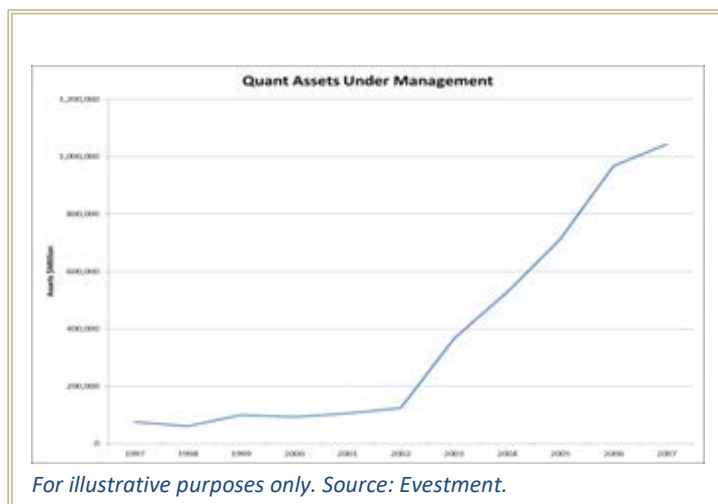# Quant Meltdown: 10 Years Later

George Mussalli

I remember Monday, August 6th 2007 vividly. It was a pleasant summer morning in Boston and I was enjoying my daily walk to work through the Back Bay. I stopped for a coffee and bumped into a former colleague, a high yield portfolio manager. As I approached and greeted him I saw the horror in his face, something was wrong. He inquired as to whether anything crazy was happening in equities and then proceeded to tell me his high yield portfolios were a blood bath. It was business as usual in the equity world. I wished him well and didn't think much more about the incident, until later that morning… 9:31am to be exact.

The first week of August 2007 exhibited some of the most volatile returns within quantitative equities in decades. In this white paper, we will review the causes of the volatility, industry reaction, and ramifications for today's market.

What happened?

In the years preceding 2007, quantitative equity managers enjoyed strong performance which resulted in attracting significant assets. After surviving value factor struggles during the internet bubble, many commonly used quantitative signals including value and momentum had a long, uninterrupted record of positive returns. This fueled interest from institutional investors who sought to diversify away from underperforming fundamental managers. Additionally, multi-strategy hedge funds saw quantitative equity market neutral strategies as a complement within their broader portfolios offering significant capacity in a liquid asset class.

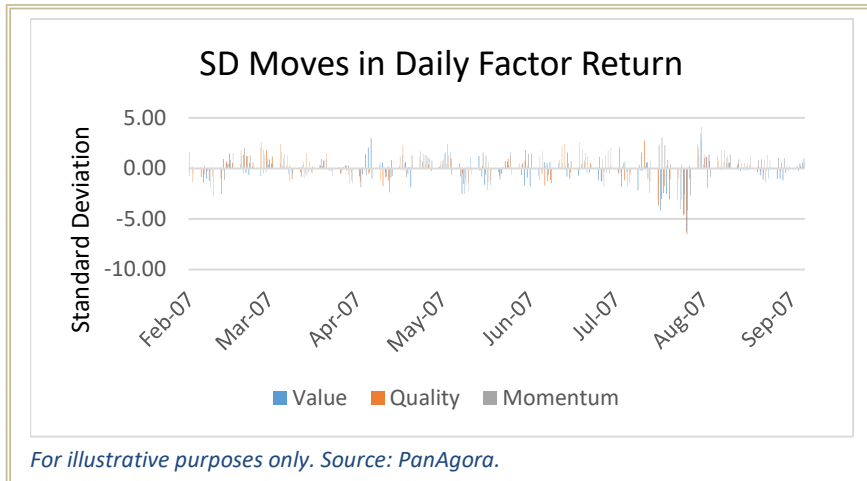*For illustrative purposes only. Source: Evestment.*

As this interest continued, large inflows combined with increasingly high levels of leverage within systematic strategies, caused the quantitative equity landscape to become fragile in the summer of 2007. The beginning of the subprime crisis introduced a burgeoning catastrophe that led to the bursting of the bubble. After years of decreasing credit quality, declining lending standards, and substantial asset inflows, conditions within the subprime market started markedly breaking down in late summer. The first victims of the crisis were two Bear Stearns hedge funds and Boston-based Sowood Capital, all of which began to wind down in early August 2007 due to plunging subprime prices. The subprime market was frozen, leaving proprietary trading desks and multi-strategy hedge funds with a need to raise capital and cut risk. The most liquid parts of their portfolios were in quantitative equity.

1

Sample Factor Performance

Sample Factor Volatility
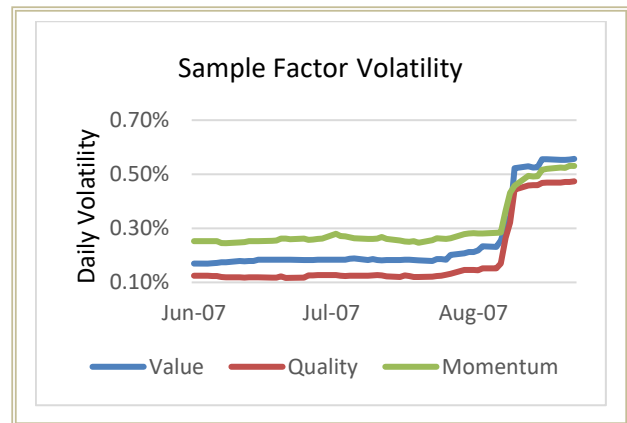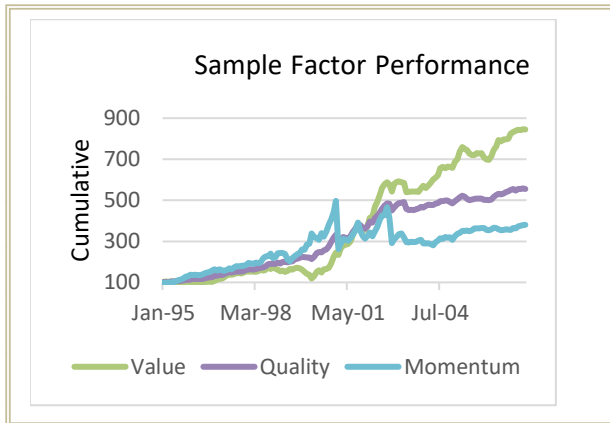
For illustrative purposes only. Source: PanAgora.

The first day of the quantitative meltdown quickly followed on August 6th, and the bloodbath continued for two more days. Volatility of factor returns rose five-fold, and factors experienced six-plus standard deviation moves. The principals on which modern quantitative portfolio management were built had faltered; otherwise uncorrelated factors became almost perfectly correlated, wreaking havoc within risk models.

SD Moves in Daily Factor Return

For illustrative purposes only. Source: PanAgora.

Market response

As quantitative investors worldwide de-levered their portfolios – some by force due to high levels of leverage, others doing so more strategically- prices bottomed on August 10th, 2007 and a recovery followed. The selling was complete and the resulting carnage was observed by fundamental managers as well as by the managements of the companies themselves. Countless articles in the financial press desperately tried to explain the large price movements of certain companies with little success. Some of the headlines included: "*TW Telecom rises 23% as earnings match average earnings estimate*"; "*IFF Corp down 6% as earnings are reported in line with the average estimate*"; and "*Sanmina fell 13% as the company may lose Lenovo as a customer*". As journalists searched for reasonable explanations for these massive moves, only quantitative managers had the answer: the losers ranked attractively and the winners poorly based on traditional quantitative metrics. At the end of the week, many of these companies were trading exactly where they had traded at the beginning of the week. As IFF fell 6% after matching earnings estimates, many sell-side analysts upgraded the stock, perplexed by the price action and identifying it as an attractive buying

opportunity. Quantitative managers who held their positions were not affected by the meltdown and fundamental managers stepped in to stabilize the situation.

Was it sustainable?

How could this happen? What was the genesis of the quantitative equity meltdown? Hundreds of teams of highly skilled and educated quantitative investors that independently developed models and managed portfolios across the world suddenly became highly correlated and experienced similar large drawdowns. We can point to two major catalysts for this phenomenon:

- Similar research structure (i.e. factor inputs)
- Common portfolio construction methodology

Many of these seemingly disparate investors shared a similar research thought process. Common alpha factors such as price momentum, valuation and quality, powered most, if not all, quantitative equity models. Evidence of widespread use within the industry is reflected in the performance of those factors during August 2007.

While factor model correlation among managers may have been somewhat low, portfolio correlation became extremely high, and group think appears to be the culprit. Quantitative managers were using similar procedures to build portfolios, including risk models, constraints and liquidity measures, which further contributed to the high correlation of returns.

PanAgora conducted an experiment to illustrate this point. Beginning with ten completely random, uncorrelated small cap U.S. 'alpha' sources – much more uncorrelated than ten actual quantitative managers - we demonstrated how the use of a common traditional portfolio construction methodology results in a portfolio that will behave almost identically to a portfolio created by any other manager using similar construction methods.

First, we constructed ten portfolios of equal tracking error to the benchmark with no other constraints. As shown in **Figure 1**, the portfolios exhibit extremely high tracking error relative to each other, reflecting the uncorrelated nature of the underlying alphas. As we continue to add constraints such as sector, stock and liquidity limits, the ten portfolios converge to a point where they are almost identical to one another. It is reasonable to assume that had we started with much higher real life correlations, the portfolios would react very similarly to a large shock to the model.

This example illustrates why we believe that a highly differentiated portfolio construction methodology is as important as the alpha modeling process. PanAgora believes that developing proprietary portfolio construction algorithms leads to higher transfer coefficients than traditional off-the-shelf optimizers (e.g. Axioma and MSCI Barra) to build portfolios.

Figure 1 Optimized Portfolio Results Using Randomly Generated Alpha Targets

	1	2	3	4	5	6	7	8	9	10	Iteration #1)	
1											Long/Short	100%
2	15.1%										Benchmark	R2000
3	13.9%	14.7%									Universe	Russell 2000
4	14.1%	14.6%	13.9%								Risk Aversion	0.0075
5	13.3%	15.7%	14.5%	14.8%							Max security Weight	none
6	13.9%	15.1%	13.5%	13.8%	14.2%						Max sector Weight	none
7	15.1%	15.0%	13.5%	14.2%	15.7%	14.0%						
8	13.3%	14.0%	12.8%	13.4%	13.8%	13.0%	13.2%					
9	14.4%	15.0%	13.5%	14.1%	15.0%	13.3%	13.7%	12.5%				
10	13.1%	13.7%	12.6%	13.1%	13.5%	12.6%	13.1%	11.3%	12.1%		Mean TE	13.8%

	1	2	3	4	5	6	7	8	9	10	Iteration #2)	
1											Long/Short	100%
2	13.5%										Benchmark	R2000
3	11.5%	13.8%									Universe	Russell 2000
4	12.8%	14.3%	12.9%								Risk Aversion	0.0075
5	13.8%	15.4%	13.7%	14.6%							Max security Weight	none
6	13.2%	14.8%	12.9%	14.0%	15.1%						Max sector Weight	+/-3%
7	12.4%	14.2%	11.1%	13.7%	14.2%	13.7%						
8	11.8%	13.4%	11.5%	13.1%	13.9%	13.2%	12.6%					
9	11.9%	14.0%	11.3%	13.4%	14.1%	13.3%	12.6%	11.8%				
10	11.5%	13.7%	10.9%	13.2%	14.1%	13.0%	12.5%	11.3%	11.5%		Mean TE	13.1%

	1	2	3	4	5	6	7	8	9	10	Iteration #3)	
1											Long/Short	100%
2	4.3%										Benchmark	R2000
3	4.4%	4.5%									Universe	Russell 2000
4	4.4%	4.4%	4.5%								Risk Aversion	0.0075
5	4.5%	4.5%	4.6%	4.6%							Max security Weight	1%
6	4.4%	4.5%	4.4%	4.3%	4.7%						Max sector Weight	+/-3%
7	4.5%	4.6%	4.5%	4.7%	4.5%	4.7%						
8	4.5%	4.5%	4.5%	4.6%	4.5%	4.5%	4.5%					
9	4.5%	4.6%	4.7%	4.5%	4.9%	4.6%	5.0%	4.6%				
10	4.5%	4.4%	4.7%	4.4%	4.7%	4.5%	4.6%	4.5%	4.4%		Mean TE	4.5%

	1	2	3	4	5	6	7	8	9	10	Iteration #4)	
1											Long/Short	100%
2	3.6%										Benchmark	R2000
3	3.2%	3.5%									Universe	Russell 2000
4	3.7%	3.6%	3.5%								Risk Aversion	0.0075
5	3.3%	3.4%	3.5%	3.8%							Max security Weight	1%
6	3.8%	3.6%	3.5%	3.4%	3.6%						Max sector Weight	+/-3%
7	4.0%	3.7%	3.9%	3.7%	4.0%	3.6%					Max position ADV	50%
8	3.4%	3.5%	3.7%	3.5%	3.6%	3.7%	3.8%					
9	3.7%	3.5%	3.4%	3.6%	3.8%	3.6%	3.6%	3.5%				
10	3.7%	3.3%	3.4%	3.3%	3.6%	3.4%	3.8%	3.5%	3.4%		Mean TE	3.6%

For illustrative purposes only. Source: PanAgora.

New signals and big data to the rescue, or simply a fad?

In the years following the quantitative crisis, performance of commonly used factors continued to be inconsistent and quantitative managers turned their focus to adding new types of signals to their models. Themes such as factor timing, idiosyncratic risk and news sentiment (i.e., Traditional factors) dominated academic journals. If value and momentum were now considered risk factors with lower risk-adjusted returns than previously experienced, there was a belief that skilled managers could time the cycles to capitalize on buy and sell opportunities. As we have seen, this strategy yields a low Sharpe ratio. Another popular area of focus was to identify New Factors
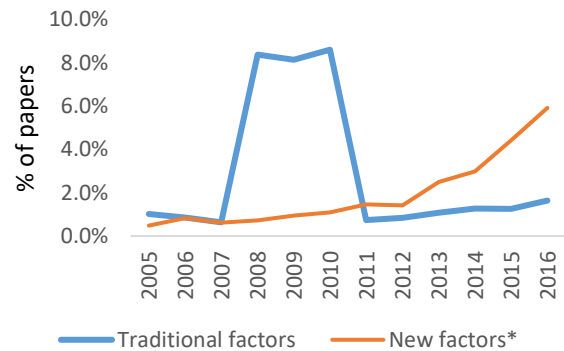
For illustrative purposes only. Source: PanAgora.

such as the sentiment of news articles as they were written to predict the future direction of the stock price, Big Data and Machine Learning. However, as more market participants pursued these signals and the data became more readily available, the already weak signals completely deteriorated. In spite of the brain power being dedicated to these new techniques, few new alpha sources were uncovered. These new ideas lacked true fundamental intuition to support them.

Time heals all wounds

In the years that followed, some quantitative managers attempted to pursue new ideas and factors. However, as traditional factors continued their upward ascent, the discussion of these newer factors quieted. The quantitative industry reverted to what was comfortable – value, quality, and momentum. As the months and years go by with traditional factors doing well, most factor weighting algorithms will continue to place more weight on more traditional factors over newer, untested, innovative and difficult to create factors.

Those who fail to study history are destined to repeat it… There is reason to be cautious. We have examined the drivers of performance of a universe of 12 quantitative U.S. small cap mutual funds over the past ten years. Around the time of the quantitative crisis, approximately 40% of the funds' returns were driven by common factors such as value, quality, and momentum. During the next few years when managers were under pressure to differentiate their strategies due to the crisis, the explanatory power of those variables declined to 25%. However, in recent years as these common factors have resumed contributing to overall performance, the volatility of 2007 has become a distant memory. Compounding this issue, a new generation of quantitative managers who did not experience those extreme days in August 2007 has taken the helm and, as such, reverted to a similar pattern that held a decade ago, with 40% of returns coming from common factors.

For illustrative purposes only. Source: PanAgora.

The next crisis?

After an event of the magnitude of the 2007 quantitative meltdown, common wisdom would suggest that market participants learned their lesson and will not repeat their mistakes. The market will adapt and similar events will not repeat in our lifetimes. However, let's assess the current market structure and the thought process behind the decision makers to see if things have really changed over the last ten years. Today, quantitative equity assets continue to rise. Although the system has much less leverage than it did in 2007, there are more assets invested in quantitative products and the advent of Smart Beta has pushed more dollars into the same type
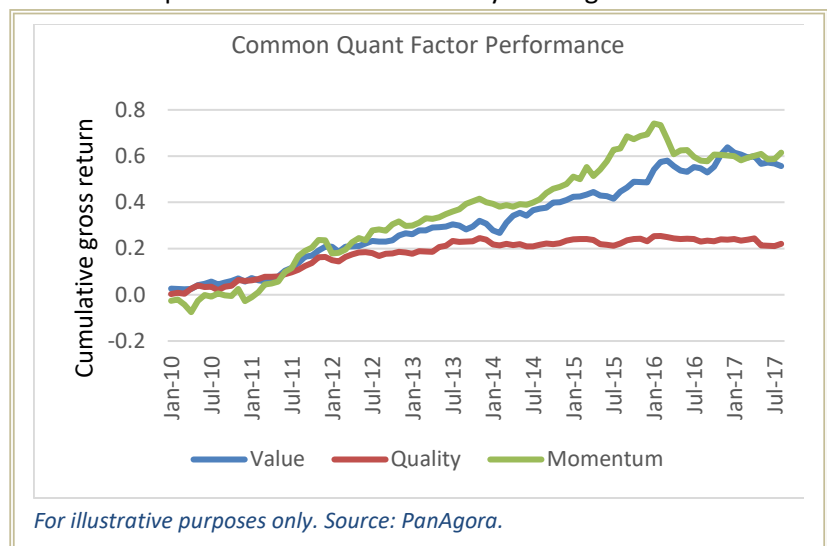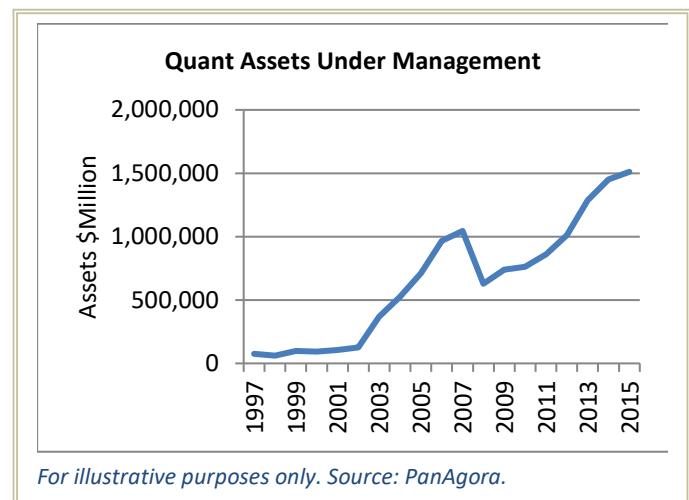
of signals utilized by a majority of equity managers. Active quantitative managers who continue to tilt towards traditional value and momentum may find very turbulent times ahead.

Déjà vu all over again?

A seemingly infinite amount of big data has become remarkably commoditized in a short period of time and this will inevitably have a profound effect on the investment landscape. Prepackaged data sets and off-the-shelf models have made it easier for new entrants to compete in the quantitative arena, presumably many lacking the training or expertise of tenured quantitative managers. The consumption of prepackaged data by new entrants lacking the experience and history of existing quantitative managers could have a profound impact – positive or negative – on the market. Every sell-side team has published their 150-page study on how to incorporate Big Data and Machine Learning into a quantitative process. Investment managers are rushing into big data in droves and are data mining as many of the over-marketed data sets as possible. Adding these new, seemingly uncorrelated signals to a traditional quantitative process may appear to produce innovative alpha sources. However, they may also provide a false sense of security in that they could possibly be a buffer to the next quantitative crisis. We caution that many of these "new" signals lack any significant theoretical underpinnings.

One reasonable concern should be the reluctance of would-be natural buyers to take advantage of deeply discounted stocks during the next crisis. With large amounts of unstructured data being processed and assessed differently across quantitative managers, the ability to assess quality and authenticity of unique data sets will continue to become more complicated for fundamental investors to grasp. While fundamental managers stepped-in and purchased high quality, cheap companies that were impacted during the last meltdown, the same buyers may not be as willing to bailout retailers based on satellite imagery pointing to a parking lot full of cars last week... In fact, it would not be surprising for the fundamental managers to avoid making investment decisions based on new structured

Quant Assets Under Management

For illustrative purposes only. Source: PanAgora.

and unstructured data sets used by quantitative investors. If that is the case, quantitative managers themselves may need to find their own solution to the next crisis. Given PanAgora's long history of quantitative investing and our advantage of having experienced the 2007 meltdown, we are aware that, as new entrants move to take advantage of big data, the potential for unforeseen consequences could loom in the not so distant future.

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Index Descriptions

The Russell 2000® Index is an unmanaged list of common stocks that is frequently used as a general performance measure of U.S. stocks of small to midsize companies. The smallest 2,000 securities in the Russell 3000 Index are included in this index. This broad-based securities index is not subject to fees and expenses typically associated with managed accounts or investment funds. Investments may not be made directly into an index.