

# THE VALUE OF NOTHING: A REVIEW OF *THE QUANTS*, BY SCOTT PATTERSON

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Scott Patterson, former financial journalist for the Wall Street Journal, has written a book-length love letter to quantitative finance and its practitioners. To judge by some comments posted on amazon.com and elsewhere, though — “naïve”, “mathematically illiterate”, “sensationalism”, “bumbling idiot” — the love is not requited. This surely reflects the hypersensitivity of an insular profession unaccustomed to criticism — what economist P. Krugman has termed the “Ma, he’s looking at me funny!” mode of political-economic discourse.[1] Of course, the book is not really about the sort of people who write comments on the websites of online retailers. The “quants” of Patterson’s title are a handful of capitalist potentates, supremely successful and influential practitioners of mathematically inspired finance. Putting to one side a certain oversensitivity to criticism, and the unquestionably sensationalist subtitle — “How a New Breed of Math Whizzes Conquered Wall Street and Nearly Destroyed It” — many who identify with the job-title “quant” are very far removed from the world of Patterson’s conquering heroes, or with Patterson’s enthusiasm for them. While the book makes little pretence of reflecting their careers or their experience, it probably offends by implying — with little evidence — that the managers and the menials share a unified mathematical culture and mindset.

But the managers, and their real and perceived relationship to mathematics, do make an important story. Economic historians teach us that one indispensable ingredient to a financial crisis is an excuse for ignoring the lessons of the past, for overriding the traditional safeguards, for believing that “this time is different”. [15] The most recent round of excuses were provided, if not directly by mathematicians, then under the banner of mathematics, and the crisis that ensued was of terrifying proportions. For this reason alone *The Quants* would deserve the attention of the mathematical community. Few readers will be bored, and most will learn some things that are worth knowing about the world, and about the place of mathematics in the world.

This book joins a long list of recent popular or semi-popular titles on quantitative finance and its practitioners. It is not the best in all respects, certainly not as a technical primer. Its approach can seem infuriatingly non-analytical and apolitical, even willfully obtuse at times. But it is intelligent and serious, by and large, and its relentless focus on the look and feel of the rarefied quant world, while a limited perspective, is a valuable one, and one that requires the skills of a talented journalist, which Patterson obviously is.

The quants, as Patterson describes them, “couldn’t care less about a company’s ‘fundamentals’, amorphous qualities such as the morale of its employees or the cut of its chief executive’s jib. That was for the dinosaurs of Wall Street [...] who focused on factors such as what a company actually made

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and whether it made it well. Quants were agnostic on such matters, devoting themselves instead to predicting whether a company's stock would move up or down based on a dizzying array of numeric variables". It's an old story, actually. A similar conflict embroiled the earliest attempts, three centuries ago, to expand the nascent probability theory beyond its disreputable origins in games of chance. Historian Lorraine Daston writes

The mathematicians created a new approach to the subject that challenged the previous *practice* of risk, legal and otherwise. [...] It was as if the jurists and the commercial class they wrote for lived in a world of fine-grained detail where regularities were partial at best [...] It was not a world of constant surprises, but it was one where specific, up-to-the-minute, and above all personal knowledge counted, knowledge to be sifted and weighed by an old hand in the business. The mathematicians, in contrast, apparently lived in a world strictly governed by invariable laws that could be expressed as the function of a small number of variables. [...] The world of the mathematicians was simple, stable, and predictable. [6, Chapter 3.1]

How did that twilight struggle turn out? According to Boris Gnedenko[11], the probabilists were routed. To the early gambling studies there followed a profusion of "papers devoted to applications in various branches of the natural sciences and public life. Many of these had so little validity that they were considered 'mathematically scandalous affairs.' Disenchantment followed and among Western European mathematicians probability theory began to be thought of as some kind of mathematical entertainment hardly deserving serious attention."

Probability's association with gambling endangers more than just respectability. Human beings have natural intuitions about risk which are systematically violated by cards, dice, and roulette wheels. That is why casinos draw customers: For a risk junky, a trip to the casino is like watching a good magic act. As evolutionary psychologists have remarked, "If humans had evolved in casinos where their winnings translated into reproductive success, selection probably would have eliminated the gamblers fallacy." [13] In the real world, probability theory is a specialized adjunct to more natural human intuitions, not a substitute.

In Patterson's account, modern quantitative finance has its origins in the work of Ed Thorp, a mathematician who applied the Kelly Criterion to blackjack in his 1962 book *Beat the Dealer*, before turning the same principles to finance in *Beat the Market* (1967). Patterson makes clear (as do other sources) that Thorp himself has always been the farthest thing from a gambler by temperament, but his work (and his success) clearly helped to legitimate the finance-as-gambling metaphor, and some of his intellectual heirs now revel in high-stakes poker parties and junkets to Las Vegas casinos. Describing the credit derivatives group at Deutsche Bank around 2000, Patterson writes "In their downtime, Weinstein's traders would randomly bet on just about anything in sight: a hundred on the flip of a coin, whether it would rain in the next hour, whether the Dow would close up or down." The financial markets are "the world's biggest casino". While "investors" put up the money, the

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quants “place bets”: Bets on trade patterns, bets on currency exchange rates, bets on company growth and defaults, and bets on the bets that other traders would make.

There is nothing new about the accusation that financial transactions involving risk — insurance, stock purchases, futures contracts — differ only in name from gambling. Indeed (see [6, Chapter 3.2]) life insurance in the 16th and 17th centuries was generally a short-term bet on the life of some famous person. But usually the accusation is lobbed from the left, to be dismissed by the financiers as propaganda, ignorant of the vital work performed by capital markets. This tension was well expressed by J. M. Keynes in his *General Theory of Employment, Interest and Money*: “As the organisation of investment markets improves, the risk of the predominance of speculation does, however, increase. [...] Speculators may do no harm as bubbles on a steady stream of enterprise. But the position is serious when enterprise becomes the bubble on a whirlpool of speculation. When the capital development of a country becomes a by-product of the activities of a casino, the job is likely to be ill-done.” Patterson’s figures would no more dwell upon the needs of enterprise or capital development than on the irregular conjugations in Middle Assyrian. “Every day they went head-to-head on Wall Street, facing off in a computerized game of high-stakes poker in financial markets around the globe, measuring one another’s wins and losses from afar, but here [in their quant poker games] was a chance to measure their mettle face-to-face.”

The taste of traders for gambling raises troubling questions. One of the fundamental principles of investing is that risk has a price: A safe investment is worth more than a risky investment with the same average return. Quantitative finance is supposed to enable investors to trade their risk: those craving security can pay others, with deeper pockets or more taste for risk, to insure their risk. Needless to say, no one entering a casino ever needed to be paid a premium to accept a risk on their capital. Traditional accounts of behavioral finance, such as [?],

It’s not all gambling, of course. The multiple casino tables of the financial markets are linked by traditional financial principles of compound interest and arbitrage. Loans at interest have been around at least since the Code of Hammurabi, and arbitrage — the financial perpetual motion machine that arises from price discrepancies — animated the first itinerant trader. In principle, if you find the same asset being sold at different prices in different markets — Patterson uses the example of gold trading for \$1000 in New York and \$1050 in London — you can buy in one market and sell in the other to generate riskless profit. Back in the day, you would have needed to float gold bricks over the Atlantic, but today the only limit on your profits would be the amount of money you could borrow to leverage your initial capital, and the amount of gold you could buy in New York before they start raising the price. Once the interest is compounded, and joined to multiple overlapping markets, commodities, interest rates, bonds with different interest rates and maturities, securities that combine multiple other securities or are contracts on future values — it’s easy to see how all of these create a mathematical space of financial instruments in which finding the arbitrage combinations can be a fascinating

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problem, theoretically and practically. But it's also easy to see why genuine arbitrage opportunities are rarer than rubies.

*Statistical arbitrage* expands the possibilities, by allowing for randomness. Instead of working with discrepancies in current prices, it attempts to extract profits where current prices predict divergent future average expectations. Patterson is at his best when describing statistical arbitrage strategies, both the mechanisms and the psychology that gives birth to them. These all depend on inefficiencies in pricing mechanisms, which create short-term disequilibria that can generate profits as they reset.

Unless they don't. The book is punctuated by crises, large and small, where the expectation fails. A casino owner only needs to pump enough money through the system, and let the law of large numbers take care of the rest. In the financial markets all the "bets" are correlated, in hard-to-estimate ways, and the probabilities are only vaguely defined, estimated by analogy with the past. Pumping large quantities of borrowed money through these strategies can lead to a meltdown. The book is punctuated by crises, large and small, where the expectation is not realized. This should be no surprise, as there is no statistical difference between a failure of traditional patterns that arises from "inefficiencies", and one that arises from genuine changes in market relationships, or novel investor sentiment — or because the new quant strategies themselves are driving the market prices.

Arbitrage is a bit like dumpster diving. In an essay [7] unaccountably neglected by the economics elite, Lars Eighner formulated three rules for safely consuming discarded comestibles. The third rule is particularly relevant here: seeking always to answer the question "Why was this discarded?" Statistical arbitrage contradicts the principle of "efficient markets", that market prices incorporate all currently available information. There is no reason why this principle needs to be true — indeed, there are good reasons, well discussed in this book, to believe it is not — but mathematical market models generally depend on it. Thus, the computations of quantitative finance are largely based on the principle that these computations are a waste of time. Patterson repeatedly circles back to this paradox, which clearly troubles many of the quants. How can they consistently beat the market average? Some explanations on offer:

- **They're smarter than other people.** This seems to be, unsurprisingly, their favored explanation. Information doesn't sell itself, and it doesn't translate itself into asset prices. Traders who translate new information into prices can profit, a process that Patterson (in one of his more felicitous tropes) compares to throwing meat into a pool full of piranhas. The meat disappears quickly, but the piranhas do get fed. Now, Patterson describes the quants — with some notable exceptions — as unconcerned with anything so coarse as commerce, but their pattern-seeking is another way to integrate information, including past information and unrecognized persistent biases. By bringing new understanding to the processing of the financial information, they are grabbing scraps of the meat that the other piranhas have not yet found.

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- **Regulatory arbitrage.** Retail banks, pension funds, municipal governments, and many other institutional investors are tightly regulated, forced to make decisions based on crude categories. Laws constrain the sorts of risks they are allowed to take with the funds entrusted to them. By loaning the capital to hedge funds or investment banks the regulations vanish, a benefit sometimes called *regulatory arbitrage*. This is a bit like finding cans of soup on their sell-by date in the supermarket dumpster. Considerable theoretical ingenuity has gone into producing financial instruments, such as the now infamous auction-rate securities, that duplicate traditional banking functions within an unregulated securities framework. In 2008 Timothy Geithner, then president of the New York Federal Reserve and now U.S. treasury secretary, blamed this “shadow banking” sector for the collapse of confidence that had frozen world credit markets.
  - **Special privileges.** A significant portion of quant profits come from their access to information and trades closed to ordinary investors. Some are legitimate: They have top-of-the-line computer systems for bringing in market information, processing it, and executing trades automatically. They work for major international investment banks, or they win special treatment from the traders as large customers. Other sources of information are more dubious, particularly their awareness that their own vastly leveraged trades are moving the market. Indeed, many of the most lucrative trades are simply closed to outsiders. Michael Lewis’s wonderfully entertaining *The Big Short* tells of several groups of investors, either marginal or complete outsiders to Wall Street, who saw the collapse of mortgage-backed securities coming years before it happened. The big quants would have made a short sale in microseconds, but these people struggled for years to make the necessary contacts.
  - **They act crazy.** Patterson’s quants cultivate an aura of strangeness. Some gamble manically. Many defy Wall Street dress conventions. They organize company paintball tournaments. One rages at bad news and destroys computer monitors. One makes a show of busking in a Wall Street subway station. They rave about the Truth of “Alpha.”<sup>1</sup>

Patterson describes all this with amusement, as some blend of pimply math-nerd culture and plutocrat eccentricity. He never considers its strategic value. If Trader A makes a large sale of stock Z, he signals that he doesn’t think Z is worth holding at the current price, causing the price to drop. George Akerlof analyzed this problem in his famous study of the used car market, and came to the conclusion that this information imbalance — A knows why he sold, but B doesn’t — depresses prices, and can lead to a market-destroying downward spiral. If A appears crazy, or at least inscrutable, his trades will have less influence on the market. Eccentricity functions like the poker player’s dark glasses.

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<sup>1</sup> $\alpha$  is just the intercept term in a linear regression of an individual asset price against an overall market index, but the quants, or Patterson, or both, seem to confuse it with the cabalistic aleph.

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- **Complexity and Volatility.** Many statistical arbitrage strategies depend on volatility, and on complex relationships among derivatives. When these strategies have the effect of increasing volatility, and introducing new complexities to the system it is a vicious circle for the ordinary investors, but a steady source of profit for the quants.
  - **They're not.** If I were to sell budget earthquake insurance in California, I could make a fortune — until the earthquake. Economist Joseph Stiglitz, writing of the failure of market discipline in the face of confusing risk accounting, said “Firms that produce excessively risky products would lose their reputation. Share prices would fall. But in today’s dynamic world, this market discipline broke down. The financial wizards invented highly risky products that gave about normal returns for a while — with the downside not apparent for years. Thousands of money managers boasted that they could ‘beat the market’, and there was a ready population of shortsighted investors who believed them.” [17]

In the book we see a great deal of chest-thumping among the quants, about this or that strategy having yielded consistent profits “year after year”. The time from promising neophyte to leading a proprietary trading unit can be only a few years, so the incentive to define the earthquakes out of the model can be intense, particularly for someone who is temperamentally a gambler. Until the earthquake strikes he’s a genius, and after the quake does strike he still gets to keep his genius bonus. At the height of the last crisis one of Patterson’s heroes, Citadel Investment chief Ken Griffin, estimated that his company had a 55% chance of surviving.[12] How high do the annual returns need to be, to be worth occasionally risking everything on a coin flip?

Those who would like to understand better the theory — what is quantitative about the quants? — are likely to be disappointed in this book. For all that it has to say about mathematical thinking or the application of mathematical models, it could be *Harry Potter and the Volatility Smile*, with computers instead of wands. It’s all gesture and evocation. “Thorp’s models, scanning the market like heat-seeking missiles, sought out numerous good deals.” “The quants pulled out their calculators, cracked open their calculus books, and came up with solutions.” “Already the week before, the group had started to ease back on Midas’s [the automated trading platform] engine as the market’s haphazard volatility picked up steam.” Indeed, nearly every figure of any significance in the book is referred to as a “wizard” or a “whiz”. There is “quant alchemy” and the “dark art of securitization.”

This book is primarily a psychological portrait, more than a work of popular science. The explanatory work goes down best when it is a component of his portraits of mathematicians. Claude Shannon and Benoit Mandelbrot come particularly alive here. Where he does attempt to explain mathematical concepts Patterson tends to swagger and overcompensate with exaggerated and not very helpful metaphors. Perhaps most extreme is his introduction to the random walk. Not only does he adopt the “drunkard’s walk” imagery, he gives the drunkard a backstory (an artist celebrating a breakthrough) and tells us what he’s been drinking (absinthe). And he can’t drop it when he comes to

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discuss models which jumps, forcing his drunken artist to “hop from the cathedral of Notre Dame to the Sorbonne [...] in the blink of an eye.” He labels this unlikely, but you have to wonder who this image is really helping. Perhaps the only mathematically precise statement in the book — “a 27-standard-deviation event was tantamount to flipping a coin a hundred times and getting ninety-nine straight heads” — is simply wrong. (99 heads out of 100 is only a 10-standard-deviation event. In order to have the possibility of a normal 27-standard-deviation event you need to flip more than 500 straight heads.)

What we get instead is a portrait of unresolved adolescent conflict, shading into a pervasive sexual menace. “The money was huge, the women were beautiful, and everyone was brilliant and inside the secret. [...] At Deutsche Bank, risk wasn’t fucking *managed*. Risk was bitch-slapped, risk was tamed and told what to do.” The quants identify the “dinosaur” traders of Wall Street with all the privileged bullies who humiliated them on the playground and mocked their mathematical interests in high school, and they are burning for revenge. Patterson never says directly, but he seems to be channelling their overwrought fantasies into his narration: “A friend sent Muller congratulatory flowers for his new job. The bouquet was delivered to his desk on the trading floor. It was raw meat to the grizzled traders around him: *Look at the California quant boy and his pretty flowers.*” It is hard to imagine that the Goldman Sachs trading floor was literally a congress of graybeards, much less that the “California quant boy” took place outside Muller’s imagination. No matter how many billions they shovel into their own pockets, the quants’ wellspring of self-pity is never diminished.

It is especially their masculinity that feels constantly under attack. The repeated references to “Big Swinging Dicks” suggest that this is a term of art in the finance world, supplemented with such dulcet phrases as “billion-dollar balls-to-the-walls positions”. In the 1980s, we read, “quants were seen as second-class citizens at most trading firms, computer nerds who didn’t have the balls to take the kinds of risks that yielded the real money.” Thus begins one of the more fascinating vignettes of the book, told from the perspective of one Aaron Brown who was “sick of seeing the same rich kids he’d suckered at Harvard lord it over the quants in trading-floor games such as Liar’s Poker.” Liar’s Poker is a Wall Street game, involving a large number of people gambling on patterns in the serial numbers of \$100 bills. So Brown worked out a mathematically effective strategy and introduced it to his fellow quants. The strategy — engagingly explained by Patterson, by the way — involves some new ideas, but also collaboration among the quants. “Kidder’s traders were dumbfounded[...] The quants struggled to keep straight faces. Brown nearly doubled up with laughter.” The head trader calls. “He lost, but he refused to pay, accusing the quants of cheating. The quants just laughed, high-fiving. Brown had expected this. Traders never admit to losing.” Arguably, they did cheat. But to the quants all is permitted, in their struggle against oppression. “No longer would they stand at the end of the line and be victimized by the Big Swinging Dicks.”

It hardly seems like an environment to nurture female talent. Women in this book are peripheral objects: wives and girlfriends distracting the quants with the blandishments of 40-bedroom home and hearth; or a secretary, whose

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firing gives a clue to the mental state of her (male) boss. One exception is Kim Elsesser, not a wizard but a “highly gifted” mathematician and computer programmer. She plays a part in several amusing anecdotes, some revolving around the unreconstructed misogyny of the non-quant traders, but also her own balls-to-the-walls trades, and then disappears “to study gender issues in the workplace at UCLA.” It hardly surprised me, following on this book, to read of the recent lawsuit charging persistent gender discrimination at Goldman Sachs [5], or that the number of women working in U.S. finance has been dropping steadily [18].

Toward the end, after the crash, the book’s focus shifts. Skeptical academics take the stage (along with the irrepressible and omnipresent Nassim Taleb). Emanuel Derman and Paul Wilmott, who wrote back in 2000 about the dangerous misuse of mathematics in finance [20], produced a “modelers’ Hippocratic Oath”, five estimable vows of humility, concluding with “I understand that my work may have enormous effects on society and the economy, many of them beyond my comprehension”. There is no evidence that anyone in the finance world paid much attention. It seems about as effective as combatting the modelers’ anglophone parochialism by requesting that they vow: “I understand Chinese.” They need to be taught.

The mathematics culture of my student days still wielded “uselessness” à *Hardy* as the guarantor of a mathematician’s clean conscience. In the nearly 15 years since I am not aware that professional responsibility has become a more salient topic. The AMS has had a statement on professional ethics [2] — I have not found a similar statement by any other country’s major national mathematical organization — first promulgated in 1994, and last revised in 2005. Under the rubric “social responsibility of mathematicians” confidentiality and openness are both urged, each in its season, while the impact of mathematical work, when it “may affect the public health, safety or general welfare”, incurs an obligation merely “disclose the implications of their work to their employers and to the public, if necessary.” No obligation of due diligence is mentioned, much less to search out the potential dangers and put public safety at the center of their work.

Does the corner of mathematics called “mathematical finance” genuinely bear any responsibility for financial practice? Haug and Taleb [9] have debunked the mystique of the Black-Scholes-Merton formula, arguing (persuasively, if somewhat self-contradictorily) that the formula has never been applied in the real world, that equivalent calculations have been known and applied since the dawn of time, and that it is fundamentally misleading. Li’s copula formula (which Patterson describes as a phenomenon without really explaining) has been blamed for the collateralized debt obligation (CDO) fiasco [19], but it is so banal in itself that it seems more like an excuse than a real impetus to the CDO market.

But it takes more than uselessness to buy a clean conscience these days. University mathematics departments have served the finance industry with a steady stream of students trained to look past the reality of the world to an abstract realm of interchangeable entities; to accept models axiomatically, without question; and to defy mere common sense with pride. And at least as



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important, we have participated in what G. Bowker, in his history of cybernetics [4], has termed “legitimacy exchange” (though with a view to the huge blow suffered by the reputations of both groups, perhaps it might be called a “credibility default swap”.) The mathematicians, physicists, and software engineers with fancy degrees are tokens of seriousness, like the Picasso in the lobby, the marble columns, and the expensive watch. The investor may not understand your trading strategy, but if you have a team of MIT PhDs in the back room, well, of course no one understands mathematicians, but they are smart, and precise, and probably too naïve to be dishonest. In return for lending the reputation of their subject, academic mathematicians are compensated by sharing the financiers’ reputation as important people doing serious, practical work, and the enviable status as a conduit to high-paying careers, whether or not they personally pocketed consulting fees.

Faced with dwindling public esteem, defenders of quantitative finance have sought to mortgage their intellectual stature for a legitimacy loan from the engineering profession. Patterson picks up on this, writing in his final chapter that after the 2007-8 global financial crisis — in an apparent paraphrase of Steven Shreve [16], “few — aside from zealots such as Taleb — were calling for them to be cast out of Wall Street. That would be tantamount to banishing civil engineers from the bridge-making profession after a bridge collapse.” When a mathematician talks about building bridges, I reach for my wallet. In the course of an otherwise careful and thought-provoking analysis of the many sources of the crisis [10], Martin Hellwig averred that “One might as well blame the architect of the World Trade Center for not having taken the risk into account that kerosene-filled airplanes might be flown into the building.” As it happens, the lead structural engineer for the World Trade Center, John Skilling, told reporters in 1993 [14] that the towers *had* been designed to withstand a jet collision. “Our analysis indicated the biggest problem would be the fact that all the fuel would dump into the building. There would be a horrendous fire.” The collapse has since been extensively studied as an engineering failure, but thousands survived because of the safety measures that were built into the building. Cranking the 9/11 metaphor up another notch, David Hand, former president of the Royal Statistical Society, has compared bank executives to people who break into a 747 cockpit and crash the plane, by intention or incompetence. [8] The financial mathematicians in this analogy play the role of the innocent aeronautic engineers.

It is hard to imagine top civil engineering academics reacting with comparable nonchalance if they discovered that their best undergraduates were going on to careers, not building bridges, but taking out insurance contracts on bridges that they found were likely to fail. Or boasting of how their elite training and inherent brilliance enabled them to hoodwink the plodding inspectors with their second-class state-college degrees. The engineering analogy was eloquently demolished by Nicolas Bouleau, himself a financial mathematician, but significantly also a professor at the *École Nationale des Ponts et Chaussées*. His 2009 book *Mathematics and Financial Risk* [3] has a section titled “Engineering culture and financial culture”, which was published in substantially similar form in an earlier book in 1998, when academic programs calling themselves “financial engineering” were still fairly novel. The traditions and professional

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ethic of engineering “charges them with examining painstakingly what will happen in case of an accident, a fracture or conflagration, and to effect a repair.” Reliability analysis, he goes on, is the matrix of every project, to which all other considerations are subservient. And most important — and most alien to the finance world — engineers plan for the inevitability of failure: “It is possible to plan for only the more likely even of the foreseeable dangers. Under extreme conditions, the structure will surely fail [...]. How?”

The financial engineers installed no emergency exits. Every time investors panic and pull their money out, every time the margin call comes, every time the prices drift out of control of their models, every time their positions succumb to the attacks of their competitors, we see them railing at the unfairness of it all, at the failure of the world to conform to their mathematical models, or the perfidy of the competing finance sharks. Or they bull their way through with bold trades and macho appeals to their investors. Or they get bailed out by the government. Surely, one thinks, having seen how the difference between brilliance and bankruptcy can turn on the whims of a single deep-pocketed investor, or mob panic, or the faith of creditors, or a government decision to temporarily ban short-selling, surely they cannot still believe that there is an ineffable truth to the markets, to be captured in mathematical models and calculated to the fifth decimal place.

Perhaps they don't, really. It's hard to know how seriously to take this math-nerd naïveté, and it is one of the disappointments of this book that Patterson never challenges their self image as little boys on the seashore, collecting pretty pebbles that lo and behold! happen to be pure gold. In all the many hours of interviews, one has the impression, he was so eager to capture their private maunderings that he never asked an uncomfortable or challenging question. Here we have witnessed the most prodigious forced transfer of funds from the banking system to individual hands since John Dillinger, and yet the question of premeditation is never raised: the people who end up with the billions are declared to be innocent bystanders. Not guilty by reason of insouciance. The geek defense. More than that, we are invited by Patterson to pity the miserable quants for the stressful days and sleepless nights that they suffered, as they collaboratively crashed the global financial system. AQR didn't invite spouses to its swank company Christmas party! And everyone got drunk! “A quant nightmare. Markets were at the mercy of unruly forces such as panicked investors and government regulators.”

The precision of mathematical theory, combined with extreme financial leverage to focus significant portions of the world's financial power like a laser on single points, burns through even the most seemingly robust bulkheads of international economic order. In the 2008 crisis, the walls held, just barely. Patterson says his protagonists were “somewhat chastened,” but those who survived the crisis seem mainly to have believed their infallibility confirmed. The fact that ordinary people were forced to pour trillions of dollars of their meagre wealth and postpone their relatively modest life plans in order to rescue the financial system seems not to have registered on them at all. As the story ends, we see high-frequency computerized trading being driven at an accelerating pace, a practice which would soon lead to the May 2010 “flash

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crash” on the New York Stock Exchange, with a promise of greater instability to come.

The mighty quant barons of this story are not, it must be emphasized, the entire world of quantitative finance, and one longs for a latter-day quant Max Weber to map the lines of power and the percolation of ideology through the institutions. Until he or she arrives, Patterson has produced at least one plausible journalistic portrait of the past few decades of quantitative finance, one that is at least consistent with that we find in other recent books. It is a picture from outside the mathematical community, and it shows us how, whatever we may believe personally, the successes of financial mathematics will be largely privatized, while the failures will be hung around all of our necks. “Quant alchemy” indeed. By the end, I couldn’t help thinking of H. G. Wells’s famous takedown of Winston Churchill after the First World War: “He believes quite naïvely that he belongs to a peculiarly gifted and privileged class of beings to whom the lives and affairs of common men are given over, the raw material of brilliant careers.” The quant aristocrats have had their Gallipoli. How will they adapt? How will the mathematical community respond? After the last quant has done his turn on the economic stage, it now seems hard to imagine that anyone will want to erect a statue to his memory.

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