

The Crippling of Quant Asset Management

An Editorial Comment

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My Assertion

- *While stock market levels have recently reached new all time highs, the asset under management of “quant” equity managers has remained substantially reduced from levels achieved before the Global Financial Crisis.*
 - A Blackrock report puts AUM down 35%
- *The use of the term “quant” has been struck from the marketing materials of most asset managers and replaced with substitutes such as “disciplined, structured” or the newly minted “quantamental.” There has been a widespread loss of faith in quant methods and those who use them.*
- *Even beyond the general loss of public credibility suffered by the financial services industry, the quant community has suffered an even greater loss of investor confidence.*

Has Quant Performed Poorly?

- There have been two relatively formal studies of the performance of quant managers versus traditional managers over the past decade and through the GFC
- There have also been widely discussed assertions of “crowding” among quant managers
 - Lakonishok and Swaminathan (2010)
 - Gustafson and Halper (JOI, 2010)
- Both studies found that quant managers did at least as well or better through the GFC and there is no observable crowding effect

Quants Have a PR Problem of their Own Making

The mental features discoursed of as the analytical, are in themselves but little susceptible of analysis. We appreciate them only in their effects. We know of them, among other things, that they are always to their possessor when inordinately possessed, a source of the liveliest enjoyment.

As the strong man exults in his physical ability, delighting in such exercises as call his muscles into action, so glories the analyst in that moral activity which disentangles. He derives pleasure even from the most trivial occupation which brings his talent into play. He is fond of enigmas, of conundrums, hieroglyphics; *exhibiting in his solutions of each a degree of acumen which appears to the ordinary apprehension as praeternatural.*

His results brought about by the very soul and essence of method, have, in truth, the whole air of intuition.

Quants Pretend to be Rigorous but

Even trained statisticians often fail to appreciate the extent to which statistics are vitiated by the unrecorded assumptions of their interpreters... It is easy to prove that the wearing of tall hats and the carrying of umbrellas enlarges the chest, prolongs life and confers comparative immunity from disease. A university degree, a daily bath, the owning of thirty pairs of trousers, a knowledge of Wagner's music, a pew in church, anything, in short, that implies more means and better nurture... can be statistically palmed off as a magic spell conferring all sorts of privileges...

The mathematician whose correlations would fill a Newton with admiration, may, in collecting and accepting data and drawing conclusions from them fall into quite crude errors by just such popular oversights as I have been describing.

George Bernard Shaw, *The Doctor's Dilemma*

Quant Management as a Business

- In the effort to get a broader audience of investors:
 - Quant managers have succumbed to the temptation to reduce difficult concepts to “sound bites”
 - We have encouraged the investment community to not bother reading “fine print” in research
 - When things go awry, investors feel they have been misled and cheated

“Lies, damned lies and statistics”

Fiorello LaGuardia

“For every complex problem, there is an answer which is simple, elegant and wrong”

H.L. Mencken

Spinning The Quant Meltdown

- During the “quant meltdown” period of 2007, the financial press ran daily stories quoting major institutions such as Goldman Sachs
 - Assertions were made of “seven standard deviation events” and “ten standard deviation” events in factor returns
 - Standard deviation is only a viable measure for normal and IID return distribution. Under that distributional assumption the likelihood of such extreme events infinitesimally small.
- There is a much more plausible explanation
 - They are simply **wrong** about the value of the standard deviation, or it is simply an inappropriate measure for the actual distribution

“The fault dear Brutus, lies not in our stars, but in ourselves”

Shakespeare in Julius Caesar

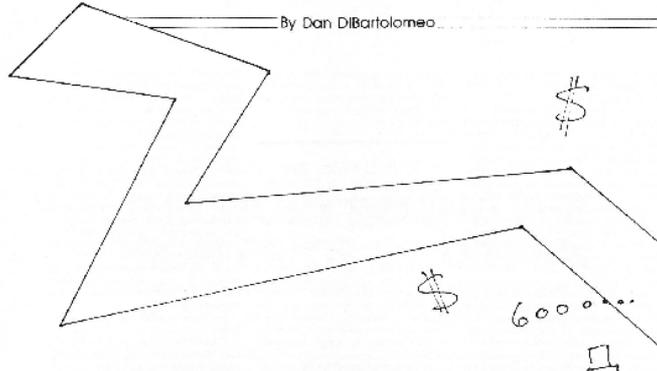
More Spinning of the Quant Meltdown

- Shortly after the quant meltdown the Financial Times did an editorial suggesting that because so many funds used Barra and Northfield optimization systems, the portfolios were similar so trades became crowded. Basically the article asserted the GFC was our fault.
 - I was rather amused to think we were so influential
- When I talked to the writer at a FTSE conference a year later, he admitted that the idea come from where I thought it had come from.
 - The idea of crowding is rather strange. Since every share of stock is owned by someone, if two portfolios are more similar to one another it means those two portfolios must be more different from other investors.
 - Crowding occurs when similar portfolios all seek liquidity at the same time, which is an issue of bad estimation of trading costs
- There is also a logic problem
 - Consider a fire in a crowded theatre

Fuel on the Fire: Axa Rosenberg

- There was a bug in the optimization and risk management computer code. They found the bug and they didn't fix it promptly.
 - A fine of \$25 million was levied and founder Barr Rosenberg forced out of the industry.
- Two Views
 - In a presentation to the London Quant Group, Bernd Scherer argued that the case is nonsense since there is nothing to back up the idea that the software bug materially impacted actual investment outcomes.
 - In a recent presentation to the Chicago Quantitative Alliance, Jeff Brown of 18 Asset Management (Canada) argued that Axa Rosenberg got what they deserved for a deliberate cover-up.
- Consider a fundamental PM that has too many martinis over lunch and then goes back to the office to enter trades
 - Should the SEC require the firm to disclose this to clients?

Computers Did It: Blame HFT for Flash Crash



COMPUTERS AND THE CRASH: DID THE MACHINES REALLY DO IT?

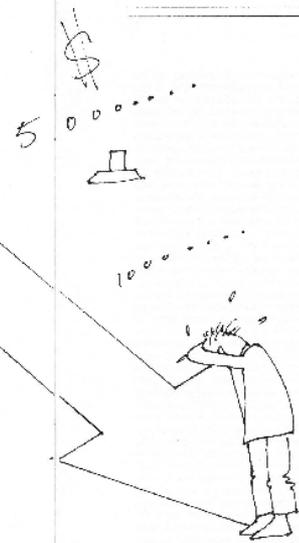
A lot of people blamed computers for last year's stock market crash. We look at the role they really played.

The stock market crash on October 19, 1987, reduced the wealth of every man, woman, and child in the United States by an average of \$5,000. In total, more than \$1 trillion in the value of traded stocks was wiped out in the span of just seven hours. The morning newspapers of Tuesday, October 20, began the inevitable fingerpointing. One of the most popular rationalizations was that computer-aided trading practices, which had come into vogue in recent years, had gone haywire. In short, it was all "the computer's fault."

To begin to understand the role computers played in what has come to be realized as a near-total collapse of the world's capital markets, we first must return to grips with the anomaly of the financial events themselves. In addition to one-day loss of nearly a third of the value of all stocks traded in the United States, every major stock exchange in the world dealt with near-panic conditions. Total losses around the world exceeded \$2 trillion in a matter of a few days. This sum is greater than the accumulated national debt of the United States, which has taken over 200

years to accrue. In Hong Kong, things got so bad they simply closed the stock exchange for a week, bringing finance and commerce to a near standstill.

The Dow Jones Industrial Average lost 508 points, over 23 percent of its value, on October 19. This percentage is more than double the 11.4-percent loss recorded on October 29, 1929, the event normally cited as having triggered the Great Depression. The likelihood of such an event happening randomly, given the history of stock market ups and downs, is so small, as to be nearly incalculable.



early outliers blaming a financial apocalypse on "computer failure" were just wishful thinking. What's also become evident is that computers did play a major role in the market crash and that computers will (like it or not) continue to play a vital role in the proceedings of the financial markets in the future.

Computer involvement in the stock market collapse can be roughly divided into two basic categories. The first is computer substitution of the routine work at the stock and commodity exchanges in the actual execution of financial transactions, dissemination of market information, and processing of post-execution paperwork.

The second kind of computer involvement, and the one more widely criticized, is that the availability of high-speed computers has led investment institutions such as pension funds and mutual funds to adopt complex trading strategies that often require the simultaneous (and, hence, necessarily automated) execution of hundreds of "buy" or "sell" orders. Two such techniques that had gained popularity are known as "program trading" and "portfolio insurance."

If we look at the routine functions of computers in stock market transactions, we're first led to the Direct Order Transaction (DOT) system of the New York Stock Exchange. DOT is a complex computer system used to route certain incoming transaction orders to the appropriate "specialist" on the exchange floor. The role of the specialist is to act as the moderator of the flow of orders, matching up buy and sell orders, and often transacting with their own money in order to stabilize price movements when an imbalance of buyers versus sellers makes a particular stock's price move erratically.

The main processing station of DOT had a certain capacity of 68 messages per second. Each of the attached printers had the ability to produce 10 to 15 printouts a minute. On October 19, orders for nearly 400,000,000 shares of stock were processed through DOT. This volume so overwhelmed the DOT system that the processing of orders was delayed up to one and a half hours. Although no actual hardware failure is acknowledged by the New York Stock Exchange, some reports suggest that

up to 75 percent of DOT's network capacity was inoperative at certain points during trading on October 19. The NYSE also suffered through two software failures, one of which "lost" reports on 5,000 completed transactions. The other failure bogged down the process of matching incoming order cancellations with active orders.

The delays resulting from the overburdened DOT system are generally considered a key element in the market crash, because without the ability to execute transactions in a timely fashion, strategies such as program trading and portfolio insurance are incapable of implementation.

In concept, portfolio insurance is very simple. Many investment institutions such as pension funds know exactly the amount of money they need to maintain in order to fund future pension payments. When past investments have gone well, pension funds have "excess" money that can be invested aggressively in order to obtain a higher investment return. When investments do poorly, pension managers switch money out of the stock market and into more conservative investments such as government bonds, so as to assure maintaining the necessary minimum funds. In practice, large pension funds often have many investment managers operating in different specialized segments of the stock market.

In order to implement an "insurance" strategy, selling transactions are often accomplished not by selling actual stocks, but, rather, by selling stock index futures contracts, which are essentially a regulated form of gambling on the movements of the market. To implement a "sell," an institution sells futures contracts (bets the market will go down) at occasionally exchanges such as the Chicago Mercantile Exchange. As long as the movements of actual stocks and the related futures remain reasonably in concert, selling contracts has the same practical effect as selling a broad portfolio of stocks.

A related strategy is "program trading." It's clear in theory that movements of actual stock prices and the prices of futures contracts should remain closely related. This is easily shown by considering that as a substitute for owning a portfolio of stocks, an investor could buy a futures con-

tract. "Tony" Repp, of the New Amsterdam Partners investment management firm, later suggested in a presentation to the Boston Security Analysts Society that the odds of such an event were approximately one chance in a million with 43 zeros. But perhaps the scariest statistic of all is one that points out the tremendous fragility of modern financial markets: During the two weeks surrounding October 19, numerous dramatic price swings, both up and down, took place, but the total volume of shares traded was less than 1 percent of U.S. publicly-owned stocks.

But why blame all this on computers? In the many months since October 19, it's become clear that the

Dan DiBartolomeo is president of Northfield Information Services, a consulting firm specializing in computer-oriented investment analysis. Copyright 1988 by Dan DiBartolomeo

Blame the Computers

- The preceding slide shows a picture of my 1988 article about the October 1987 stock market crash
 - The Brady Commission investigation was largely done by Bob Glauber and is later headed by NASDAQ and Freddie Mac. I've talked to both Bob and Nick Brady (former US Treasury secretary)
 - Believe it or not, the computers didn't do it
 - Silly assumptions about markets being infinitely liquid did along with some esoteric (and dumb) policies for futures clearing
- The funniest phone call I ever got from an asset management firm
 - Their quant team had created an **automated** strategy
 - Monthly it evaluated stocks, cross-referenced with analyst ratings, optimized (using Northfield) and submitted trades
 - The quant team quit and went to another firm

Structural Problems: Non Aligned Interests

- Quant asset managers and pension consultants have effectively conspired to make “tracking error” the key metric of portfolio risk
 - Investors don’t pay their bills with benchmark relative money
 - Tracking error is the metric by which managers manage their risk of being fired as managers.
 - It is also the risk that the consultant looks stupid for recommending the manager
 - Ex-post tracking error is often the only quantitative measure of risk for many pension plans despite the fact that it addresses a small portion of total risk
- This isn’t exactly hot news
 - Roll (1992)
 - Wilcox (1994)
 - Kritzman, Light and Rich (1996)

Mine is Bigger than Yours (IR)

- Almost every asset manager asserts that their Sharpe Ratio or information ratio is higher than peers so they are a better manager
 - It's really hard (i.e. impossible) for everybody to be above average
 - No one talks whether differences in IR are statistically significant
 - Jobson and Korkie (1981), LeDoit and Wolf (2008)
- These ratio measures are essentially unrelated to investor utility except for investors so risk averse they would never be in equities
 - Higher ratios do not imply better outcomes except in the presence of unlimited leverage
 - deGroot and Plantinga (2003)
- If you account for the non-zero possibility of hiring a bad manager, a high SR or IR is not always a good thing
 - diBartolomeo (2010)

“The Secret Formula that Destroyed Wall Street”

-- *Wired* --

- “We are so accustomed to disguise ourselves to others that in the end we become disguised to ourselves”
 - Francois de la Rouchfoucauld
- The Gaussian Copula
 - A mathematical approach to marginal probability densities
 - David Li, Journal of Fixed Income (2000)
 - Adopted by all rating agencies and major structured product issuers and guarantors (e.g. AIG) from 2005 onward
 - Economic payoffs from a defaulted loan are not normally distributed
 - Results are extremely dependent on heroic assumptions regarding the independence of mortgage borrowers

The Oops in Gaussian Copula

- Lack of correlation is a necessary but not sufficient condition to establish independence for the Central Limit Theorem
- Consider investing in two hedge funds (this example inspired by *Iceberg Risk* by Kent Osband)
 - The two funds have offices in the same office building
 - Each trading day the two fund managers meet for morning coffee and flip a coin
 - If the coin comes up heads, they hold exact same positions
 - If the coin comes up tails, they go long and short against each other
 - What is the time series correlation of their returns?

The Worst Outcome of the GFC



The Fallacy of Back-testing

- Cheap Computer Capacity
 - Napoleon with M-16s
 - High kill ratio, but does it mean anything
 - Data Mining
- To clean or not to clean, that is the question?
 - Data cleaning beyond your control
 - Revised versus reported data
- “Just because we can doesn’t mean we should”
 - Dr. Ian Malcolm (Jeff Goldblum) in *Jurassic Park*
- *Back-tests should be considered the upper bound not the expectation of live outcomes*

Asserting Market Inefficiencies

Say not, "I have found the truth," but rather, "I have found a truth."

Say not, "I have found the path of the soul." Say rather, "I have met the soul walking upon my path."

Kahlil Gibran, *The Prophet*

"I would never want to join any club that would accept me as a member."

Groucho Marx

Anomalies And Basic Algebra

- The vast preponderance of quant equity managers have some dependence on the supposed “value” anomaly
 - Markets are persistently inefficient across a wide array of time periods and countries
- A different view suggests that any price sensitive strategy (value or momentum) replicates an option on the cross-section of returns
 - diBartolomeo (2003)
 - Momentum strategies are long the option and have positive skew
 - Value strategies are short the option and have negative skew
 - When value performs poorly it performs very poorly so it should provide a risk premium
- Low volatility strategies
 - CAPM is a single period model. Arithmetic returns are linear in risk
 - Geometric returns must be a convex function of risk
 - Portfolios with sufficiently high beta can be expected to underperform

Two Horror Stories and a Comment

- The tax sensitive retail portfolio
 - A client asked us for help optimizing a particular style of account
 - The portfolio was basically passive to track a US large cap index
 - Must have exactly 40 names at all times
 - All securities must trade in round lots
 - Average account size \$50,000
- The high yield fund income fund
 - Buy Treasury bonds for an income mutual fund
 - Sell in the money call options on the bond for large option premiums
 - Count the option premium as income so the fund yield is much higher than the bond yield. You are intentionally reducing share value
- The “pay to play” conference
 - No way this would be allowed in any scientific field

The Roots of Quantitative Finance: Adult Edition

- Drinking and gambling, with “Last Call”
- The “Problem of the Points”
- Gerolamo Cardano (1501-1576)
 - The Book on Games of Chance
 - 1526, 1663
- Typhoid and the role of syphilis

A Good Thing Quants Did!

From page 35 of No One Would Listen, the story of the Bernard Madoff financial fraud by “whistleblower”, Harry Markopolos

“I turned to a man named Dan diBartolomeo. Dan is the founder of Northfield, a collection of math whizzes who provide sophisticated analytical and statistical risk management tools to portfolio managers.

Dan is an eccentric, bow-tie-wearing East Coast surfer with a photographic memory that revels in math.”

Madoff Evaluated

Page 36 of No One Would Listen

“Bernie Madoff was a fraud. And whatever he was actually doing it was enough to put him in prison. I knew it was true but it was so hard to believe.”

Less than one day in early 1999 elapsed between page 35 and page 36

Conclusions

- Quant equity AUM has declined markedly because investors have lost faith in equity management methods that purported to be rigorously thought out and executed
- What many quant products have done is maximized the utility function of the asset manager rather than the investor
- This has been a bigger problem on the quant side than the fundamental side because the quant community is unwilling or unable to articulate their investment concepts in common language without using misleading statistics to exaggerate the expected benefits of their efforts
- In some cases, clearly irrational investment strategies have been undertaken simply because they could be presented in a form attractive to uninformed investors.