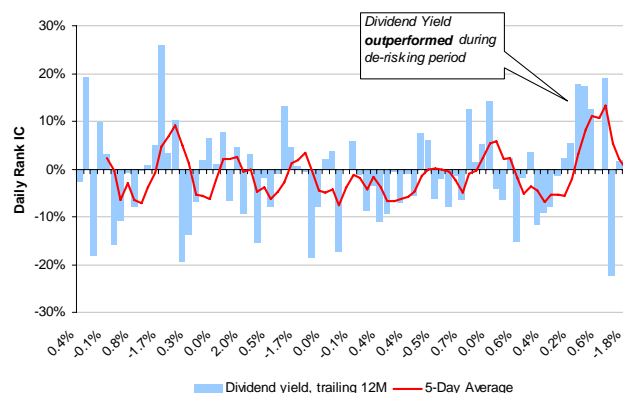
Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 13: Daily performance of ROE (rank IC)



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 14: Daily performance of Dividend Yield (rank IC)



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

In the next section of this report we will look at how we can manage these risk exposures to mitigate the impact of changes in risk appetite. But before we do, we want to touch on the second reason why we think quant managers are not to blame for the recent erratic factor performance.

Quants can't move the market like they used to

The second reason we think quant investors are less likely to blame this time around – compared to August 2007 – is due to the diminishing volume of assets under quantitative management. Unfortunately, given the challenges quants have faced in recent years, we have seen a steady outflow in the amount of money being allocated to quantitative strategies. Both the absolute assets under management (AUM) and the percentage of AUM commanded by quant managers have shrunk dramatically from the all time highs in 2007. For this reason, we believe that the capacity of quantitative managers to move the market has been considerably reduced.

Furthermore, we think the average pairwise correlation between quant models is substantially lower than it was in 2007. Based on our conversations with quant managers around the globe, the majority of managers have started to change their core models to some extent. Prior to 2007, traditional quant models using generic factors had performed well for almost a decade. There was little incentive to incorporate new factors or new portfolio construction techniques. Why would one want to take the risk of adding new factors if the existing factors worked just fine? Of course, the summer of 2007 changed everything. Since then most traditional factors have seen significant performance decay.² Likewise, quant models that take a constant exposure to these common factors have also suffered. As a result, most managers now have realized that they need to do something different. Research studying new data sources, new ways to construct factors, and new portfolio construction techniques has started to attract attention again.³ Managers are trying to differentiate themselves in numerous ways, for both performance reasons but also to satisfy their own investors (and consultants). As a result, we believe that quant models in 2011 are significantly less correlated than in 2007. This in turn reinforces our view that the capacity of quant investors to herd and move the market has been reduced.

² For example see: Luo, Y., R. Cahan, J. Jussa, and M. Alvarez, 2010, "GTAA/Signal Processing: Style rotation", *Deutsche Bank Quantitative Strategy*, 7 September 2010

³ For example, our *Signal Processing and Portfolios Under Construction* research series.

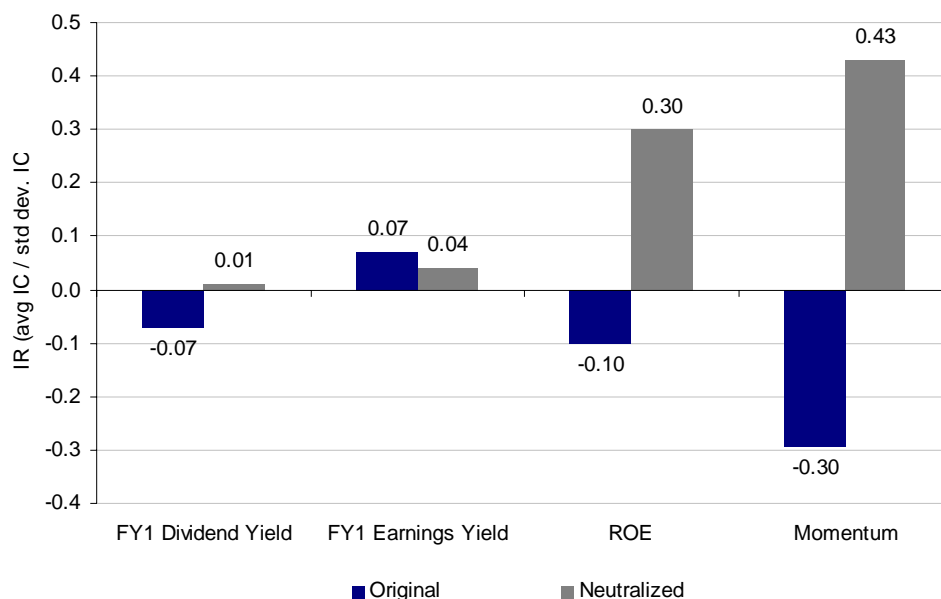
What are we going to do about it?

Factor neutralization to the rescue

In our *Portfolios Under Construction* research series last year, we introduced a technique called factor neutralization.⁴ The idea with this technique is to strip out the inherent risk, or volatility, exposure of quant factors. Once volatility exposure is neutralized, the factor is less prone to being thrown around by rapid shifts in risk aversion. Could this technique have helped stabilize performance through the recent factor turbulence?

In Figure 15 we compare the performance of neutralized and un-neutralized versions of some common factors over the problematic December and January period. In three out of four cases, the neutralized factor outperforms the un-neutralized factor.

Figure 15: Performance of original versus neutralized factors, 1 Dec 2010 – 28 Jan 2011



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

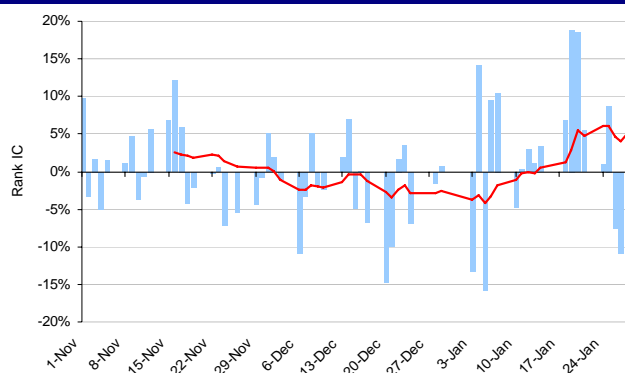
This does seem to suggest that neutralization has the potential to help reduce the impact of large swings in risk aversion on factor performance. Of course, this is a very short sample period, so we need to treat these results with a degree of caution. However, we did find in our previous research that neutralization also improves risk-adjusted performance over the long run, for a wide range of common factors.

Outside of the performance enhancement, our neutralization results allow us to make another important point about the nature of the reversal we have seen. Consider Figure 16 and Figure 17, which show the time-series performance of a simple value factor before and after neutralization, respectively. What we find is that the sharp swings in factor performance in the raw factor are damped down in the neutralized version. This suggests that the increase in

⁴ Luo, Y., R. Cahan, J. Jussa, and M. Alvarez, 2010, "Portfolios Under Construction: Volatility = 1/N", *Deutsche Bank Quantitative Strategy*, 16 June 2010

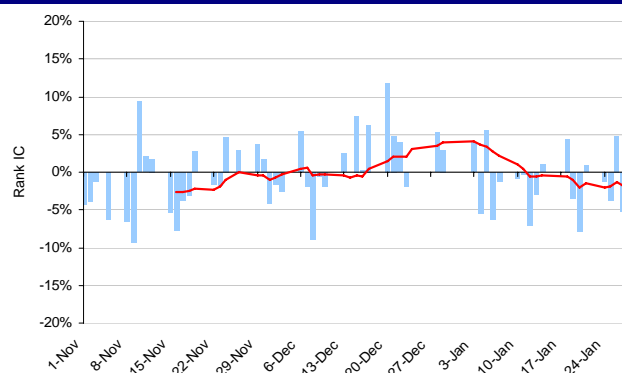
volatility of these factors is not being caused by quant deleveraging or herd-like style rotation. Instead most of the swings in factor performance can be attributed to the embedded volatility exposure of the factor. Moreover this volatility exposure is not particular to quantitative investing; it is macroeconomic and systematic and is related to the current risk-on risk-off attitude of investors.

Figure 16: Performance of FY1 Earnings Yield (rank IC)



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 17: Performance of Neutralized FY1 Earnings Yield (rank IC)



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Building a more robust alpha model

A second potential solution we propose follows our recent research on robust factor models⁵. In our robust factor model research, we find two interesting observations. First, systematically predicting factor returns can significantly improve model and portfolio performance. Second, regardless of whether we proactively predict factor returns or not, structured factor covariance matrices always lift model and portfolio IR.

Figure 18 and Figure 19 show the factor weights of the 12 common factors using the sample covariance matrix and the single index estimator, respectively, under a naïve factor return prediction scenario. On the other hand, we also show (Figure 20 and Figure 21) the factor weights using sample and single index covariance estimators, under our *LINEAR* factor return prediction model⁶. One can see from the charts that the weights allocated to price momentum have been close to zero in both our models.

In our research, we find a particular structured factor covariance estimator, called the single index (SF) model, works particularly well. In this case, we do not try to predict stock level risk⁷. Rather, we try to estimate factor risk. When we build our alpha models, we need to generate good estimates for both the factor returns and the factor risk and correlation. The purpose of this research is to find a more accurate estimator of factor risk and correlation. Essentially, we look for a “hyper” index on factors. We argue that market sentiment (as measured by VIX index) could potentially be a driver of factor risk and correlation. This is also related to the factor neutralization proposed above.

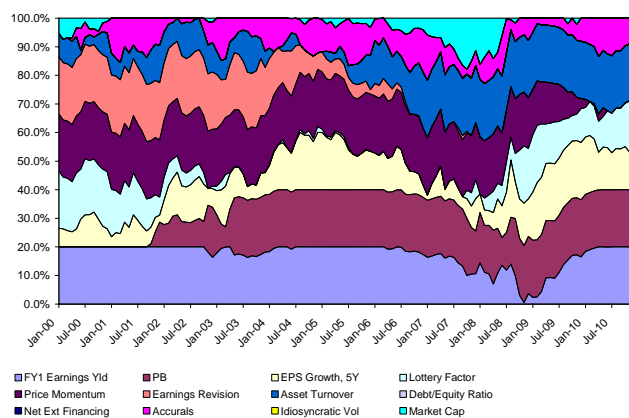
⁵ Luo, Y., R. Cahan, M. Alvarez, J. Jussa, and J. Chen, 2011, “Portfolios Under Construction: Robust factor models, *Deutsche Bank Quantitative Strategy*, 24 January 2011

⁶ The *LINEAR* model is our full-fledged style prediction model, using macroeconomic, capital market, and seasonal patterns. Details on the *LINEAR* model can be found in Luo, Y., R. Cahan, J. Jussa, and M. Alvarez, 2010, “Signal Processing: Style rotation”, *Deutsche Bank Quantitative Strategy*, 7 September 2010.

⁷ We leave that for risk model vendors like Axioma or Barra.

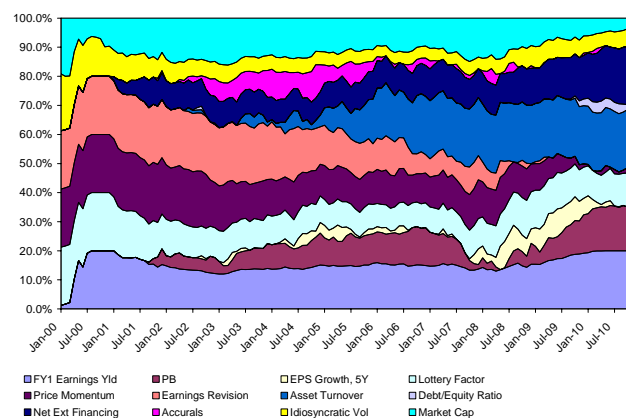
The rationale behind our single index covariance estimator is simple. We argue that regardless of whether a manager believes in factor timing or not, he or she needs to take into account factor risk and correlation. Factors have different exposures (betas) to market risk. When market risk declines (rises), managers should also reduce (increase) the weights of those factors with lower exposures to market risk and increase (reduce) the weights of those factors with higher exposures to market risk.

Figure 18: Factor weight: naïve style prediction/sample covariance matrix



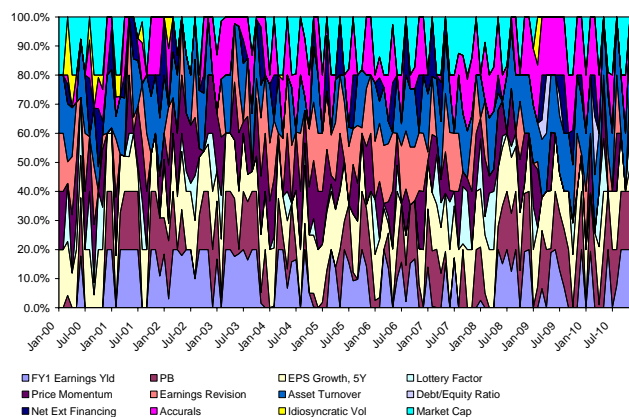
Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 19: Factor weight: naïve style prediction/single index covariance estimator



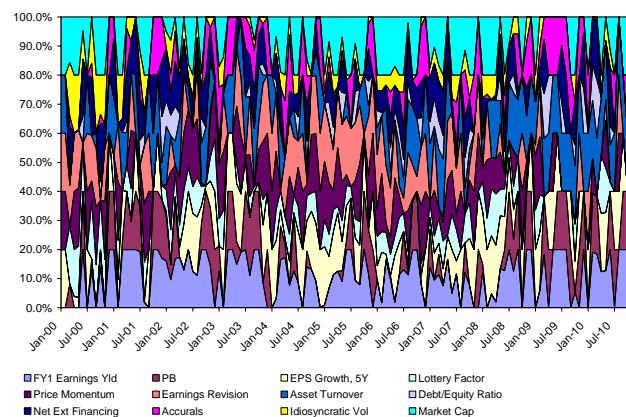
Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 20: Factor weight: LINEAR style rotation/sample covariance matrix



Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

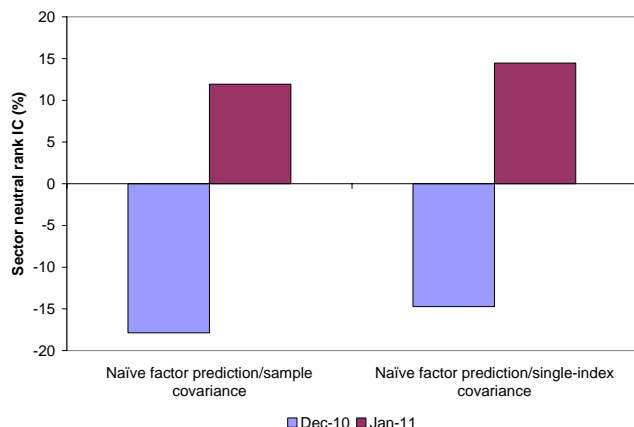
Figure 21: Factor weight: LINEAR style rotation/single index covariance estimator



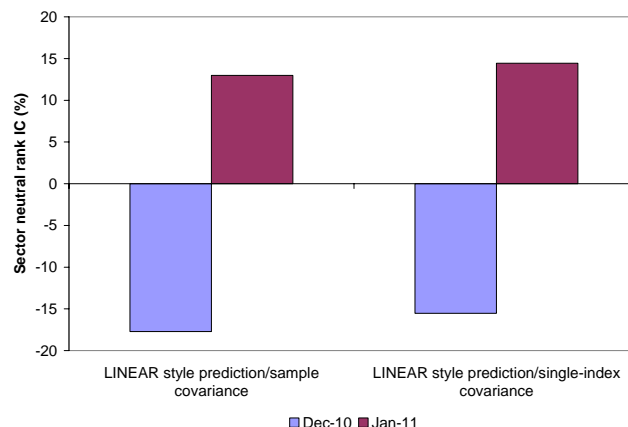
Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

The performance of the four models in December 2010 and January 2011 illustrates two key findings (see Figure 22 and Figure 23).

- December 2010 was indeed a much worse month than January 2011. Actually, all four alpha models underperformed significantly in December 2010, but are up strongly in January 2011.
- Using the single index factor covariance estimator improves model performance under both naïve style prediction and sophisticated style prediction scenarios, in both December 2010 and January 2011.

Figure 22: Naïve style prediction

Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

Figure 23: Sophisticated style prediction

Source: Bloomberg Finance LP, Compustat, Haver, IBES, Russell, S&P, Thomson Reuters, Deutsche Bank

In other words, another potential way to reduce the impact of risk reversals on model performance is to become smarter in how we weight the factors within our model. By using the VIX index in a single index model for factor covariance, we can automatically adjust our factor weights to better match different risk regimes.

Conclusion

We thought as quants watchers we had learned a lot from the past three years about the need to be proactive instead of reactionary. However, the recent hand-wringing over the purported 'quant crisis' of January 2011 has caused us to reevaluate. We believe this episode is a useful reminder that we should leave the after-the-fact hyperbole to the news reporters. Instead, we think a more productive approach is to focus on how we can mitigate the exposure of our models to future swings in risk aversion. Calling January a crisis exacerbates a head-in-the-sand mentality that is counterproductive because it implies that this episode was a surprise, or a special, one-off event. We don't think that is the case. While the timing of these de-risking or re-risking events is always unpredictable, what should be obvious is that this is not the first – and certainly won't be the last – swing in risk aversion we will see. In fact, given the volatile macroeconomic backdrop, we should be expecting these types of reversals with regularity, rather than jumping up and down with surprise when one springs upon us.

Instead of looking backwards, let's get on the front foot. One way to do this is to neutralize the volatility exposure inherent in our factors. As we have shown in our research, this allows us to smooth factor performance through precisely the type of risk reversals we have just witnessed. In fact, January 2011 was a perfect out-of-sample test of our neutralization technique. It turns out the neutralized versions of the factors we track were indeed able to mitigate a lot of the underperformance we saw in the raw versions of our factors.

As a second solution, we show that a robust factor modeling technique can also protect our final alphas from sharp and unexpected swings in factor performance. Specifically, we show that by using the single index (SF) factor covariance estimator rather than the sample factor covariance matrix, we are able to reduce downside risk in December 2010, and better capture the upside in January 2011. Regardless of whether managers want to proactively predict factor returns or not, we believe they should adjust factor weights based on estimated factor risk and correlation, which are in turn driven by market risk sentiment as measured by the VIX index.

As a final thought, we can't emphasize enough the importance of understanding the risk exposure of every factor in a multifactor model. Risk management is not something that should be left in the back office or to the portfolio construction stage – it should proactively involve every aspect of the quant model, starting with the alpha factors. In upcoming research, we will address how to manage extreme downside risk in a multifactor alpha model. There are a series of benefits to doing so. For example, we will be dealing with a dozen factors rather than tens of thousand assets; therefore, the dimensionality is substantially smaller and tail risk is much easier to estimate. If we are able to control for extreme downside risk in the alpha model, the portfolios built on these models are also less likely to be exposed to severe underperformance in times like these.

Appendix 1

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