

view, one could still suspect that supply side effects could jeopardize this optimal solution: if physicians have any opportunity to charge too much, due to market power of any sort, for procedures that are fully covered, the net benefit from health insurance is less than predicted by the theory (which relies on the standard assumption that prices reflect the value of the purchased good). The book approaches this issue (p. 152, "a price-reduction strategy"), but for severe illness with an objective content, such that the insurer might monitor the physician as agent. My concern is that, in the future, health insurers (and specifically public insurers such as Medicare) might have to deal increasingly with diagnostics with subjective content, such as depression or chronic fatigue syndrome, rather than with clear-cut diagnostics such as cancer or diabetes, and see coinsurance as the easiest way to curb expenditures, even if welfare-decreasing.

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Why Stock Markets Crash: Critical Events in Complex Financial Systems, by Didier Sornette, 2003, Princeton, NJ: Princeton University Press

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Consider the following events: a pressure tank within a rocket propulsion system fails during a launch; tectonic plates shift, causing the first significant earthquake in a locale for several decades; a stock market experiences a crash after a prolonged run-up in price levels. The commonality here is that all of these events are ultimately characterized by a "rupture" in the underlying system, following a buildup of "pressure" over a period of time. The recognition of certain engineering and geologic events as analogous in this way to financial market crashes was the impetus for the interesting and enjoyable new book *Why Stock Markets Crash: Critical Events in Complex Financial Systems*, by Didier Sornette.

The major thesis of this book is that a stock market crash is not the result of short-term exogenous events, but rather involves a long-term endogenous buildup, with exogenous events acting merely as triggers. In particular, Sornette examines financial crashes

within the framework of the “spontaneous emergence of extreme events in self-organizing systems,” noting that “extreme events are characteristic of many . . . ‘complex systems.’” The author employs mathematical tools—specifically, log-periodic power laws—to study the prebubble or precrash buildup in a financial system to its critical point.

Efforts by nonfinancial people to analyze and explain financial phenomena using quantitative techniques from the hard and engineering sciences can be of tremendous use and interest to those of us in the financial community—provided that the mathematical techniques are applied by an author with an exposure to and understanding of the financial instruments, processes, and markets that are being analyzed. The author of *Why Stock Markets Crash* has done an admirable job of understanding and appreciating the financial world and its nuances. Didier Sornette is a professor of geophysics at UCLA, as well as a research director at the National Center of Scientific Research in France. He specializes in the prediction of catastrophic events within a complex system framework. In this book, as well as in a portion of his hundreds of journal articles, he takes his previous work in the physical and geological sciences and exports his mathematical modeling and prediction skills to the financial markets.

In the first chapter, Sornette places historical extreme financial events—in particular, market crashes—in a complex, self-organizing system framework. This is followed by two chapters devoted, respectively, to the basic concepts and characteristics of financial markets, and to some statistical analyses demonstrating that financial crashes are essentially outliers. Chapters 4 and 5 explore positive feedback mechanisms and describe models for speculative bubbles. In Chapter 6, fractals and log-periodicity are introduced and discussed. This will likely be a key point of interest for many readers. The mathematics accelerates a bit here, but it is presented reasonably and is not crucial to following the general argument. Chapters 7–9 build upon the prior material by analyzing crashes in both developed and emerging markets, and by examining the resulting possibility of predictions of crashes and bubbles in the financial markets. Chapter 10 concludes the text by discussing some interesting issues, such as economic and population projections, associated with the next roughly one-half century.

There are not many equations in this book—but that is not to say that it is not a technical read. Even skipping over the occasional purely mathematical expositions, there is a lot of technically oriented material to absorb. There are quite a number of graphs and charts, which are helpful in explaining and supporting the author’s arguments, although they also have a technical aspect to them. But even if one were to skip the most technical aspects of the book, the main thrust of the work is clear and continuous throughout the book.

One enjoyable aspect of the book, and a manifestation of the author’s hard science background, is the occasional analogy with, or anecdote about, the physical or life sciences. An example is an analogy made between the concept of “efficient markets” and the information coded into DNA. On the this-gave-me-some-pause side, the author does occasionally reveal his hard science background with a reference or analogy to a technical item that the general reader is not likely to understand. Also, there is a possible danger of getting so caught up in the mathematical modeling that one can forget

about all of the nonquantitative aspects and influences on the financial markets. But the author, reasonably and refreshingly, realizes and acknowledges these qualitative considerations.

In addition to generally clear and readable text, the author also offers readers a list of 463 references, covering a wide range of relevant material from (for example) the physics, biology, economics, and finance literatures. Overall, a highly recommended, enjoyable, well-researched, and thought-provoking book for anyone interested in stock markets and the modeling of financial processes.

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