


THE QUANTS



How a New Breed of
Math Whizzes
Conquered Wall Street
and Nearly
Destroyed It

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Chapter 1: All In

Peter Muller stepped into the posh Versailles Room of the century-old St. Regis Hotel in midtown Manhattan and took in the glittering scene in a glance. It wasn't the trio of cut-glass chandeliers hung from a gilt-laden ceiling that caught his attention, nor the pair of antique floor-to-ceiling mirrors to his left, nor the guests' svelte Armani suits and gem-studded dresses. Something else in the air made him smile: the smell of money. And the sweet perfume of something he loved even more: pure, unbridled testosterone-fueled competition. It was intoxicating, and it was all around him, from the rich fizz of a fresh bottle of champagne popping open to the knowing nods and winks of his friends as he moved into a room that was a virtual murderer's row of topflight bankers and hedge fund managers, the richest in the world. His people.

It was March 8, 2006, and the Wall Street Poker Night Tournament was about to begin. More than a hundred well-heeled players milled about the room, elite traders and buttoned-down dealmakers by day, gambling enthusiasts by night. The small, private affair was a gathering of a select group of wealthy and brilliant individuals who had, through sheer brainpower and a healthy dose of daring, become the new tycoons of Wall Street. This high-finance *haut monde*—perhaps Muller most of all—was so secretive that few people outside the room had ever heard their names. And yet, behind the scenes, their decisions controlled the ebb and flow of billions of dollars coursing through the global financial system every day.

Mixed in with the crowd were professional poker players such as T. J. Cloutier, winner of sixty major tournaments, and Clonie Gowen, a blond Texan bombshell with the face of a fashion model and the body of a Playboy pinup. More important to the gathering crowd, Gowen was one of the most successful female poker players in the country.

Muller, tan, fit, and at forty-two looking a decade younger than his age, a wiry Pat Boone in his prime, radiated the relaxed cool of a man accustomed to victory. He waved across the room to Jim Simons, billionaire math genius and founder of the most successful hedge fund on the planet, Renaissance Technologies. Simons, a balding, white-bearded wizard of quantitative investing, winked back as he continued chatting with the circle of admirers hovering around him.

The previous year, Simons had pocketed \$1.5 billion in hedge fund fees, at the time the biggest one-year paycheck ever earned by a hedge fund manager. His elite team of traders, hidden away in a small enclave on Long Island, marshaled the most mind-bending advances in science and mathematics, from quantum physics to artificial intelligence to voice recognition technology, to wring billions in profits from the market. Simons was the rare investor who could make Muller feel jaw-clenchingly jealous.

The two had known each other since the early 1990s, when Muller briefly considered joining Renaissance before starting his own quantitative hedge fund

inside Morgan Stanley, the giant New York investment bank. Muller's elite trading group, which he called Process Driven Trading, was so secretive that even most employees at Morgan weren't aware of its existence. Yet over the previous decade the group, composed of only about fifty people, had racked up a track record that could go toe-to-toe with the best investment outfits on Wall Street, cranking out \$6 billion in gains for Morgan.

Muller and Simons were giants among an unusual breed of investors known as "quants." They used brain-twisting math and superpowered computers to pluck billions in fleeting dollars out of the market. By the early 2000s, such tech-savvy investors had come to dominate Wall Street, helped by theoretical breakthroughs in the application of mathematics to financial markets, advances that had earned their discoverers several shelves of Nobel Prizes. The quants applied those same breakthroughs to the highly practical, massively profitable practice of calculating predictable patterns in how the market moved and worked.

These computer-driven investors 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, the Warren Buffetts and Peter Lynches of the world, investors who focused on factors such as what a company actually made 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 numerical variables such as how cheap it was relative to the rest of the market, how quickly the stock had risen or declined, or a combination of the two—and much more.

That night at the St. Regis was a golden hour for the quants, a predators' ball for the pocket-protector set. They were celebrating their dominance of Wall Street, just as junk bond kings such as Michael Milken had ruled the financial world in the 1980s or swashbuckling, trade-from-the-hip hedge fund managers such as George Soros had conquered the Street in the 1990s.

Muller flicked a lock of sandy brown hair from his eyes and snatched a glass of wine from a passing tray, looking for his friends. A few nonquants, fundamental investors of the old guard, rubbed elbows with the quant crowd that night. David Einhorn, the boy-faced manager of Greenlight Capital (so named when his wife gave him the green light to launch a fund in the 1990s), could be seen chatting on a cell phone by a tall, narrow window overlooking the corner of 55th Street and Fifth Avenue. Just thirty-seven years old, Einhorn was quickly gaining a reputation as one of the sharpest fundamental investors in the business, putting up returns of 20 percent or more year after year. Einhorn was also an ace poker player who would place eighteenth in the World Series of Poker in Las Vegas the following year, winning \$659,730.

The next billionaire Muller spotted was Ken Griffin, the blue-eyed, notoriously ruthless manager of Chicago's Citadel Investment Group, one of the largest and most successful hedge funds in the business. Grave dancer of the hedge funds, Citadel was known for sweeping in on distressed companies and gobbling up the remains of the bloodied carcasses. But the core engines of his fund were computer-driven mathematical models that guided its every move. Griffin, who sported a nonsense buzz cut of jet-black hair, was the sort of man who triggered a dark sense

of foreboding even in close associates: Wouldn't want to mess with Ken in a dark alley. Does he ever smile? The guy wants to be king of everything he touches.

“Petey boy.”

Muller felt a jolt in his back. It was his old friend and poker pal Cliff Asness, manager of AQR Capital Management, among the first pure quant hedge funds. Asness, like Muller, Griffin, and Simons, was a pioneer among the quants, having started out at Goldman Sachs in the early 1990s.

“Decided to grace us tonight?” he said. Asness knew Muller wouldn't miss this quant poker coronation for the world. Muller was obsessed with poker, had been for years.

He'd recently roped Asness into a private high-stakes poker game played with several other traders and hedge fund hotshots in ritzy Manhattan hotel rooms. The game had a \$10,000 buy-in, couch cushion change to topflight traders such as Asness and Muller.

The quants ran the private poker game, but more traditional investment titans joined in. Marc Lasry, manager of Avenue Capital Group, the \$12 billion hedge fund that would hire former first daughter Chelsea Clinton later that year, was a regular. Lasry was known for being a cool investor whose icy demeanor belied his let-it-roll mentality. He was said to have once wagered \$100,000 on a hand without even looking at his cards. And won.

The real point of Asness's needle was that he never knew when the globetrotting Muller would be in town. One week he'd be trekking in Bhutan or white-water rafting in Bolivia, the next heli-skiing in the Grand Tetons or singing folk songs in a funky cabaret in Greenwich Village. Muller had even been spotted belting out Bob Dylan tunes in New York's subway system, his keyboard case sprinkled with coins from charitable commuters with no idea the seemingly down-on-his-luck songster was worth hundreds of millions and flew around in a private jet.

Asness, a stocky, balding man with a meaty face and impish blue eyes, wore khaki pants and a white tee peeking out from his open collar. He winked, stroking the orange-gray stubble of his trimmed beard. Though he lacked Muller's savoir faire, Asness was far wealthier, manager of his own hedge fund, and a rising power in the investment world. His firm, AQR, short for Applied Quantitative Research, was managing \$25 billion and growing fast.

The year before, Asness had been the subject of a lengthy and glowing profile in the *New York Times Magazine*. He was a scourge of bad practices in the money management industry, such as ridiculously high fees at mutual funds. And he had the intellectual chops to back up his attacks. Known as one of the smartest investors in the world, Asness had worked hard for his success. He'd been a standout student at the University of Chicago's prestigious economics department in the early 1990s, then a star at Goldman Sachs in the mid-1990s before branching out on his own in 1998 to launch AQR with \$1 billion and change, a near record at the time. His ego had grown along with his wallet, and so, too, had his temper. While outsiders knew Asness for his razor-sharp mind tempered by a wry, self-effacing sense of humor, inside AQR he was known for flying into

computer-smashing rampages and shooting off ego-crushing emails to his cowed employees at all hours of the day or night. His poker buddies loved Asness's cutting wit and encyclopedic memory, but they'd also seen his darker side, his volatile temper and sudden rages at a losing hand.

"Here comes Neil," Asness said, nodding toward Neil Chriss. A quiet, cerebral mathematician with degrees from the University of Chicago and Harvard, Chriss had cut his teeth on Wall Street at Morgan Stanley, where he'd met Muller. In 1998, he took a job at Goldman Sachs Asset Management just after Asness had left. By 2004, Chriss was quietly building a cutting-edge quant machine at a giant hedge fund called SAC Capital Advisors, run by the eccentric and reclusive tycoon Steve A. Cohen. He was also a member of the quants' poker-playing inner circle.

"Seen Boaz?" Chriss asked, scanning the room. They looked for the fourth member of their private poker game, Boaz Weinstein. Just thirty-three, Weinstein was head of all credit trading in the United States at Deutsche Bank, the German behemoth. A chess "life master," he'd made vice president at Deutsche in 1999 at the tender age of twenty-five. Two years later, he was named a managing director of the firm, one of the youngest in the bank's history. He ran a wildly successful internal hedge fund at Deutsche that he planned to name Saba, Hebrew for "wise grandfather" (in honor of his own saba). A few times a year, Weinstein jetted off to Las Vegas along with members of MIT's secretive blackjack team, several of whom had worked on Deutsche's trading floor. The team had already gained fame in the bestseller *Bringing Down the House* and was soon to get the Hollywood treatment in the movie *21*. People who knew him said Weinstein's name was on more than one Vegas casino's blacklist.

He didn't care. There were plenty of casinos, none better than the one he played in every day from his third-floor office in downtown Manhattan. Wall Street.

"Over there," said Muller, pointing to Weinstein, dough-faced, brown-haired, typing rapidly on a BlackBerry while chatting up Gowen. Asness whistled and cleared his throat.

The players soon got down to business. A melodic chime summoned stragglers into the main room, where vested dealers waited behind scattered rows of card tables, fresh decks arrayed in wide rainbows before them. The game was Texas Hold'em.

The action was cordial on the surface, cutthroat between the lines. It was a charity event, after all. Nearly \$2 million in proceeds would go to support a math program for New York City's public schools—a fitting beneficiary, as the players were Wall Street's glorified mathletes. Muller, Asness, Griffin, and Weinstein were all quants. Math was the very air they breathed. Even the custom-made poker chips at the event were stamped with the names of mathematical river gods such as Isaac Newton.

The potent combination of their mathematical brilliance, feverishly competitive natures, and out-on-the-edge gambling instincts led to an almost fanatical obsession with poker—the odds, the looping mental games, the bluffing (if I bet this much, he'll think that I think that he thinks . . .). Asness didn't take the game as seriously as Muller, Weinstein, and Chris did. He'd picked it up in the past few

years after an internal tournament at AQR (which he happened to win). But the guys he was playing against were insane about poker. Muller had been frequenting poker halls since the 1980s during his days as a young quant in Berkeley, California. In 2004, he'd become so serious about the game—and so good at it—that he joined the World Poker Tour, pocketing nearly \$100,000 in winnings. He played online poker obsessively and even toyed with the bizarre notion of launching an online poker hedge fund. Weinstein, more of a blackjack man, was no slouch at the poker table, having won a Maserati in a 2005 NetJets poker tournament. Griffin simply hated to lose to anyone at anything and approached the poker table with the same brainiac killer instinct that infused his day-to-day trading prowess.

No matter how hard they might play elsewhere, no poker game mattered more than when the gamblers around the table were their fellow quants. It was more than a battle of wits over massive pots—it was a battle of enormous egos. 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 was a chance to measure their mettle face-to-face. Each had his own particular strategy for beating the market. Griffin specialized in finding cheap bonds through mathematical formulas, or, via the same logic, cheap, down-on-their-luck companies ripe for the picking. Muller liked to buy and sell stocks at a superfast pace using Morgan Stanley's high-powered computers. Asness used historical tests of market trends going back decades to detect hidden patterns no one else knew about. Weinstein was a wizard with credit derivatives—securities whose value derives from some underlying asset, such as a stock or a bond. Weinstein was especially adept with a newfangled derivative known as a credit default swap, which is essentially an insurance policy on a bond.

Regardless of which signature trade each man favored, they had something far more powerful in common: an epic quest for an elusive, ethereal quality the quants sometimes referred to in hushed, reverent tones as the Truth.

The Truth was a universal secret about the way the market worked that could only be discovered through mathematics. Revealed through the study of obscure patterns in the market, the Truth was the key to unlocking billions in profits. The quants built giant machines—turbocharged computers linked to financial markets around the globe—to search for the Truth, and to deploy it in their quest to make untold fortunes. The bigger the machine, the more Truth they knew, and the more Truth they knew, the more they could bet. And from that, they reasoned, the richer they'd be. Think of white-coated scientists building ever more powerful devices to replicate conditions at the moment of the Big Bang to understand the forces at the root of creation.

It was about money, of course, but it was also about proof. Each added dollar was another tiny step toward proving they had fulfilled their academic promise and uncovered the Truth.

The quants created a name for the Truth, a name that smacked of cabalistic studies of magical formulas: alpha. Alpha is a code word for an elusive skill certain individuals are endowed with that gives them the ability to consistently beat the

market. It is used in contrast with another Greek term, beta, which is shorthand for plain-vanilla market returns anyone with half a brain can achieve.

To the quants, beta is bad, alpha is good. Alpha is the Truth. If you have it, you can be rich beyond your wildest dreams.

The notion of alpha, and its ephemeral promise of vast riches, was everywhere in the hedge fund world. The trade magazine of choice for hedge funds was called Alpha. A popular website frequented by the hedge fund community was called Seeking Alpha. Several of the quants in the room had already laid claim, in some form or another, to the possession of alpha. Asness named his first hedge fund, hatched inside Goldman in the mid-1990s, Global Alpha. Before moving on to Morgan in 1992, Muller had helped construct a computerized investing system called Alphabuilder for a quant farm in Berkeley called BARRA. An old poster from a 1960s film noir by Jean-Luc Godard called Alphaville hung on the walls of PDT's office in Morgan's midtown Manhattan headquarters.

But there was always a worry haunting the beauty of the quants' algorithms. Perhaps their successes weren't due to skill at all. Perhaps it was all just dumb luck, fool's gold, a good run that could come to an end on any given day. What if the markets weren't predictable? What if their computer models didn't always work? What if the truth wasn't knowable? Worse, what if there wasn't any Truth?

In their day jobs, as they searched for the Truth, channeling their hidden alpha nerds, the quants were isolated in their trading rooms and hedge funds. At the poker table, they could look one another in the eye, smiling over their cards as they tossed another ten grand worth of chips on the table and called, looking for the telltale wince of the bluffer. Sure, it was a charity event. But it was also a test. Skill at poker meant skill at trading. And it potentially meant something even more: the magical presence of alpha.

As the night rolled on, the quants fared well. Muller chalked up victories against Gowen and Cloutier in the early rounds. Weinstein was knocked out early, but Muller and Asness kept dominating their opponents. Griffin made it into the final ten before running out of luck and chips, as did Einhorn. The action got more intense as the hour grew late. Around 1:30 a.m., only three players were left: Muller, Asness, and Andrei Paraschivescu, a portfolio manager who worked for Griffin at Citadel.

Asness didn't like his first two cards on the next deal and quickly folded, happy to wait for a better draw, leaving the pot to Muller and Paraschivescu. The crowd fell quiet. The incessant honking city whir of Fifth Avenue penetrated the suddenly hushed room.

Breaking the silence, Griffin shouted a warning to his underling: "Andrei, don't bother coming into work next week if you don't knock Pete out." Some in the crowd wondered if he meant it. With Griffin, you never knew.

The room went quiet again. Paraschivescu lifted a corner of the two cards facedown on the table before him. Pair of fours. Not bad. Muller bent the corner of his two cards and eyed a pair of kings. He decided to go all in, sweeping his chips

into the pot. Suspecting a bluff, Paraschivescu pushed his mound of chips forward and called, flipping over his pair of fours. Muller showed his kings, his only show of emotion a winsome glint in his blue eyes. A groan went up from the crowd, the loudest from Griffin. The other cards dealt in the hand couldn't help Paraschivescu, and he was out.

It was down to Muller and Asness, quant versus quant. Asness was at a huge disadvantage. Muller outchipped him eight to one after having taken Paraschivescu to the cleaners. Asness would have to win several hands in a row to even have a chance. He was at Muller's mercy. Griffin, still smarting from his ace trader's loss, promised to donate \$10,000 to Asness's favorite charity if he beat Muller. "Aren't you a billionaire?" Asness chortled. "That's a little chintzy, Ken."

After the deal, Muller had a king and a seven. Not bad, but not great. He decided to go all in anyway. He had plenty of chips. It looked like a bad move: Asness had a better hand, an ace and a ten. As each successive card was dealt, it looked as though Asness was sure to take the pot. But on the final card, Muller drew another king. Odds were against it, but he won anyway. The real world works like that sometimes.

The crowd applauded as Griffin rained catcalls on Muller. Afterward Muller and Asness posed for photos with their silver trophies and with Clonie Gowen flashing a million-dollar smile between them. The biggest grin belonged to Muller.

As the well-heeled crowd of millionaires and billionaires fanned into the streets of Manhattan that night, they were on top of the world. The stock market was in the midst of one of the longest bull runs in history. The housing market was booming. Economists were full of talk of a Goldilocks economy—not too hot, not too cold—in which steady growth would continue as far as the eye could see. A brilliant Princeton economist, Ben Bernanke, had just taken over the helm of the Federal Reserve from Alan Greenspan. In February 2004, Bernanke had given a speech in Washington, D.C., that captured the buoyant mood of the times. Called "The Great Moderation," the speech told of a bold new economic era in which volatility—the jarring jolts and spasms that wreaked havoc on people's lives and their pocketbooks—was permanently eradicated. One of the primary forces behind this economic Shangri-la, he said, was an "increased depth and sophistication of financial markets."

In other words, quants, such as Griffin, Asness, Muller, Weinstein, Simons, and the rest of the math wizards who had taken over Wall Street, had helped tame the market's volatility. Out of chaos they had created order through their ever-increasing knowledge of the Truth. Every time the market lurched too far out of equilibrium, their supercomputers raced to the rescue, gobbling up the mispriced securities and restoring stability to the troubled kingdom. The financial system had become a finely tuned machine, humming blissfully along in the crystalline mathematical universe of the quants.

For providing this service to society, the quants were paid handsomely. But who could complain? Average workers were seeing their 401(k)s rise with the market, housing prices kept ticking ever upward, banks had plenty of money to lend, prognosticators imagined a Dow Jones Industrial Average that rose without fail,

year after year. And much of the thanks went to the quants. It was a great time to be alive and rich and brilliant on Wall Street.

The money poured in, *crazy* money. Pension funds across America, burned by the dot-com collapse in 2000, rushed into hedge funds, the favored vehicle of the quants, entrusting their members' retirement savings to this group of secretive and opaque investors. Cliff Asness's hedge fund, AQR, had started with \$1 billion in 1998. By mid-2007, its assets under management neared \$40 billion. Citadel's kitty topped \$20 billion. In 2005, Jim Simons announced that Renaissance would launch a fund that could juggle a record \$100 billion in assets. Boaz Weinstein, just thirty-three, was wielding roughly \$30 billion worth of positions for Deutsche Bank.

The growth had come rapid-fire. In 1990, hedge funds held \$39 billion in assets. By 2000, the amount had leapt to \$490 billion, and by 2007 it had exploded to \$2 trillion. And those figures didn't capture the hundreds of billions of hedge fund dollars marshaled by banks such as Morgan Stanley, Goldman Sachs, Citigroup, Lehman Brothers, Bear Stearns, and Deutsche Bank, which were rapidly transforming from staid white-shoe bank companies into hot-rod hedge fund vehicles fixated on the fast buck—or the trillions more in leverage that juiced their returns like anabolic steroids.

The Great Hedge Fund Bubble—for it was a true bubble—was one of the most frenzied gold rushes of all time. Thousands of hedge fund jockeys became wealthy beyond their wildest dreams. One of the quickest tickets to the party was a background in math and computer science. On Wall Street Poker Night in 2006, Simons, Griffin, Asness, Muller, and Weinstein sat at the top of the heap, living outsized lives of private jets, luxury yachts, and sprawling mansions. A year later, each of the players in the room that night would find himself in the crosshairs of one of the most brutal market meltdowns ever seen, one they had helped to create. Indeed, in their search for Truth, in their quest for alpha, the quants had unwittingly primed the bomb and lit the fuse for the financial catastrophe that began to explode in spectacular fashion in August 2007.

The result was possibly the biggest, fastest, and strangest financial collapse ever seen, and the starting point for the worst global economic crisis since the Great Depression.

Amazingly, not one of the quants, despite their chart-topping IQs, their walls of degrees, their impressive Ph.D.'s, their billions of wealth earned by anticipating every bob and weave the market threw their way, their decades studying every statistical quirk of the market under the sun, saw the train wreck coming.

How could they have missed it? What went wrong? A hint to the answer was captured centuries ago by a man whose name emblazoned the poker chips the quants wagered with that night: Isaac Newton. After losing £20,000 on a vast Ponzi scheme known as the South Sea Bubble in 1720, Newton observed: "I can calculate the motion of heavenly bodies but not the madness of people."