

CHAPTER 1

Quake

“Take aggressive risks, but manage losses.”

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On the morning of August 6, 2007, a Monday, I arrived early at WorldQuant's office in Old Greenwich, Connecticut. I had a lot on my mind: I was in the middle of moving, my head filled with the logistical details of movers, schedules, and the kids. By 10 a.m., however, I knew something was wrong. We had been hit, seemingly out of nowhere, by a wave of losses on our statistical-arbitrage trades – a strategy, common to a hedge fund firm like WorldQuant, that takes advantage of pricing differentials between related financial securities.

As the hours ticked by, anxiety quietly gripped the office. Because our trading is automated, the atmosphere at a quantitative investment management firm like WorldQuant resembles a library far more than it does a frantic trading floor. Nobody's screaming or rushing around. But that Monday you could feel the tension. There was little laughter, and the portfolio managers, clearly nervous, drifted in to discuss their exposures. The next day it got worse.

WorldQuant had been in existence for only six months, although I had been engaged in quantitative trading, which involves using sophisticated math and large amounts of data to identify trading opportunities, since 1995. At WorldQuant we had poured resources into developing about a hundred predictive algorithms we call alphas: mathematical expressions and computer source code that we rigorously back-test before putting them into production in live investment strategies. All that effort went into ensuring that we *wouldn't* take a hit like the one we were suffering. We knew that individual alphas regularly weaken or fail, and we were no strangers to drawdowns – we experienced significant declines roughly once a year back then. But our alphas were not supposed to fail collectively. This was bad.

You know what they say: When the CEO moves into a new house, it's a signal to sell. What we didn't know immediately was that similar losses were hitting our competitors at other quant firms. Renaissance Technologies, D.E. Shaw, AQR, and Highbridge Capital Management all saw their finely honed strategies take a sudden nosedive. Goldman Sachs, which at the time had one of the largest

quant books – \$165 billion – eventually lost more than 30%. Just like us, our rivals must have been struggling to figure out what had happened and why it seemed to be happening just to quant firms.

There had been some ominous signs in the surrounding financial world. For much of the summer, fallout from the unfolding subprime mortgage crisis had been sending shock waves through the markets. Bear Stearns was forced to close two mortgage-backed credit funds, and there were signs that European banks were growing wary of lending to one another. But our investment strategies were designed to be market neutral – that is, uncorrelated with the broader market. Those subprime issues, in theory, should not have affected the quantitative strategies we employed at WorldQuant. But then, nearly every quant shop probably thought the same way.

Quant firms are only a slice of the hedge fund world, which in turn is only part of the investing universe. Though firms like WorldQuant were hit hard on August 6, 2007, there were no signs of a broader collapse. The next day the Federal Reserve decided to leave interest rates unchanged. Stocks fell after the announcement, then recovered; that week the S&P 500 edged down only very slightly.

As we tried to figure out what had happened, all we really knew was that our relative-value and statistical-arbitrage alphas were not working, as if their plugs had been pulled. We suspected that someone out there had taken a hit and was liquidating, setting off a chain reaction of selling, but we lacked the time, the distance, and the data to comprehend fully what was going on. We watched nervously as the problem spread from the U.S. to Japan.

Over my trading career I'd learned a number of lessons that had served me well: *Don't get emotional about your trades. React instantly to bad news. If it's scary, run. Take aggressive risks, but manage losses.* Back in August 1998, when I was just building my trading portfolio, the Russian government suddenly devalued the ruble and defaulted on its debt. In the resulting violent drawdown, I saw my entire year's gains evaporate in a few days. A month after that, hedge fund firm Long-Term Capital Management needed a

bailout by major banks to avoid causing damage to the American financial system. Now, almost nine years to the day later, that chaotic time was on my mind.

The problem of looking ahead, of course, is that you can't know how big or how long the declines will be. After the first losses on Monday, I made the decision to start liquidating the entire portfolio on Tuesday, giving up all the year-to-date profits. Some of this was my memory of the Russian default, when I held on too long, and some was intuition – observing the fear in people's eyes. Liquidating was difficult to swallow, but on Wednesday the carnage deepened, and we felt lucky to be out of it. On Thursday I came into the office early and made a decision to jump back in with 50% of our capital. I was aware that the market could sweep lower, but once again I was relying on intuition – not just on instinct, but on instinct shaped by experience.

In fact, the markets righted themselves as suddenly as they had declined. Just like that, most of the participants were making money again, though we took a few months to get back to 100% invested. We ended up having a pretty solid year. But those who hesitated to sell, had trouble liquidating, or sold into the recovery doubled their pain.

That August 2007 episode became known as “the quant quake,” and it contained a number of lessons: There are risks that you've never thought about, and there are uncertainties. Sometimes you have to act quickly with too few data points. At WorldQuant we may practice quantitative trading, but we also know when to rely on intuition born of experience.



The firm went on to generate stable returns again, and as we accumulated the alphas that we use to build strategies, we experienced fewer significant drawdowns. In the industry the quant quake triggered a rethinking of investment models and a considerable amount of debate. Were too many quantitative hedge funds chasing the same strategies and eliminating the profits? What *did* happen in early August 2007?

To this day the evidence remains circumstantial and no one really knows for sure what set off the quake. But in the subsequent years, we've developed a better idea thanks to academic research. A month or so after the quake, two finance academics, MIT's Andrew Lo and Amir Khandani, tried to unravel what had happened by building quant portfolios and simulating the episode – in a sense, running the history backward. They concluded that somewhere in the markets a large player – Lo and Khandani thought it was a bank, but Bob Litterman, who ran Goldman's quant fund at the time, later argued it was a multistrategy hedge fund – may have taken a hit and quickly sold a large relative-value position to respond to credit-related margin calls or to take risk-reduction measures. Given what was going on at the time, there may have been a link to the growing subprime mortgage problem. Liquidating positions in turn put pressure on quant firms with similar positions heavily invested in equities, made worse by leverage, which magnifies gains in rising markets and losses in falling ones.

Then a contagion effect developed, with the stress in one part of the market spreading to others. Prices fell, and the more they fell, the worse it got. The fact that the quant quake seemed to target relative-value trades may have been a coincidence, but it did suggest that unrelated markets had inadvertently grown more correlated, creating a so-called crowded trade without realizing it, and raising the risk for everyone.

We would see far broader and more dangerous correlations emerge when the global financial crisis broke upon us all. When Lehman Brothers collapsed in September 2008, WorldQuant had another scare: Lehman was our prime broker in Asia and Europe, and its failure meant we couldn't trade our overseas portfolios for several days. But in this case, at least, we knew what the problem was. We quickly negotiated a new prime brokerage relationship and got back into the market in about a week.

As the world struggled to recover from the financial crisis, WorldQuant continued to perform and grow. Today we believe our greatest growth is still ahead of us. We have seen remarkable increases in people and data, computing power and market

experience. In fact, it has become clear to me that we are part of an *exponential* revolution in quantitative finance.

What does that mean? I believe that nearly all aspects of WorldQuant's business, and perhaps our broader business lives, are undergoing not linear but exponential growth. As a result, goals that seem shocking today will look normal tomorrow and useless the day after. Exponential thinking requires audacity, not complacency. It means not believing in limits, which are temporary and meant to be broken. It calls for risk-taking as a way of life. In exponential thinking the terrain ahead is always unknown. In unknown terrain there are always bumps; it's a world of turbulence and risk. And the rewards are growing exponentially for those who can digest all this information.

When WorldQuant launched, in 2007, we had 37 employees. Today we employ more than 600 researchers, portfolio managers, technologists, and support staff in 25-plus offices around the world, including over 125 Ph.D.s. Though the number of alphas at our command seemed large in 2007 – and it was, relatively speaking – it has since exploded. We now have more than 10 million alphas archived in the WorldQuant databases, and over the short term our goal is 100 million in the next few years and 1 billion in five to 10 years. That's big, exponential growth, which we expect to happen.

We have built WorldQuant around a handful of core ideas.

Alphas, like ideas, are infinite. Trading can be taught. We believe we hold the future of trading in our hands. We believe that talent is statistically distributed globally but opportunity is not, so we must go out and try to match talent to opportunity. The competitive demands of the market drive us to reach out and continually seek a diversity of opinion – and of ideas, which produce alphas. That's one of the lessons of the quant quake: Don't get sucked into a crowded trade. Think differently.

This means three things. First, WorldQuant is, in part, a technology company that must operate globally to tap talent. Second, WorldQuant is a global *alpha factory*, whose output is an ever-growing stream of diverse investment ideas. Last, WorldQuant must shape itself by exponential thinking – by thinking big. Our view is

that with great success comes great responsibility. And some of that sense of responsibility extends to educational efforts, particularly in quantitative fields.

Among the most important responsibilities is translating these core beliefs into concrete actions, finding ways to use WorldQuant's insights and resources to provide people around the world with opportunities to develop and demonstrate their talents.

In 2014 we launched the WorldQuant Challenge, inviting participants to build high-quality alphas. It's part competition, part learning opportunity – contestants use and experiment with our proprietary simulation and back-testing software, WebSim. Just as impressive as the alphas we've seen generated have been the locations from which they were generated. We've had participants hailing from the eastern coast of India to rural China, reinforcing the fact that a few major cities, or even a few countries, don't have a monopoly on talent or great investment ideas.

In 2009 we started the WorldQuant Foundation, which furthers charitable initiatives, including making high-quality education more accessible worldwide, through targeted donations to organizations and helping students continue their journey in education. To date, we've offered scholarships to talented individuals who have graduated from esteemed universities in China, the Middle East, and the U.S.

It struck me that we use technology at WorldQuant to scale our business – why couldn't we use technology to "scale" high-quality education, making it more readily available for students around the world? I wanted to start with a subject that I knew well: quantitative finance. That's why in 2015 we launched WorldQuant University, which offers a free, online master's degree in financial engineering. Two years into the program, we now have about 1,800 students in more than 90 countries. To be clear, the goal of WorldQuant University is to make high-quality education more accessible, not to be a recruiting tool. Therefore, as part of our nonprofit mission, we have agreed not to hire any WorldQuant University graduates for at least a full year after their graduation. Instead, the goal of WorldQuant University is to enable students to

become leaders in their communities and fields, further spurring community and industry development.

Underpinning each of these initiatives is my belief in the power of education, in the ability of learning and technology to open the door of opportunity for talented, motivated individuals around the world.

This book brings together aspects of my life, work, and thought. It's part memoir; part my thoughts on markets, math, and science; and part my reflection on what has and hasn't worked in my life and my profession. It's about the development of powerful computing tools and my discovery of computer programming and computer simulation, initially in video games. It's about the interaction of machines, data, and humans. Not surprisingly, a major preoccupation is the nature of financial markets: complex, self-organizing systems that are as natural as the weather, waves, earthquakes, evolution, and deep structures of physics, biology, and math. Prediction is difficult in these complex systems, and disasters always seem to come as a surprise. Quantitative investing is shaped by probability, randomness, correlation, and the law of large numbers.

Two underlying themes provide the focus for *The UnRules*. First, there is the notion of rules – and the central, paradoxical UnRule that no rule or model or alpha is perfect or will survive forever in an ever-changing world. This UnRule is a reality of the trading markets that also applies to life. Some rules will fade as conditions change. Some will prove less effective as a result of their success. Others will recognize their potency and rush to copy them – a phenomenon known as arbitrage. An alpha is a kind of rule, or at least a hypothesis, usually about some relation in the market that will affect securities, a signal amid the market noise. (We will explore these algorithms, which connect man to machine, much more deeply in this book.) As a guide to life and trading, these rules reflect both the universe my colleagues and I created at WorldQuant, with its quantitative strategy, powerful simulation software, and global development of alphas, and the lessons of my own journey from Soviet servitude to American freedom.

I am often asked how I came to start WorldQuant. Every society, in every age, has placed a high premium on success and money. For some, of course, the goal is frankly material. For others, material goods are a means to other ends: not personal property or a giant bank account, but the ability to pursue goals free of material want, to secure the well-being of those they love and those who depend upon them, confident that their property will not be stolen by thieves or capriciously expropriated by those in power. The freedom to pursue a wide range of goals is part of what allows a society to call itself free – along with the understanding that people differ in what they wish for out of life.

Countless books, courses, and self-help programs promise the accumulation of wealth. I've looked into any number of them. My conclusion? Wealth results from a clearly understood goal and a set of personality traits more than from any particular set of abilities or tricks.

Almost no one begins life with a clear set of goals. Nearly everyone stumbles upon them – some sooner, some later, some never. Goals evolve, shaped by experience and hammered into place by an individual's response to challenge and change. I have had about 30 jobs in my life, and I've lived in about 30 places. My journey has been far from glamorous, and it's left a deep imprint on my psyche. Looking back, I can see how my early life in what then was the Soviet Union, my family's determination to seek freedom, and the jobs I took to help them and support myself all laid the foundation for what came later – and in particular for WorldQuant. Those experiences also left me committed to the values that now guide my life: hard work; persistence; respect for others; uncompromising ethics; gratitude; and the desire for love, family, success, and, especially, self-determination.

That journey began in Minsk.