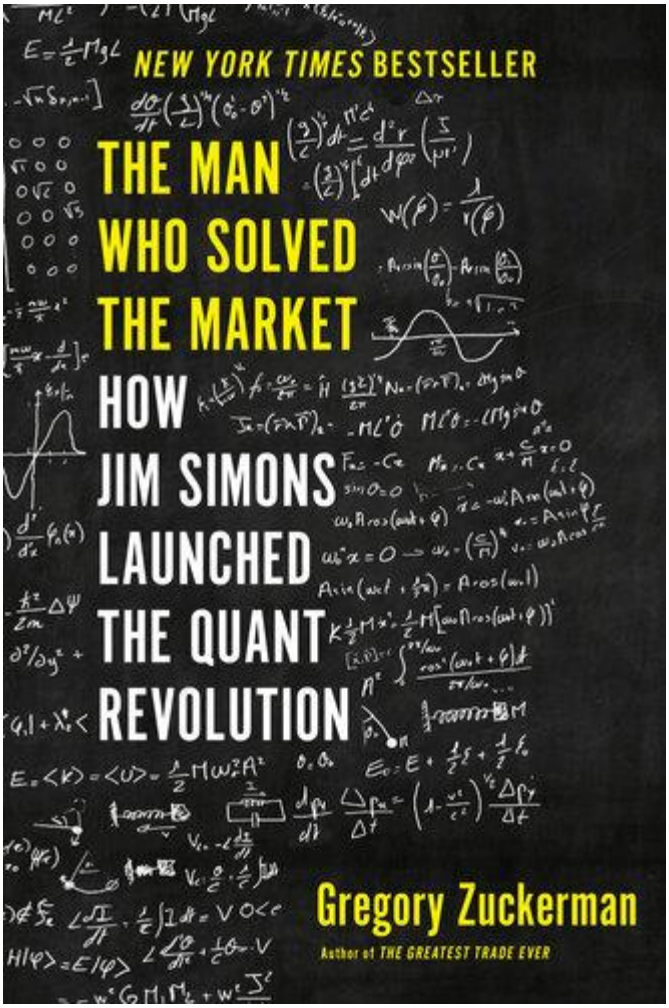
Excepts from
"The Man Who Solved the Market: How Jim Simons Launched the Quant Revolution"
by Gregory Zuckerman | 2019 | Penguin Publishing Group



Introduction

I've tried to tell Simons's story in a way that will appeal to the general reader as well as to professionals in quantitative finance and mathematics. I will refer to **hidden Markov models**, kernel methods of machine learning, and stochastic differential equations, but there also will be broken marriages, corporate intrigue, and panicked traders.

Chapter 2

Simons and the code-breakers proposed a similar approach to predicting stock prices, relying on a sophisticated mathematical tool called a **hidden Markov model**. Just as a gambler might guess an opponent's mood based on his or her decisions, an investor might deduce a market's state from its price movements.

Chapter 3

Simons named his new investment company Monemetrics, combining the words “money” and “econometrics” to indicate that he would use math to analyze financial data and score trading gains. At the IDA, Simons had built computer models to spot “signals” hidden in the noise of the communications of the United States’ enemies. At Stony Brook, he had identified, courted, and managed talented mathematicians. Now Simons would hire a team of big brains to pore through the market’s data to identify trends and develop mathematical formulas to profit from them.

Simons wasn’t sure where to start. All he knew was that currency markets had become unshackled, presenting profit potential. He did have an ideal partner in mind for his fledgling firm: Leonard Baum, one of the co-authors of the IDA research paper and a mathematician who had spent time discerning **hidden states** and making short-term predictions in chaotic environments. Simons just had to convince Baum to risk his career on Simons’s radical, unproven approach.

Lenny Baum was born in 1931, the son of immigrants who had fled Russia for Brooklyn to escape rampant poverty and anti-Semitism. At the age of thirteen, Lenny’s father, Morris, began work on the floor of a hat factory, where he eventually became the manager and owner. As a teenager, Lenny was six feet tall with a barrel chest, his high school’s top sprinter and a member of its tennis team, though his delicate hands suggested someone more comfortable turning the pages of a textbook than competing on a court.

One day, while visiting nearby Brighton Beach with friends, Lenny spotted a vivacious and attractive young woman chatting with friends. Julia Lieberman had come with her family to the United States at the age of five from a small village in Czechoslovakia, clutching her favorite doll as they escaped the Nazis on the last boat from Europe in 1941. Once in New York, Julia’s father, Louis, spent months unsuccessfully searching for a job. Discouraged, he decided to show up at a local factory and try to blend in with its workers. Louis proved such a tireless laborer that he was added to the payroll. Later, Louis operated a laundromat in the family’s small row house, but the Lieberman family would always struggle financially.

Lenny and Julia fell in love and eventually married and moved to Boston, where Lenny attended Harvard University, graduating in 1953 and then earning a PhD in mathematics. Julia finished fourth in her class at Boston University before obtaining a master of arts in education and history at Harvard. After joining the IDA in Princeton, Baum was even more successful breaking code than Simons, receiving credit for some of the unit’s most important, and still classified, achievements.

“Lenny and some others were definitely higher than Jim in what we in management used to call ‘lifeboat order,’” Lee Neuwirth says.

Balding and bearded, Baum pursued math research while juggling government assignments, just like Simons. Over the course of several summers in the late 1960s, Baum and Lloyd Welch, an information theorist working down the hall, developed an algorithm to analyze Markov chains, which are sequences of events in which the probability of what happens next depends only on the current state, not past events. In a Markov chain, it is impossible to predict future steps with certainty, yet one can observe the chain to make educated guesses about possible outcomes. Baseball can be seen as a Markov game. If a batter has three balls and two strikes, the order in which they came and the number of fouls in between don't matter. If the next pitch is a strike, the batter is out.

A **hidden Markov process** is one in which the chain of events is governed by unknown, underlying parameters or variables. One sees the results of the chain but not the "states" that help explain the progression of the chain. Those not acquainted with baseball might throw their hands up when receiving updates of the number of runs scored each inning—one run in this inning, six in another, with no obvious pattern or explanation. Some investors liken financial markets, speech recognition patterns, and other complex chains of events to hidden Markov models. The Baum-Welch algorithm provided a way to estimate probabilities and parameters within these complex sequences with little more information than the output of the processes. For the baseball game, **the Baum-Welch algorithm** might enable even someone with no understanding of the sport to guess the game situations that produced the scores. If there was a sudden jump from two runs to five runs, for example, Baum-Welch might suggest the probability that a three-run home run had just been hit rather than a bases-loaded triple. The algorithm would allow someone to infer a sense of the sport's rules from the distribution of scores, even as the full rules remained hidden.

"The Baum-Welch algorithm gets you closer to the final answer by giving you better probabilities," Welch explains.

Baum usually minimized the importance of his accomplishment. Today, though, Baum's algorithm, which allows a computer to teach itself states and probabilities, is seen as one of the twentieth century's notable advances in machine learning, paving the way for breakthroughs affecting the lives of millions in fields from genomics to weather prediction. Baum-Welch enabled the first effective speech recognition system and even Google's search engine.

For all of the acclaim Baum-Welch brought Lenny Baum, most of the hundreds of other papers he wrote were classified, which grated on Julia. She came to believe her husband was getting neither the recognition nor the pay he deserved. The Baum children had little idea what their father was up to. The few times they asked, he told them his work was classified. Baum did tell them what he wasn't working on.

"We're not making bombs," he reassured his daughter Stefi one day, as controversy about the Vietnam War flared.

Unlike Simons, Baum was a homebody who spent little time socializing, playing poker, or interacting with others. Most evenings, he sat quietly on a faux-leopard-skin couch in his family's modest Princeton home, scribbling on a yellow pad with a pencil. When Baum ran into

a particularly challenging problem, he'd stop, gaze far into the distance, and ponder. Baum fit the stereotype of an absentminded professor—once, he came to work with half a beard, explaining that he had become distracted thinking about mathematics while shaving.

During his tenure at the IDA, Baum had noticed his eyesight deteriorating. Doctors eventually determined he suffered from cone-rod dystrophy, a disorder affecting the cone cells on the retina. Baum found it difficult to engage in activities requiring visual clarity, such as tennis. Once, at the net, a ball hit Baum square in the head. The same thing happened in Ping-Pong; his clear blue eyes would see the ball for a moment and then lose it, forcing Baum to drop the sports.

He remained surprisingly upbeat, focusing on pleasures he still could enjoy, such as walking two miles a day near despite the decline of his fine, sharp, straight-ahead vision, Baum maintained an unbreakable optimism.

"Let the problem be," Baum liked to say, usually with a smile, when his kids came to him with concerns. "It will solve itself."