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Book Review

***The Physics of Wall Street: A Brief History of Predicting the Unpredictable* by James Owen Weatherall**

Brian M. Kruchkow

A USAFA graduate comments on predicting the unpredictable when surveying new spaces at the frontiers of defense policy.

James Owen Weatherall's book about the robust interplay of Wall Street and physics is a captivating romp about select physicists as well as a lesson on how finance both succeeds and falls short when it applies mathematical models to predict economic behavior.¹ Such a book is a surprising candidate for a review in *Space and Defense*. Yet the ideas Weatherall presents are innovative, and they offer a framework for thinking about the problems with which this journal is concerned. In fact, *The Physics of Wall Street* provides a timely solution to a major challenge space and defense policy faces in modeling rare political events.

The Physics of Wall Street is an easy read, for Weatherall has made his book interesting as both intellectual history and personal narrative. Finance and physics are not top reads for most people, of course, unless they are a practitioner in either field or they need highly specialized information. Yet Weatherall's book appeals to a wide audience with insightful biographies of physicists who shaped finance. Each chapter of the book begins as a story about a notable physicist, and introduces the mathematical theory for which that person is known. Weatherall, as an example, uses anecdotes from the brief life of Louis Bachelier, intertwined with Bachelier's revolutionary idea of how price changes are in essence a random walk.² This is the central virtue

of the book; neither physics nor finance ever becomes dull. Indeed, the mathematical theories of the physicists become irresistible as the currency for appreciating their rich life story.

Weatherall adeptly explains complicated mathematics and financial theories, making these ideas accessible for anyone curious enough to open the book. One of the most delightful parts of *The Physics of Wall Street* is when Weatherall cheerfully walks the reader through the discovery of log-normal distributions (skewed bell curves) and how this realization affected expectations of volatility and ultimately prices in the stock market.³ Greater still is Weatherall's explanation of Cauchy-distributions: how a mathematician named Benoit Mandelbrot proved that the standard deviation of prices most people thought of as normal actually needed to incorporate "extreme" events more frequently than expected, which Mandelbrot termed as "fattening the tails."⁴ The book eases the reader through these concepts and makes sure to enliven math and financial terms with stories about how Mandelbrot and others came to their ideas. In this way Weatherall transforms two difficult subjects into a pleasant and edifying journey for any reader.

One area where the book falls short is Weatherall's sanguine treatment of the people about which he writes. Weatherall, of course, must discuss the merits which make each of his characters worthy of being in the book; however,

¹ 2Lt. Brian Kruchkow, USAFA '16, is a pilot in the U.S. Air Force. Weatherall, James Owen. *The Physics of Wall Street: A Brief History of Predicting the Unpredictable* (New York: Mariner Books, 2013).

² Weatherall 2013, pp. 1-24.

³ Ibid., pp. 35-39.

⁴ Ibid., pp. 49-75.

there also has to be context. The entirety of Chapter 5, for example, is about Fisher Black, one of the thinkers who created and profited from the model we use today to price derivatives. Yet Weatherall elides the controversy still raging in economic circles over whether Black was indirectly responsible for one of the largest financial collapses in history, which nearly brought down the entire derivatives market.¹

Weatherall's formula of giving biographical information of the physicists he chooses makes for an interesting read, but most of that information covers only favorable fragments of the character's career; it does not present a holistic view of the physicists' work or negative social implications of their respective ideas.

SPACE & DEFENSE DEVOTEES AND THE PHYSICS OF WALL STREET

The salient reason why this book matters for *Space and Defense* is that some of the ideas shaping contemporary physics and finance are pertinent to contemporary defense thinking. When Weatherall covers Mandelbrot, the reader quickly realizes the monumental shift Mandelbrot the individual brought to our collective understanding of the world in which we live.

Essentially Mandelbrot proved our world is much more volatile and less stable than we choose to believe, even after we see data definitively indicating its volatility. Tremendous price movements, for example, happen much more frequently than expected, just as extreme events in general happen more frequently (in the fat tails of a non-normal distribution). This finding is sobering to those equipped with a mere bell curve, attempting to defend not only financial order but a peaceful and just world order. *The Physics of Wall Street*, then, is an introduction to thinking anew about innovation, risk, and predicting what may happen in Nature, whether physical, economic, or social.

Toward the end of his biographies, Weatherall introduces the reader to a little-celebrated physicist named Didier Sornette and showcases

Sornette's groundbreaking theories on log-periodic predictions.² Weatherall deftly explains how Sornette's model predicted the 2008 financial crisis as a culmination of precursors, relatively tiny cracks in the system.

With this account, Weatherall offers policy makers a realistic hope that humanity can predict catastrophic events, which any policy maker concerned with national defense in an international system of states must consider. Perhaps some extreme events so frequent in Mandelbrot's model may be accurately predicted in a timely manner by Sornette's approach. If so, this would raise the bar on what policy makers may do in mitigating or preventing catastrophic events from happening in the first place.

Weatherall's book stands on the thesis that significant real world events are more predictable than they appear. This opposes conventional wisdom for many concerned with space and defense. Our standard notions hew closer to the black swan theory popularized in Pentagon circles by Nassim Taleb.³ Taleb warns that black swan events will at some point upend the world, and there is *no way* to head them off.

While it seems unlikely that all catastrophic events will ever be predicted accurately, Weatherall, *contra* Taleb, urges it is worthwhile to attempt to model these outcomes and to test models by investing precious resources Taleb would hold in reserve. In this sense, Weatherall's book gives a refreshing rebuttal against darkness and paralysis induced by black swans. Defiant to the end, Weatherall parades real-life example after example of problem-solvers who did not tarry but strove mightily until eventually they predicted the unpredictable.

¹ *Ibid.*, pp. 105-129.

² *Ibid.*, p. 169.

³ Nassim Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2010).