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REVIEW ESSAY

**The Quants: How a New Breed of Math Whizzes Conquered Wall Street and Nearly Destroyed It**, by Scott Patterson. New York: Crown Publishing, 2010, 352 pp., $27.00 hardbound.

**My Life as a Quant: Reflections on Physics and Finance**, by Emanuel Derman. Hoboken, NJ: John Wiley & Sons, 2007, 292, pp., $16.95 paperback.

# The Crash of the Quants

**Wight Martindale, Jr.**

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Americans have long been mesmerized by scientific genius. Think Thomas Edison and Albert Einstein. We are equally fascinated by financial wizards: J. P. Morgan, Michael Milken, Warren Buffett.[1] In the "quant" revolution on Wall Street that took place over the past twenty years, in which mathematical and scientific experts created new high-tech investment strategies, we put the two together. Everyone from Barney Frank to Ben Bernanke to Fannie Mae to the heads of the Harvard and Yale endowment funds to the chief executives of the world's largest banks and investment banking houses—even average investors in many cases—fell under the spell of the quants.

It turns out that Roger Lowenstein's very fine *When Genius Failed* was wildly mistaken[2]—so-called "genius" did not fail, it returned with a vengeance to create even greater havoc. These two books, *The Quants: How a New Breed of Math Whizzes Conquered Wall Street and Nearly Destroyed It*, by Scott Patterson, and *My Life as a Quant: Reflections on Physics and Finance,* by Emanuel Derman, provide contrasting insights

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[1] Randall E. Stross's *The Wizard of Menlo Park: How Thomas Alva Edison Invented the Modern World* (New York: Three Rivers, 2007) is a popular biography. Dozens of books, many with equally grand titles, have been written about the other men mentioned in this paragraph, and more no doubt will be written in the future.

[2] Roger Lowenstein, *When Genius Failed: The Rise and Fall of Long-Term Capital Management* (New York: Random House, 2000).

into the financial crisis of 2007–2008 and give us an opportunity to consider what part education, or the lack of it, played in forming the mindset of its enablers.

Patterson's intriguing book introduces us to the handful of mathematical whiz kids who managed to legitimize the 30- and 40-to-1 debt-to-asset investing ratios that were eventually taken on by Fannie Mae, the subprime mortgage originators, and some commercial banks and brokers. These men are game-players—but game-players with an edge. Their edge is intellectual; they learned how to beat the dealer when they were quite young—while still in high school.

Their college experience did nothing to change this. Why?

Because college, too, can be a game, not about wisdom or attaining wisdom, but a game for grades, for certification, and for social climbing. Far too often humanities and undergraduate business students are taught how to play the game by teachers who manage their own careers through bogus peer review publishing no one reads, political advocacy masked as "learning how to think independently," utterly trivial classroom discussions, and by coddling their impressionable young students with inflated grades and easy assignments.

Smart kids spot this nonsense immediately. Run the best, the brightest, and the most ambitious students through this transparently silly process, and you get unrepentant arrogance and the 2007–2008 financial crash, the biggest since the stock market collapse of 1929.

The financial crisis of the past few years was fueled by too much borrowing, and the boldest and most confident borrowers—which includes the hedge funds but also the off-balance sheet financing of special purpose investment vehicles—could only operate by invoking the authority of the super-quants. It could be argued that they provided the intellectual authority—"peer review approval" in academic circles—for reckless lending that ensued everywhere. Without the intellectual bravado, or what might better be called insensibility to risk, that these hedge fund traders flaunted, normally financially conservative institutions such as Deutsche Bank and the Harvard Management Company Endowment would not have been handing over their money without understanding the risks they were taking.

All of the trading wizards in *The Quants* are also enthusiastic gamblers and all of them have impressive academic pedigrees. For example:

Edward Thorpe (b. 1932), Princeton-Newport Partners, author of *Beat the Dealer: A Winning Strategy for the Game of Twenty-One* (1962), the godfather of quants; BS in physics, Ph.D. in mathematics, UCLA;

Jim Simons (b.1938), founder of Renaissance Technologies; BA in mathematics, MIT, Ph.D. in mathematics, University of California, Berkeley;

Peter Muller (b. 1963), Morgan Stanley private hedge fund, pianist and songwriter; BA in mathematics, Princeton;

Cliff Asness (b. 1966), Goldman Sachs Global Alpha fund; BS in economics and electrical engineering, University of Pennsylvania, Ph.D. in finance, University of Chicago;

Ken Griffin (b. 1970), Citadel Investment Group; BA in economics, Harvard;

Boaz Weinstein (b. 1974), Deutsche Bank, chess life master at 16; BA in philosophy, University of Michigan.

Most of these men grew up as if they were intellectual latch-key kids with plenty of time on their hands. In Lomita, California, Ed Thorpe's father worked the graveyard shift at the San Pedro shipyards while his mother worked the swing shift at Douglas Aircraft. He was alone for many hours and Patterson writes that "he had the freedom to let his imagination roam wild. Blowing things up was one diversion. He tinkered with small homemade explosive devices in a laboratory in his garage."

Cliff Asness grew up in fashionable Roslyn Heights on Long Island. Patterson writes of his high school days: "In school Asness received good grades, but his interest in Wall Street didn't extend beyond the dark towers of Gotham in the pages of *Batman*. Obsessed with little other than girls and comic books, Asness was listless as a teenager, without direction and somewhat overweight. At times he showed signs of a violent temper that would erupt years later when he sat at the helm of his own hedge fund."

Ken Griffin spent his youth in Boca Raton, Florida, where he took an early interest in computer programming. "His mother would ferry him to the local Computerland, where he would spend hours chatting up the salespeople about new gizmos and software," Patterson recounts. Considered a math whiz, Griffin started managing other people's money while he was an undergraduate at Harvard.

Peter Muller grew up in Wayne, New Jersey. He showed an early aptitude for math and loved to play all kinds of games, from Scrabble to chess to backgammon. As a senior in high school he designed a computer program that could play backgammon.

Boaz Weinstein was raised, as Patterson tells us, "in the privileged Manhattan neighborhood of the Upper East Side. He seemed to have money all around him." In addition to playing chess he won a stock-picking contest while a student at New York City's elite Stuyvesant High School.

**Beating the House**

There is some parallel between the quantitative trading these men perfected and card-counting at the blackjack table: in both cases the bets increase when the odds improve. Quantitative trading required super-high speed computers that would not only detect patterns before competitors could see them, but also execute trades instantly. This last technical achievement is often referred to as "high frequency trading," and it was pioneered by Jim Simons at Renaissance Technologies.

Speed as a factor in getting into and out of trades was important because positions often were not held for long. From a statistical point of view, Patterson explains, Simons realized that "the ability to predict what will happen tomorrow, or the next few hours, is far better than the ability to predict what will happen a week or two down the road." Simons also pushed beyond mere algorithms; he hired code-cracking cryptographers as well as speech recognition experts—this last group because speech recognition programs try to guess what sound is coming next in order to keep up with the speaker.

While all of these super-quants were intensely secretive, the field soon became overpopulated. When this happened, returns fell. For example, Ken Griffin's Citadel Investment Group, which began in late 1990, racked up returns in its first three years of 43 percent, 41 percent, and 24 percent. But in 2002 its flagship fund was up only 13 percent, slipping below 10 percent for the next three years. As performance slipped, managers could only boost returns by adding more leverage, that is, by borrowing more money to finance their trading positions.

The speculative crash of 2007–2008 might have been anticipated because quantitative trading meltdowns occurred twice recently, and they both occurred for the same reason. The first event was the

October 1987 equity market collapse, when portfolio insurance, the new quant device of the time, accelerated the stock market's decline rather than slowed it down. The second was the failure of Long Term Capital Management (LTCM). LTCM was populated with Ph.D.'s (even two Nobel Prize winners in economics), but after initial returns of 40 percent per year, investors lost $4.6 billion in less than four months in 1998. The firm had to be bailed out by the New York Fed and by fourteen other dealers and banks that had been trading with them.

In both cases the collapses occurred because market liquidity could not absorb all the selling that hit the market at the same time, and the funds were heavily leveraged. At such moments even good trading positions appear to be losers. As Lord Keynes explained many years ago, "Markets can remain irrational longer than you can remain solvent." It is a mistake to think that buyers will always be present to accommodate sellers. But the brainiest traders in world, or at least most of them, seemed to have learned nothing from these lessons.

The details of the collapse of the mega-hedge funds in August 2007 remind us that truth can be stranger than fiction. None of the managers we have been following got caught up in the mortgage bubble, in which mortgages were extended to people with very little equity who could not really afford them. Indeed, Weinstein made his firm $250 million by shorting the subprime mortgage market, that is, selling subprime bonds they did not own, planning to buy them back at a lower price after their value collapsed. Citadel, Asness at AQR, and Peter Muller at Morgan Stanley believed they had dodged the subprime bullet. A few days before the crash Weinstein threw a lavish celebration party at his Southampton summer home; he had gotten the subprime trade right and he knew it.

Then events suddenly took a vicious turn. On Friday, August 3, TV host Jim Cramer ranted about a fixed-income Armageddon (shouting "They know nothing"—still played before each of his daily shows). He had been tipped off that hedge funds all had the same big trades on and they were all moving against them. The financial tsunami actually hit on August 6, the Monday following Cramer's rant. Subprime borrowers were defaulting on their loans, thus triggering waves of selling in everything else as over-leveraged managers sought cash wherever they could get it. A global deleveraging was taking place, and it would take all the quant funds down with it. That is, with no bids or very low

bids for mortgage derivatives, fund managers sold whatever else they owned and could get a bid on, which turned out to be what the other hedge funds owned.

The whiz kids' first hope was that there was just one big seller, perhaps Goldman's Global Alpha fund, and that eventually that selling would stop. One manager at the time recalled, "Quant managers tend to be kind of secretive; they don't reach out to each other. It was a little bit of a poker game." So the quants continued to devour each other.

Muller's fund lost $300 million and Asness lost $500 million—*in a single day*. In the first six trading days of August, Goldman's Global Alpha fund had lost $1.5 billion. As Patterson reminds us, "the carnage was taking place beneath the surface, the billions in hedge fund money evaporating."

The crisis ended as suddenly as it had appeared. At the end of the week Goldman Sachs put $3 billion of its own money into Global Alpha, and on the following Monday Goldman held a conference call to explain what they had done. Temporarily, confidence was restored, and the quant funds began to recoup their losses.

The markets and the regulators thought the worst was behind them. But it was not. In March of the following year the crisis caught up with the major brokerage firms, the first of which to collapse was Bear Stearns. Then, in September 2008 Lehman Brothers filed for bankruptcy. Fannie Mae and Freddie Mac were nationalized. AIG had to be taken over. Chaos returned.

Citadel's flagship fund lost 20 percent in September alone, and was down 35 percent for the year. Boaz Weinstein, age 35, was now managing $30 billion in assets at Deutsche Bank. He, too, believed the worst of the credit crisis was over. But in September, as bank lending froze, the swaps market ceased to function, Deutsche Bank management had had enough: they would advance Weinstein's group no more money; they wanted to see sales. When the selling stopped Weinstein had lost $1.8 billion, causing hundreds of his fellow employees in other departments to lose their jobs and their bonuses.

In the spring of 2008 Cliff Asness continued to believe that the stock market would recover, so he was badly positioned for the September declines. For the year his Absolute Return fund was down 46 percent, about in line with the Standard & Poor 500 index, which was down 48 percent.

Peter Muller lost about 40 percent for the year. Like Asness and Griffin, he had a huge amount of personal wealth invested in his fund.

The two older guys did better. John Simons's Medallion fund was up 80 percent for 2008, and Ed Thorpe, who had toned down his operation and switched to a new strategy using no leverage, was up 18 percent. One might say that with age comes wisdom, and wisdom is not something we can do without.

**Adding Value?**

Eventually we must ask ourselves, what is the value of what these quants actually do for capital markets, for society, and for the world? They do not finance new businesses as venture capitalists do. Nor are they activists seeking to replace or improve managements. They are not credit men or workout specialists, guiding companies through the bankruptcy process. They are not accounting experts. How much value is added in capital structure arbitrage trading within a company?

It is at this point that it is useful to read Emanuel Derman's autobiography *My Life as a Quant*, which provides an instructive contrast to the activities of Patterson's quants. Derman, a South African native who received his Ph.D. in theoretical physics from Columbia in 1973 and then migrated to the Quantitative Strategies Group at Goldman Sachs, is the story of a very smart man who did not blow up the financial markets—he simply wanted to solve complex mathematical problems. Not surprisingly, he's back at Columbia, where he teaches quantitative finance.

Derman is a scientist in the purest sense. He has a mature curiosity, not idle, adolescent insatiability. He loved the history and the traditions of the Columbia physics department (which had more than its share of Nobel Prize winners), where "brilliance seemed paramount" and where "the classes I liked best were taught by people who gave you a feel for what it was like to discover something new, as well as the sense of how it had been done." There is no sense of dominance or power over others involved in his thinking. He is not beating the dealer.

Derman is always conscious of the predecessors in his field; he knows he is laboring within an august tradition. "The essence of theoretical physics is the attempt to look at the universe and then mentally apprehend its structure," he writes. "If you are right, you emulate Newton and Einstein: you find one of the Ten Commandments. You write down a simple set of laws that, plucked from nowhere, miraculously describes and predicts how God's world works. This is the struggle to which I aspired....Even mathematical beauty is not enough."

On his move to finance: "When I moved to Wall Street, I found

quantitative finance to resemble phenomenology much more than it resembled pure theory. Quantitative finance is concerned with the techniques that people use to value financial contracts, and given the fluctuations of the human psyche, it is a pragmatic study of surfaces rather than a principled study of depths. Physics, in contrast, is concerned with God's canons, which seem to be more easily captured in the simple broad statements that characterize profound physical laws."

Emanuel Derman grew up in the old-European culture of Cape Town. Foreigners were common in the Columbia physics department and academic expectations were high. The chapter titles of Derman's book are drawn from authors he has read, and it is a serious list: Goethe, Flaubert, Kafka, Simone de Beauvoir, Graham Greene, and Gregor von Rezzori. He later speaks of reading Tolstoy, Nabokov, and Robert Musil. Few American high schools or colleges can boast of such a reading list. Derman contributed his share of quantitative strategizing and risk-taking at Goldman Sachs, but the overall impression is of a man whose background, education, and native thoughtfulness enabled him to develop more fully as a human being and consequently to keep finance in perspective. He does not look at life or at mathematics purely as a trader or gambler. He believes life is about more than outsmarting other people. It is also about understanding what we are doing and who we are. He takes an interest in the most profound questions of life.

Unlike Derman, Patterson's quants are essentially thrill-seekers who love gadgets, poker, card counting, and mental competitions of all sorts. In hindsight, it appears that they may have confused their avocation (gambling) with their vocation (wisely managing other peoples' money). They often appear as rootless eccentrics and yet they conned their bosses and their investors into believing they could make huge profits with little risk. Alan Greenspan, who also prided himself on his intelligence, supported them, as did the United States Congress and eventually many of the biggest banks around the world. What they all should have remembered is that the misuse of someone else's money is morally wrong. As *The Economist*'s pioneering editor, Walter Bagehot, explained a century ago, savers must be respected; they are entitled to a reasonable return on their money, and to prudent lending by their bankers. This principle is true for people, for companies, and for nations.

One of these aggressive traders' blind spots was the proper appreciation of debt—other people's money—

without which they could not build their castles in the air. The leverage foolishly granted them by irresponsible supervisors allowed them to bully more modest traders in the markets and to demand excessive fees. Their pay was based on absolute returns, not risk-based returns. But all that extra leverage, as we now know, is risk writ large. *Compensation should be less for a leveraged manager, not more.*

**It's Time to Get Serious**

Aristotle warned us that the perversion of the best thing is the worst thing (the best state is run by a good king, the worst state is run by a tyrant). Thus, the best use of money can feed a family, build a home, or roads—even a nation. The worst use of money buys momentary thrills and then squanders it away. Should our "best and the brightest" devote their time and energy to beating the dealer and running up commodity prices?

Our society celebrates these whiz kids because they make so much money, but if we pause, we discover that these new masters of the universe are often quite trivial people. We see that they overpay for modern art, give themselves lavish parties, and throw temper tantrums at trembling employees. If they did not learn from their recent experiences, and if they do not retire with greater wisdom, it can only be because it was never wisdom that they sought.

The defenders of these traders will say that their job is simply to maximize return, and it is the job of the regulators to restrain them. But this is an oversimplification. Derman illustrates the virtue of having a bit of a regulator inside each one of us. Individually, no one of these money managers would have created a problem, but collectively, they mattered very much. When everyone rushes the regulators at once, we should not be surprised if the regulators fail. We also need personal internal constraints—the most valuable constraint being to reign in our pride, and the greed which often follows close behind it.

A proper education should address these essential issues of life, which are contained in the Hebrew Bible, in the philosophies of the ancient Greeks, in the people created by Shakespeare, and in the characters of Dostoevsky's novels. A serious look at life should not lead one to strive for Napoleonic supremacy, but to humility and a respect for the past.

This is what wisdom is all about, and the elite schools these traders attended should not forget it. What all these very smart young men needed in their fancy schools was what everyone needs; they needed someone who wanted them to be serious about life and to expect more from themselves.