

## **Book Review: *Why Stock Markets Crash: Critical Events in Complex Financial Systems***

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

Quite often the end result of research by physicists on the subject of complex phenomena not phrased in terms of their expertise is a conglomerate of analogies. Many such studies hardly incorporate the perspective of the same problem as seen from the point of view of other disciplines. In addition, the conclusions drawn from oversimplified premises are too universal and have little bearing on the problem being considered. As a result, they hardly attract the attention of scientists from other fields, and certainly not that of the general reader. However, the book being reviewed by Didier Sornette is a notable exception to this general premise.

The title alone is sufficiently appealing to attract a very wide public. At the same time it raises a deeper scientific question. Before approaching the answer from the point of view of his research, the author analyses stock exchange crashes from several perspectives, as revealed by the extensive bibliography, which, surprisingly enough, even includes a sermon. In this book Sornette discusses the relation between the physics of critical phenomena and the dynamics of financial markets. Finally, Sornette ventures an apocalyptic prediction for the future evolution of financial markets. In this way, the book embodies a true scientific effort to understand the dynamics of financial markets. It is not to be considered, of course, as a definitive and complete explanation, but at least, as a rigorous attempt at one.

The book begins with a chapter on financial crashes and a preliminary analysis of their prediction. At the end of the chapter the author presents his main hypothesis, which is developed in depth in subsequent chapters: “the build-up of financial bubbles manifests itself as an overall super-exponential power-law acceleration in the price growth accompanied by log-periodic oscillations.” Historical series of prices are the foundation of all the quantitative analyses that lead D. Sornette to propose this hypothesis. The second chapter concentrates on these series and the model

most widely accepted as a way to understand them: the random walk hypothesis. Although this model is accepted as a good approach to describe most price fluctuations, it cannot explain extreme events, precisely those more correlated to crashes. With this idea in mind, the third chapter proves the existence of outliers empirically and emphasizes once again that the aim of the book is to establish the possibility of predicting them. Before explaining his theories, the author describes several experiments and advances that reveal how crucial human psychology has become in understanding financial bubbles. The section on the impact of “gambling” in US history is, to say the least, shocking.

From Chapter 6 onwards, we are introduced by the research by Prof. Sornette and his collaborators. The author begins by exploring the subtle relation between the hierarchical structure of financial markets, and the existence of log-periodic time oscillations as time approaches the end of a financial bubble. He takes this to indicate the beginning of a severe crash. From this perspective, a multitude of crashes in several markets and at different times are analysed in the following Chapters 7 and 8. In spite of the diversity of different market crashes, the approach to the critical moment exhibits universal behaviour, as confirmed by the regularity in the parameters of fits made on price series. The author does not hide instances where the theory is not supported by the data. Moreover, in the following chapter, he discusses on the predictive capacity and statistical relevance, in general, of fits made on time series of prices. Finally, Chapter 10 discusses the future of financial markets, the worldwide economy and even, perhaps, the whole of humanity. Although warnings have frequently been sounded in the past, we must also accept that, at some moment, “finite-size” effects related to the scale of our Earth will emerge and prevent future limitless growth. Prof. Sornette dares to predict that we are not very far from this scenario.

The book is written in a readable style and does not require technical knowledge. Any reader interested in a serious approach to the origin and possible prediction of financial bubbles will enjoy reading it. Furthermore, I feel that any researcher deciding to explore the relatively new field of Econophysics should read this book, although he/she may not necessarily agree with the author’s conclusions.

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