The attack of the Quants

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Over the past few decades, quantitative funds have achieved enormous relevance in the financial markets. According to Institutional Investor magazine, four out of the five largest Hedge Funds in the world (*Bridgewater, AQR, Two Sigma and Renaissance*) are purely quantitative, while eight out of the top ten have relevant quantitative strategies. When considering leverage, quantitative funds control approximately 70% of the assets allocated among the hundred largest alternative funds in the world.

And the growth continues. Several of these funds have crossed the $100 billion mark, some already approach $ 200 billion. Ray Dalio's *Bridgewater* and Cliff Asness's AQR, the two largest Hedge Funds in the world, hold more than $ 150 billion each (if you take their leverage in consideration, that is approximately one trillion in assets). According to a HFR's 2018 report, quantitative funds exceeded $1 trillion in AUM. As most of them follow short-term strategies (high frequency trading), meaning the execution of thousands of transactions per day, they account for more than 70% of the entire volume of transactions on US Exchanges, says Greyspark, a London based consulting company. Furthermore, they participate in almost every market in the world. In Brazil, players such as *Cachaça Trading* (*Renaissance Technologies*), *Headlands*, *Citadel* and others reflect the trend, trading stocks of all sizes and segments.

Let us also remember the case of *SAC Capita*l, which was for decades one of the most iconic and controversial Hedge Funds in the world. The house was famous for its *CIO Portfolio*, a strategy run by CIO Steve

Cohen in person. Leveraging their team's outstanding trading ideas, it generated huge alpha in performance. Following prolonged collisions-confrontations with regulators and authorities, however, the fund was shut down and later restarted as *Point 72*, which manages around $ 15 billion. Currently, most of the *CIO portfolio* risk is no longer allocated by Cohen's preferences but by quantitative models. In that sense, one of the largest investors in the world has been replaced by computers and artificial intelligence algorithms.

Renaissance Technologies' Medallion Fund uses algorithms to operate a fully quantitative, short-term portfolio with approximately four thousand long and four thousand short positions in all asset classes, leveraging up to 10 times its own size. It has the most spectacular performance record in the world, an astonishing gross compound return of 66% yearly for no less than thirty years, or net 39%(*yoy*) if we subtract its exorbitant 5% (administration) and 44% (performance) fees. Since itslaunched in 1988, there was only one single year it ended with negative returnsfinishedinnegative. While financial markets were falling apart in 2008, it yielded 82% that year. In 2020 so far, they are up around 40%, surfing various market distortions caused by the pandemic. Over the years, *Medallion* has returned all their client's money, currently managing only their own proprietary capital.

Anyone who visits *AQR Capital's* website (the largest quantitative fund in the world) will find countless impressive articles on the advances in market prediction high tech. A morerecent one brings uphighlights a new machine learning software for text reading that classifies content as bull, bear or neutral, later checking up the results with significant assertiveness.

In the case of *Bridgewater* - where most of the strategies are quantitative - a model assembles scores of assertiveness in their team's opinions, linking them to numerous scenario variables such as bull or bear market, making or losing money, day of the week, month and so on. In this way, the model weighs the opinions according to their moments. Every manager out there knows we all may listen more closely to A than to B at a given time but do the opposite at another time. Some analysts will have impressive assertiveness if you just simply switch the sign of their calls!

So why do we think it is worth to study the functioning of this "new" type of player? Firstly, rising stars attract our intellectual curiosity, obviously. Secondly, this is a dynamic that mirrors inside our own arena the technological disruptions impacting sectors where we invest. Furthermore, understanding the probabilistic way in which quantitative funds make decisions (vis-à-vis the traditional school) can help us to capitalize short-term market movements made by noise created from quantitative models.

Traditional attempts to predict the future follow rational decision models based on historical information, ultimately relying on the experience of managers and analysts. Meanwhile, most quantitative funds base decisions on *Markov Chains*: mathematical models where the next step is determined by the last step. In other words, ***Quants*** do not care about our memories and explanations. They run themselves without human intervention, feeding data back into artificial intelligence algorithms. Essentially, it is the reverse of the fundamentalist investment school, based on experience.

A great chunk of quantitative strategies relates to super short-term trades, even thousands of daily trades seeking to earn few cents. Quite often, those are essentially *front running* trades over offers placed by traditional investors, which allow room for movements by not being that overly sensitive to the price accuracy of their actual deals. That means eating crumbs all day long, every day. Over a broader timeframe, nonetheless, that equals to significant results achieved under low risk. Aside possible debates or judgements over the *front running* itself, the strategy floods the markets with liquidity, an externality taken as anything but negative. Large quantitative funds are major liquidity providers through their algo traders – among them, *Renaissance Technologies* and *Citadel* are known for it.

Also noteworthy was the support from Stock Exchanges for the development of such strategies, in a classic free-market American style capitalism, with no regulation hassle. But regrets might be ahead since the evolution of so-called *dark pools* where millions of shares are traded underneath the lights of regulation. It is a Wild West of *front running* and one of the biggest cowboys in the world is English company *XTX Markets*. Albeit unknown to general public, they trade more than $150

billion per day using only algorithms, across almost all global assets and markets.

Recent thrilling statistics show that for every transaction order placed in US stock exchanges, sixty other orders are cancelled, consequence of a constant liquidity prospection performed by the ***Quants***. The side effect is a false sense of real market's liquidity. Bank of England's economist and scholar Andy Haldane is currently one of the biggest critical voices studying the issue. Through several must-read articles he raises concerns of systemic risk created by false liquidity measures.

Another interesting takeaway from these strategies is their ability to work 24 hours on all exchanges and all markets in the world. During the apex of markets downfall last March, most of the relevant price movements were seen during traditional trading's *after hours*. Daily gaps were created in huge volumes by systems working during the dawns. Warren Buffet once stated that "*If you don't find a way to make money while you sleep, you will work until you die*". Right now, no one takes the advice more seriously than quantitative funds.

Adding up the Moore's Law and its reflexive effects on computational and database developments, it is difficult not to project an even bigger competitive advantage for the ***Quants***.

As in the cryptocurrency mining industry, the quantitative fund industry depends on constant increases in computational capacity, so as to mine more and more data and apply them on matrices (data) evolving further and further beyond human vision. While a human trader records less than 5% of Bloomberg's service and information capacity, some quantitative funds download the entire database multiple times per day. *Renaissance Technologies*, for instance, built part of its algorithms based on a voice recognition structure using artificial intelligence to listen to calls, news or meetings, or even looking for new algorithms to operate in its funds.

The portfolio management industry suits well in the definition of *doing the same thing, in the same way, for a long time*. Decisions consider lots of numerical and historical arguments analyzed by our limited human brains, fueled by our experiences and emotions. This revolution overruns our binary and basic speed processing restriction (zero or one); and will be hastened even more by quantum computing's economical accessibility, bringing brand new directions for the old financial industry.

Risking a little bit of futurology, we glimpse some possible crossroads in the face of quantitative funds. As their algorithms rely on gigantic and historical databases from times when decision making was a purely human sport, they are - in practice - trying to predict prices movements based on past the next human decision. As mentioned earlier, nonetheless, these algorithmsalready respond for large trading volumes and already control some alternative markets. Given their own growing relevance, how effectively can these funds go forward? Nowadays, some already work in reverse mode in reading "signals vs noises", with noises becoming signals (example: false crossings of moving averages).

Finally, where does this all leave us, fundamentalist investors equipped with prefrontal cortex and lifelong market experiences? Initial conclusions suggest: (i) longer (even more) investment strategies, considering ***Quants*** dominate super short timeframes; (ii) remodeling to a financial world of more stretched trends (up and down); and (iii) the ability to withstand more volatility in short periods of time. Structural volatility may not change, but short-term swings are expected to be extremely violent. We will likely watch numerous flash crashes due to the deleveraging of quantitative portfolios. Think of the forced sales of "portfolio insurances" in 1987, or more recently, S&P 's late 2018 minicrash, or the global markets Covid-19 correction of March 2020.

During the second half of March, there were clear deleveraging patterns associated with the ***Quants*** with significant reductions in depths of their buy and sell offers. Technically, many of the quantitative models use a certain pattern of volatility and liquidity to feed their risk models, which determines net exposure, maximum portfolio leverage and leverage adjustments on a dynamic way. In times of abrupt volatility change such as that, especially when linked to a market of constant gaps as was the case, the maximum leverage of those models gets reduced aggressively. As a result, systems spit out reductions in portfolios. At the same time, liquidity decreased, as liquidity providers also uses models that are affected. All of this is performed automatically by computers, with no emotions and interpretations involved.

As described before, what matters is the current price for the next decision. This mechanism feeds itself and exacerbates movements. Upwards, volatility contracts, allowing more leverage and more aggres-

siveness by liquidity providers, while downwards the opposite is true. When we bring in derivatives and the numerous products designed to sell volatility, chaos can happen. Bear in mind that 2020 would be (or will?) the 11th bull market year in a row; and selling volatility - although scary - has been a winning strategy.

This chaos fades away when variables that affect risk change or when new leverage is achieved. As a real example of that, two 5x leverage funds that are theoretically "market neutral" within the *Renaissance Technologies* family declined by of 12 to 14% in the last week of February.

The global stock market rally since April reflects signs of adjustments in quantitative models, especially in statistical arbitrage funds seeking to generate alpha in interdependent market neutral operations (example: long Coke; short Pepsi). We assume that the coronavirus macro event was a feast for the ***Quants***. Soon we shall know better.

It is at our most highly daily task to separate signals from noises, thus identifying good investments.

We believe it is essential to understand the mechanics of the ***Quants*** because in times of deleveraging they are powerful noise generators, leading markets to distortions that translate into excellent opportunities.

In our experience as surfers, so often swells are predicted by signals such as wind. Despite the noise that may come along, such as a bad weather and its social reactions, we take the signal that waves are coming.

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