WINDHAM®

INVESTING IN TIMES OF TURBULENCE

Windham Investment Review

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The recent crisis in the sub-prime mortgage market and its extension to seemingly unrelated markets suggests that conventional approaches to risk management may not suffice during periods of financial stress. We may be better served by using measures of volatility and co-movement derived from turbulent markets rather than deriving them from samples comprising both quiet and turbulent times.

Consider, for example, how we typically estimate volatility and co-movement. We begin by calculating returns over some time interval such as a day, a week, or a month by subtracting the asset's beginning price from its ending price and adding to this price change the income produced by the asset. Then we divide this quantity by the beginning price to derive a rate of return. And from these returns we calculate standard deviations and correlations as measures of volatility and co-movement. In most periods, however, the price changes we record merely reflect the fact the prices are noisy. Nothing of economic, financial, or political import occurred to justify revaluation of assets. In other periods, though, such as August 1998 when Russia defaulted on its sovereign debt, price changes legitimately reflect significant events. Yet the formulas we use to calculate standard deviation and correlation place just as much emphasis on the noisy returns as they do on the event driven returns.

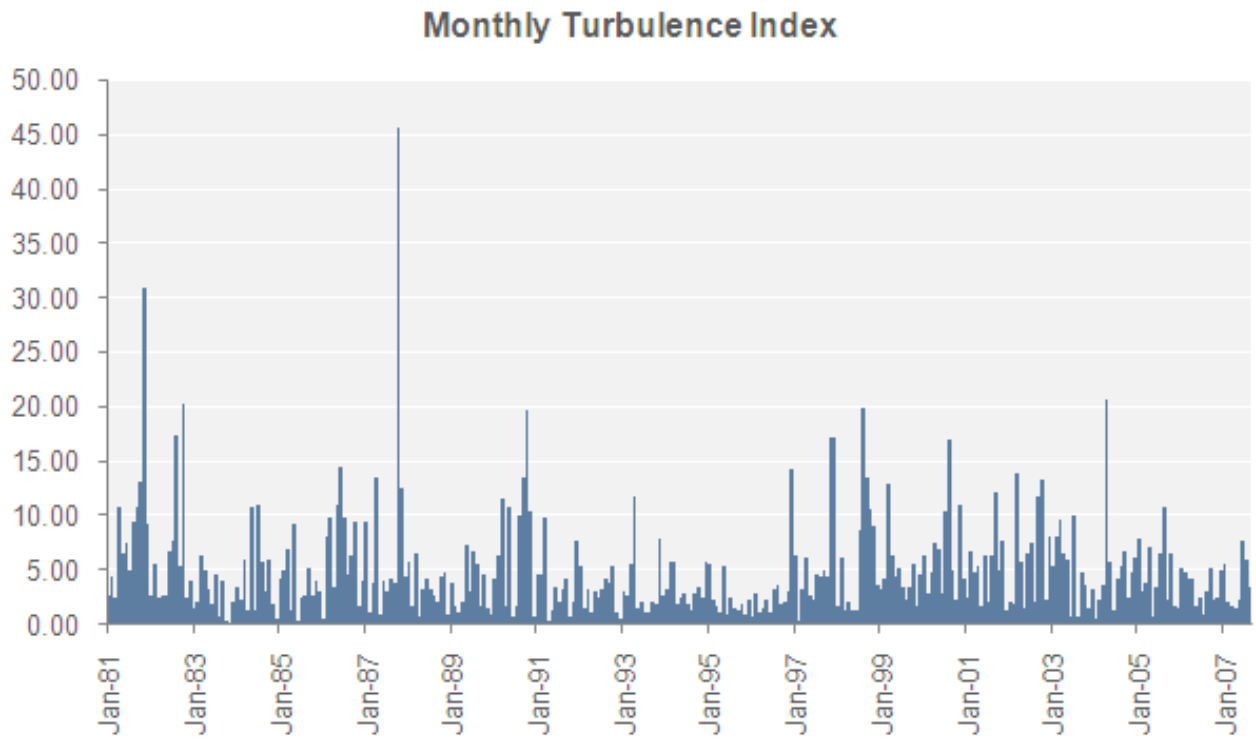
We propose partitioning historical returns into two sub-samples, one associated with quiet periods and one characterizing times of turbulence, and computing standard deviations and correlations that are specific to these regimes. To proceed we must classify asset returns for each period as either quiet or turbulent. We use statistical unusualness as a proxy for market turbulence, and we characterize a set of returns as statistically unusual either because one or more of the returns is significantly above or below average or because they interact in an uncharacteristic fashion. We end up with a score for each period indicating its level of unusualness.

We next seek to determine whether volatility and correlation differ from the levels that prevail during quiet times. If, for example, correlations across a set of assets rise during turbulent periods, then our portfolio may be less diversified during periods when diversification is most essential. If, on the other hand, correlations are lower than expected during turbulent periods, assets intended as hedges for one another may fail to perform this function. Awareness of the time varying nature of risk may help us to construct portfolios that are more resilient to turbulence.

01 Our Turbulent Past

We applied this methodology to monthly returns of U.S. stocks, foreign stocks, real estate, commodities, and U.S. bonds. It is no surprise that October 1987 was the most turbulent month during this time frame, when the U.S. stock market dropped more than 20% in a single day. The turbulence index reached an all-time high of 45.62 that month, which is more than twice as high as the next most turbulent month, April 2004, when turbulence climbed to 20.57. The quietest month since January 1987 was April 1991 when the index barely recorded a blip at 0.31. These values are difficult to interpret in an absolute sense beyond noting that high values indicate high turbulence and low values indicate quiescence. We can gain some perspective by comparing the most and least turbulent months with the average and median scores, which were 4.79 and 3.50 respectively. Exhibit 1 shows the index scores for all of the months beginning in January 1987 through August 2007.

Exhibit 1: Monthly Turbulence Index

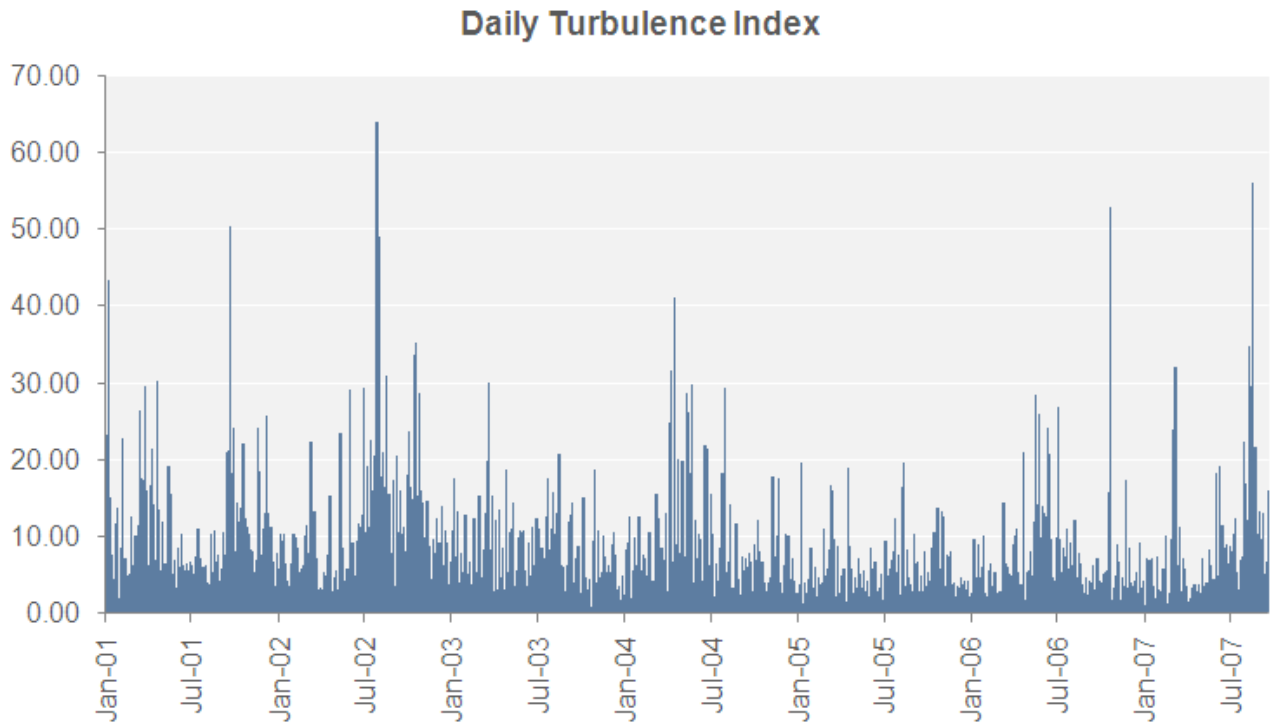


How do these statistical measures of turbulence accord with memorable historical events? The turbulence at the end of 1990 coincided with the start of the Gulf War. The next turbulent episode occurred at the end of 1996, reflecting a sharp run up in real estate prices. Turbulence again erupted in late 1997 as the Asian currency crisis unfolded. Less than one year later, in August 1998, Russia defaulted on its sovereign debt triggering a flight to safety and the collapse of Long Term Capital Management. Turbu-

lence prevailed again in August 2000 as commodity prices spiked. In April 2004, REIT prices suffered their largest monthly decline since the 1987 stock market crash.

The turbulent episodes described above had scores of 13 or greater on the turbulence index. How does the August sub-prime meltdown compare? Its score was only 3.49, which is almost identical to the median of 3.50 for the full sample. Given the dislocations that occurred in the commercial paper market and the collapse of several prominent hedge funds, why doesn't August 2007 register as a turbulent episode? Returns to the major asset classes for the month as a whole were not extraordinary. U.S. stocks rose 1.5%, foreign stocks fell 1.6%, and U.S. bonds rose 1.2%. But these numbers conceal the extraordinary volatility within the month of August. Exhibit 2 presents a turbulence index based on daily returns beginning in January 2, 2001 through September 20, 2007.

Exhibit 2: Daily Turbulence Index



Based on daily returns, August 2007 was astonishing. The average daily score for August 2007 was 13.5 versus an average daily score for the full sample of only 6.0. Moreover, August 2007 included the 2nd, 10th, and 20th most turbulent days of the entire sample. Viewed from this more granular perspective, August 2007 was indeed a turbulent period.

02 Is Turbulence Predictable?

The answer, as it turns out, is yes. The turbulence index is highly non-random. At a lag of one day, it is 33% positively correlated with itself, which means turbulence today is likely to be followed by turbulence tomorrow. Specifically, the value for tomorrow's turbulence index equals 4.04 plus 0.33 times the value of today's turbulence index. The t-statistic on the coefficient equals a whopping 14.44.

03 Summary

We can measure the statistical unusualness of a contemporaneous set of returns, taking into account both their magnitudes and the fashion in which they interact with one another. These statistically unusual returns tend to coincide with easily recognizable events, such as the 1987 stock market crash, the Gulf war, and Russia's default on its sovereign debt.

Viewed from the perspective of monthly returns, the sub-prime meltdown in August 2007 does not register as even remotely unusual, because extremely high and low daily returns netted out to rather ordinary results for the month. Viewed from the perspective of daily returns, however, August was extremely turbulent and included three of the most turbulent days in recent history.

Turbulence does not occur randomly. A simple regression analysis shows how the degree of turbulence today is strongly correlated with the degree of turbulence yesterday. But even if we cannot reliably forecast turbulence, information about how assets perform during turbulent periods may help us to build portfolios with greater resilience to stressful markets.