

## P E R S P E C T I V E

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### The August of Our Discontent: Once More Unto the Breach?

August 7, 2017

This month is the ten-year anniversary of the "quant crisis" or "quant quake" - that one week period in August 2007 when quantitative equity strategies like factor investing and statistical arbitrage suffered very large losses and then, in the next few weeks, made an almost full recovery. Given the current popularity of factor investing it seems a good time to review what happened that summer and discuss its relevance for today.

Following closely on the heels of the event, in September 2007, I did a write-up of what we thought happened. It took the form of an [interview about the crisis with myself](#) where I, with a lot of help from others at AQR, wrote the questions and the answers (I think you may catch me telling myself "that's a very good question"). Re-reading it today I think it holds up pretty well, though maybe it sounds a bit dated in places. So, I won't spend much time here reviewing the actual crisis other than to note that it was a true liquidity crisis, a trading "unwind." It was not some fundamental change. This is likely why it recovered so quickly (liquidity events are often highly temporal while "real" events are usually more lasting). Of course, "highly temporal" events can kill, so that isn't a dismissal, just a definition.

Let's agree that all-else-equal it would be nice to eliminate all strategies with big "left-tails" (i.e., strategies that can suffer statistically shocking down days or weeks.) We would all sleep better. But, all-else-is-not-always-equal. Some of those left-tailed strategies are pretty good. The obvious example is just getting long the stock market and earning the equity risk premium. It has a serious short-term left-tail<sup>1</sup> (e.g., October 1987 and August 1998) but also has been a great long-term strategy. To achieve those long-term returns you do have to survive those lefttail events (survival as in staying solvent and invested but also not voluntarily throwing in the towel at the exact wrong time).<sup>2</sup>

To start, we need to separate the ongoing [debate about factor valuations](#) from the question of short-term crash risk. In general, and not just for factors, valuations and short-term crash risk have a tenuous relationship at best.<sup>3</sup> Valuations have some predictive power for long horizon factor returns, more so for slower turnover factors (like the market itself and, to a lesser extent, the value factor) than for faster ones.<sup>4</sup> But small sample sizes can make long-horizon inferences difficult to make with confidence. Separately, we have also shown that factor valuation today is not very extreme.<sup>5</sup> This makes the question of whether valuation-based predictability "works" a pretty theoretical one right now. But, quite separate from valuation and the long-term outlook, because factor investing is so popular today, and the underlying strategies so well-known (at least in their basic forms), I've said as part of [this](#), [this](#), [this](#), and [this](#), that factor investing is now more vulnerable to short-term extreme turbulence (a polite euphemism for a few days of getting its butt absolutely kicked).

This is the crux. Short-term extreme movements are a function of lots of people trying to do the same thing at the same time.<sup>7</sup> Of course many trying to do the same thing at the same time could itself be triggered by over-valuation. But, again, that link seems historically tenuous at best as value holds sway at the long- not short-term.<sup>8</sup> Further, [as we discussed](#) back in September of 2007, factor valuations were not extreme going into that August cyclone, and thus weren't the trigger then either. Irrespective of the specific trigger, it's hard to imagine coordinated mass selling of a factor strategy occurring without it being well-known and widely implemented. That seems almost definitional.<sup>9</sup> And, the factors were popular back in '07, similar to today.<sup>10</sup>

So the next question is what can trigger sharp selling of a popular well-known strategy even if it's not very over-priced? Well, lots of things. I won't pretend that predicting such conflagrations is even vaguely a science, and I'd note that we didn't predict the August of 2007 quake nor did anyone else, as far as I know.<sup>11</sup> But we can identify a few of those things that can start the fire. For example, it could be something like a banking crisis, an abrupt regulatory change, or a loss of ability to maintain short positions. It could be triggered by poor performance if it's severe and abrupt enough to cause people to drastically reduce their desire to take risk in those strategies. It could particularly happen if there are large and sudden redemptions facilitated by investment terms linked to poor short term performance (for example, a structured product or fund with features that require immediate redemptions based on recent poor performance - we do think this combination contributed to the '07 crash). With all that said, we're still guessing. These are, by definition, rare and wild events. One of the only things we can be fairly certain about is that the next crisis won't be a repeat of the last but they probably will rhyme.

In discussing what might cause sharp selling of factor strategies, it is useful to discuss upfront some of the different ways quantitative factor investing is implemented. Many factor portfolios are still essentially traditional, long-only and implemented without leverage, designed to beat a benchmark by overweighting the stocks preferred by the factor or factors in question. The most famous version here is often called "smart beta" though we've argued before that is mainly a [relabeling](#) of something that's been around a great while. At the other end of the spectrum are factor portfolios held in long-short form, possibly long and short similar amounts (i.e., trying to be market-neutral). Removing

market exposure from a factor reduces the risk per dollar of exposure and reduces the correlation of that factor with other factors in a portfolio, leading to significantly lower risk per dollar of exposure for the multi-factor portfolio.<sup>12</sup> The resulting benefit is a better risk adjusted return but at the cost of being too low risk per dollar to matter much. Leverage can, and often is, used to make such a market-neutral factor portfolio matter in the investor's overall portfolio. Thus, leverage is quite useful, but it also can be a new danger.

While we don't think anyone can reliably forecast specific events, we are more confident about what conditions make these liquidations more likely and, if they do occur, more severe. These speculations ultimately come down to who is betting on the factors and how (in what structures and with what rules - one example discussed above being structured products with specific forced redemption rules). For instance, it seems obvious that the higher the fraction of factor investors that use leverage, and the more leverage they use, the bigger the chance of another August 2007. In an unleveraged investment there are two people who can panic sell at the wrong time, the asset manager and the client. In a leveraged investment there is often a third interested party - the lender (who can often bring great pressure to bear.) On this front we take some comfort in noting that in 2017 versus 2007 it appears that far more of the factor world<sup>13</sup> pursues these strategies without leverage (e.g., we think "smart beta" is the biggest area of growth and that is just very simple long-only, unlevered factor-based investing).<sup>14</sup> It also seems clear that those using leverage are far more conservative (conservative = less leverage) than in 2007.<sup>1,16</sup> All-in-all this is not an "all clear" by any means. But the factor investing world, at least in terms of the fraction of assets using leverage and, we'd guess more importantly, the actual amount of leverage employed where it's used at all, is more conservative than in 2007.<sup>1,1,1,20</sup>

An unheralded fact of the quant crisis of '07 was that from peak to trough of the factor drawdown, the S&P 500 was flat to up a bit.<sup>2,22</sup> That is, even while losing big, quant factors were market-neutral during the quake. The overall market's lack of interest or reaction to the quant crisis in 2007 is important. It would be an interesting contest, and perhaps a future blog topic, to come up with the single biggest common investment error out there.<sup>23</sup> But one candidate would surely be over-worrying about parts of your portfolio and not focusing on the whole. Granted sticking with a levered market-neutral quantitative factor investment process would be quite difficult through the '07 quake if that was 100% of your portfolio. But difficult at a 20% allocation? At 10%? At 5%? Sizing exposures such that you can stick with your investments through their worst times is a big part of long-term success. Conversely, sizing your investments such that you're near guaranteed to abandon them during really tough times is a recipe for near certain failure. I would wager that had they kept an overall portfolio perspective, few quant investors (outside of the all-quant firms themselves) were suffering enough to have had to take action at even the depths of 2007. But many might have panicked by viewing just their quant/factor sleeve in isolation - perhaps a lesson for next time (if there is a next time!).<sup>24</sup>

Another related difference between today and 2007, this one making now a scarier time, is that the financial media coverage and interest in factor investing is much higher than in 2007. That's pretty much a tautology with "more popular and more widely known." Again, August of 2007 went by relatively unnoticed outside of the quant world. I don't think that would be the case this time, even if markets as a whole are unaffected. In this case, the revolution will be televised. What kind of feedback loop that creates is a wild card I do worry about as, anecdotally, people seem to act less rationally the more headlines a topic garners.<sup>25</sup>

So, where does that leave us, the community of factor investors? I like to compare today to nearly thirty years ago when I first was introduced to and started studying value and momentum strategies. Well, since then, we have near thirty years of [out-of-sample evidence](#) that they work.<sup>2,27</sup> This includes testing them in a whole lot of [other places \(geographies and asset classes\)](#) and [times](#). We've added [a few more good factors](#) to the mix, but by no means have we populated a "zoo."<sup>28</sup> And today, we even can invest in these factors at historically fairly normal pricing, for the most part.<sup>29</sup> What we definitely do not have is an informational monopoly on them that protects us from the actions of other competing, or fleeing, capital. Unlike thirty years ago it's more likely that our short-term returns can be buffeted by the actions of other factor investors.<sup>30</sup> This prospect is not just theoretical as we saw it happen, big time, ten years ago. To state the remarkably obvious, something that has happened before can happen again. In fact, I'd say it is likely [to happen again at some time](#) (hopefully, long after I'm gone).<sup>31</sup> This is far from unique to factor investing - there isn't a widely known liquid investment strategy that isn't subject to the left tail of other investors' short-term actions.<sup>32</sup> The stock market itself is, once again, the primary example of this fact.

So, what do we do with very good (imho!), but, as of today, widely-known strategies? We think, not shocking I know, you should still allocate to them but do so conscious of their known left tail. Investing while in denial of real possibilities is never a good strategy. But, you're not dissuaded from allocating to an S&P 500 index portfolio because a -10%, -20%, or worse day or week is possible, are you?<sup>33</sup>

Rather, you do know that can happen and plan for it, right?<sup>34</sup> We think investors should collectively educate themselves about this possibility to minimize panic and maximize rationality should it happen. We think we should all structure our investments specifically thinking about these events, knowing this is part science and part art, to survive and even be able to take advantage of them. But, ultimately, if we believe these factors are real and priced reasonably (particularly in a world where many investments, like traditional stock and bond markets, are quite expensive), we should invest in them. We should just do it with open eyes and a plan.

Time for some final summary advice. Long-term investors who are pursuing unlevered factor tilts versus indices (this includes "smart beta") should steel themselves to ignore some possible short-term periods of large relative return differences vs. their benchmarks. Long-term investors pursuing market-neutral leveraged strategies should similarly steel themselves, but in this case for absolute (not versus benchmark) suffering. These investors in particular should think hard about August of 2007 and future similar possibilities when designing their portfolios and deciding how much to allocate to them. Finally, short-term investors unprepared for any such turbulence should eschew these factors and, instead, find a set of great strategies only they know about with thirty years of out-of-sample tests (and out-of-sample not just in time, but also in geography and asset class), with only a vanishingly small possibility of short-term crashes (as they are their secret), and yet are still reasonably priced today. Good luck with that!

[1] And actually somewhat of a right one as well.

[2] We think that reliably avoiding those left-tail events, by skillful timing, is a pipe dream (more on that later).

[3] I wouldn't say unrelated as I'd also be slightly more worried about short-term crashes in a more expensive market, or strategy, than in a cheap one. But only slightly, and, frankly, more based on intuition than evidence. The evidence suggests that valuation matters more for long-term expected returns (see the ongoing debate highlighted [here](#) and follow the links and references for discussion of which strategies it matters more for and for relatively current factor strategy valuations). But, contrary to the intuition of many (including mine!), evidence is actually quite thin about valuation predicting short-term crashes. In fact, I think the body of evidence would favor trend over value for crash prediction (though, as usual, one can use both)

[4] The analogy for markets would be that the Shiller CAPE, or similar market-wide valuation measure, has very little utility for forecasting the S&P 500's return over the next month or year, but some reasonable power for returns over the next decade. Sample sizes are even smaller for some factors (some go back to similar starts as the S&P 500, but others only start in the 1950s or later) and predictability weaker. Long-term factor predictability is weaker than market predictability both in fact and in theory as the factors are higher turnover making long-run predictions based on current portfolio characteristics less relevant and reliable.

[5] Today's common factor strategies are indeed not exceptionally expensive ([we find](#) only the "defensive" factor to be particularly dear in recent years; and even defensive is at the high end of normal valuation, not at a bubble-type extreme). Yet they are definitely well-known and popular (it's gotten to where I cannot walk down the street without being mobbed by teenagers asking for autographs). Reasonable pricing bodes well for the "ensuing long-term" when only extreme overvaluation would dissuade us. And, our version of extreme ain't the 90<sup>th</sup> percentile of normalcy but something more like the value factor in the technology bubble, or what I refer to as the [150th percentile](#).

[6] "Selling" a long-short factor strategy involves selling the long part and buying back the short part.

[7] Large price moves can also occur on very sudden, very important real news even without attempted trades, like a surprise war leading to large stock market mark-downs even before trading begins.

[8] Like that Russian investing proverb says "value is an effect best served cold."

[9] For instance, if you discovered a factor very different from what everyone else was trading, it seems likely, except by extreme coincidence, to be mostly immune from lots of other investors suddenly selling your long positions and buying your short positions (selling your factor) en masse. Note, by no means does it follow that it's a good factor. You can minimize the risk of everyone else selling your factor by picking a portfolio wearing a straight-jacket and flipping a coin with your teeth! Conversely it's not hard to imagine a very popular, well-known factor being buffeted by lots of investors getting out at the same time, regardless of its valuation.

[10] Then, like now, being well-known and even popular is not enough to cause something to automatically become expensive. For instance, the valuation factor, and value investing in general, is a big part of many or even most quantitative factor strategies (including being the source of return to many "smart beta" investments), yet the value factor has done poorly in recent years and is not at all currently expensive versus history.

[11] Getting more parochial, we have indeed spent time, both before, but admittedly a lot after August of 2007, trying to come up with some tools that forecast (or even just contemporaneously tell you) that a strategy liquidation is more likely to happen or is already happening (as you have to be able to distinguish being in the midst of a liquidation from just having a bad short-term period of performance). The tools we've come up with do things like calculate how correlated disparate factors are trading. For instance, when generally negatively correlated factors like value and momentum trade with positive correlation, it can mean a quant is aggressively buying or selling both factors at once. Another warning sign may be a high degree of similarity between a factor's, or a set of factors', short positions and those of dedicated discretionary short-sellers (we generally find that agreement with dedicated short-sellers is actually a positive for expected returns but likely raises left-tail risk as short coverings can be rapid). While these tools are intriguing they are still not so great and they tend to be overly reliant on one data point. Of the two tasks they are, not surprisingly, better at identifying a factor sell-off while it's occurring than in advance. Obviously, we have not developed a reliable predictor of crashes. I hope that doesn't come as a great shock! We have tried, and will continue to try, though we recognize the low odds of success here.

[12] These types of strategies can also be pursued in very different asset classes where some have to be levered (e.g., bonds) and some delevered (e.g., commodities and sometimes equities) so each is somewhat comparable (and thus diversification and hopefully Sharpe ratio maximized). We think this can be a great advantage but does involve even more use of shorting and leverage.

[13] The "factor world" is not the entire quant world, and I'm not intending this statement to apply to all quant strategies, some of which may be more particular to the levered hedge fund world. This essay is about investing in the widely known factors.

[14] Smart beta is also, more often than not, a tilt towards a single factor, making it perhaps more likely that if there's a next time it's less ubiquitous across factors.

[15] We think a big part of the issue in 2007 was that a lot of the capital that had flowed into "quant" strategies was very levered hedge fund capital from managers who were not quants but saw it "working" for the preceding few years and said "we need some of that." Very levered capital from those who aren't really true believers, and thus more likely to run in challenging times, is not a good combination. Reversing the logic also works.

[16] Quant leverage is lower today than a decade ago, even though market volatilities are broadly low, which tends to raise leverage for those who target constant return volatility. We tend to think that the extent of this leverage/volatility effect is often overstated, and occasionally even histrionic, but not directionally wrong. Nevertheless, we believe for quant managers in general the net result is still meaningfully less leverage today than a decade ago.

[17] With a smaller fraction of the factor investing market today being market-neutral/levered, and the levered pieces being less extreme today, we actually think market-neutral/levered factor investing is somewhat less risky today versus a decade ago. That is, the marginal risk of market-neutral/levered vs. unlevered versions is less. But I wouldn't take these conjectures too far. While they are honest you must remember that, like everyone else, we didn't forecast August 2007! That should, and does, humble us in trying to forecast the next one.

[18] Of course, that doesn't preclude total dollar notional positions being less than, similar to, or greater than 2007. Also, I call the approach more "conservative" here. I think that's true vs. 2007. But that's only a relative statement. It's very possible that the approach isn't actually conservative now but just more accurate (that is, in 2007 the industry wasn't conservative enough in underestimating the left tail).

[19] We also believe that today there is relatively less fund AUM that is subject to immediate redemption triggered by losses beyond some threshold. It is also likely that investors using leverage in these types of strategies have improved the terms of their debt financing relative to August 2007, ensuring that they have more stable financing and potentially reducing the speed and magnitude by which they need to reduce positions, which could lessen the impact of such an event.

[20] The most clearly negative signal we see is the number of footnotes I seem to need when discussing leverage!

[21] You wouldn't know this from reading the [most popular account](#) of the event which was written after the global financial crisis (GFC) really got going and, to sell a book, had to link it to that financial catastrophe. The book [The Quants](#) indeed argued that the quant crisis threatened global financial markets and, in general, sowed confusion between August 2007 and the general GFC. To be clear, global financial markets didn't seem to notice the problems quants were having in August of 2007. We think the quant crisis threatened some quants and their investors but not the overall financial markets at all (threats to the overall financial markets came much later and from other sources.) But, alas, a book about some localized quant crisis would've been a tough book to sell during and after the GFC.

[22] We would also contrast August of 2007 with the LTCM crisis in August of 1998 (yeah, August again). LTCM's strategies were much more market directional, and in fact their problems did originate in a big sell-off for markets world-wide. While they probably didn't threaten the world quite as much as many thought at the time, it was far more plausible given they were blowing up while the world was blowing up as well. Also, those of you who, like me, were around for both might have noticed that press coverage of the LTCM problems was ubiquitous, but only minor and ex post for the quant crisis. Again, we think that's, to a large extent, about whether the respective problems were market directional or not (and, of course, the extra severity of LTCM's losses).

[23] Some off the top of my head: Paying too much for exposure available for far less elsewhere is one candidate. Taking too little or too much overall risk is another pair of opposing possibilities. The formal data mining done by some quants and the informal data mining done by non-quants, when they implicitly believe the world of their experience is the world of the future, is another. Thinking about dollars not risk (i.e., the risk of an investment is not just how many dollars you allocate to it but how it impacts your overall risk which entails its risk-per-dollar and correlation with the rest of the portfolio) is one more. Generally underappreciating diversification is another. Chasing returns at the time horizon where value, not momentum, reigns is yet one more. It seems we have no shortage of these!

[24] There are behavioral/agency issues that can creep in here. Even if the losses on one sleeve are small in the context of the overall portfolio, many investors and, often more important, whoever they report to, may overly fixate on the standalone line item loss if it is large on its own.

[25] Again, this is tied up with the complicated topic of agency issues in managing the portfolio. Imagine the allocator wants to stick with the suffering strategy, even add to it, having assessed the damage to the overall portfolio as slight and the opportunity as attractive. But whoever he or she reports to is reading about the disaster in the newspaper...

[26] As always I used the word "work" like a cowardly statistician. A strategy "works" for me if it succeeds on net over the long-term which often means winning just a little more often (or a little bigger) than it loses short-term. In the real world if you say something "works" you likely mean most or all of the time. That is, if your car worked like I use the word you'd fire your mechanic! [I am not the only one to have difficulty with this concept.](#)

[27] 1990 was the last year studied in my dissertation, an early but not first study of these things (earlier for momentum than value). You really feel old when your out-of-sample period (1991-2017) is about the size of your in-sample period (1963-1990)! And you really feel geeky if that's what makes you feel old!

[28] [Some](#) commentators disparagingly refer to a "factor zoo" as a warning that we're all just datamining, finding too many factors that aren't real but simply show up in the data. [I think](#) this advice is important and datamining is a real danger, but I also think claims of a factor zoo are often exaggerated. It may apply well to the complete body of published papers on factors but not well at all to a parsimonious specific factor implementation. One can rigidly adhere to a handful of factor themes but still measure them in many ways as there's often no perfect way to measure the idea behind a factor. So, yes, lots of factors are sometimes employed, but many are noisy measures of the same idea. This can confuse some into thinking we are all operating in a factor zoo. Keeping to a handful of factor themes, insisting they work out of sample since discovery (through time, asset class, and geography), but measuring them using a large and robust set of measures is not dangerous datamining. In fact, it's somewhat the opposite.

[29] Meaning, again, that the market price of what the factors go long versus short is historically reasonable. A separate issue is investment fees which are also lower, for the most part, versus the past.

[30] While we don't see the evidence it has happened yet, eventually this can happen to our long-term returns also. Just because we argue pricing has remained resiliently reasonable in the face of factor investing's current popularity does not rule out factors getting arbitrated away going forward (or, if they're driven by inefficiencies, these inefficiencies going away through investor education). I discuss this more [here](#).

[31] But be careful of the logic of jumping from "one day a crash will happen again" to "so I shouldn't invest now or, perhaps, I should wait until the crash comes and pick the bottom." Consider again the stock market. I can tell you I believe that one day we'll see another short-term "crash." I'm guessing most market observers would agree. I can also tell you that, while lower than in the past, the stock market still offers a positive long-term expected return. If you knew a crash was coming tomorrow of course you'd wait (or go short!). But just knowing a crash, and then a recovery, will happen in the future doesn't mean waiting for it is the right thing as you give up the expected return between now and that eventuality, and that may prove far more costly.

[32] I say "liquid" because one thing illiquid investments, like private equity, venture capital, and real estate, do is shield you from this buffeting (cynically I'd mention they do this by not marking to market consistently, but they also do this legitimately by matching up liquidity terms and financing to long-horizon investing). They subject you to other risks of course.

[33] These indeed wouldn't be possible if the market wasn't also "fat-tailed."

[34] At least I hope you do!

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