Studying Financial Disruption: Bubbles and Crashes - An Interview with Didier Sornette

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Overview

The history of the financial markets is punctuated with extreme events, from the Dutch Tulip Bubble of the 17th century to the Global Financial Crisis of 2007-2009. Didier Sornette, Professor and Chair of Entrepreneurial Risks at ETH Zurich (the Swiss Federal Institute of Technology) has devoted over two decades to studying bubbles and crashes, producing a book, Why Stock Markets Crash: Critical Events in Complex Financial Systems (Princeton University Press, 2003), and numerous papers and articles. This short interview covers some of the main themes of his empirical research, the launch of the Financial Crisis Observatory (FCO) at ETH Zurich, and the development of the FCO Cockpit, a project that analyzes a vast array of asset classes, searching for evidence of bubbles or crashes in early stages of their formation.

Interview

BJM: Your research on bubbles and crashes dates back to the mid-1990s; what drew you to these topics and what are your main observations on such phenomena?

DS: The fundamental background is my philosophy that in order to learn about a system it is good to look at it out of equilibrium, particularly when it is in an extreme state of disequilibrium. Many of the systems that we observe seem to be in balance most of the time, but underneath their structures are tremendous conflicting forces that essentially cancel each other out. At the beginning of my scientific life, it was just a conjecture that extreme events could provide a fantastic opportunity to decipher the hidden forces that are combatting and counterbalancing each other and therefore hiding the true nature of the system from the investigator.

The work on financial bubbles and crashes also emerged from an analogy comparing the rupture of the financial system and a rupture of a material engineering structure. At the starting point of our research, we saw similar tell signs involving a progressive maturation towards instability that could be modeled similarly in both contexts. Specifically, we found that the mathematical language we developed for predicting the failure of key engineering structures like the Ariane space rocket turned out to be very flexible and convenient to apply to financial markets, and to bubbles in particular. Since that initial observation, the systems for analysis have become more complicated, because when you dive into the specifics of the financial markets, you must go beyond relatively superficial analogies. However, combined with the scientific and social significance of these phenomena, this was also part of our motivation and approach.

BJM: There have been numerous dramatic events around the world over the past few decades, including the Crash of '87, the dot-com bubble, and regional crises of various types, so how has studying these events guided the work up to the most recent crisis?

DS: One of our group's most important conceptual breakthroughs has been to understand how the global financial crisis in 2007-2008 occurred and examine the way in which it is tied to the evolution of the previous decades. The financial markets and national economies are continuously punctuated by phases of overheating. Some might call it over-enthusiasm, but actually it is healthy enthusiasm, because this is the kernel of innovation: taking risks and deploying capital to develop new ideas. This leads to phases of engineering and advancement, but often the system overreaches and then there is a correction. The typical view on these dynamics is based, in part, on a misconception about economics.

The GDP of the US, for example, is said to have grown at a remarkably constant average of 2% per year from 1790 until now. This is incredible, when you think about the vast technological advances, shifting demographics, and major wars that have taken place during this period. Nevertheless, there is an impression of steady, consistent growth in spite of these dramatic changes in the environment. However, when we look more closely at the figures, we find that GDP growth of 2% per year is never happening. Instead, we see a broad bimodal distribution with growth ranging between 0-1% (with tails of negative spells associated with recessions) on one hand, corresponding to an underperforming economy or recession, and growth of 3, 4, or 5%, on the other hand, which marks a boom period, hence the long-term average of 2%, but that itself is not the norm.

In order to understand 2007-2008, we can look back as far as the post war period; at the end of the Second World War, the level of technical advancement due to the war effort, largely in the US, but also in Germany and elsewhere, had spillovers with extraordinarily good consequences in terms of productivity growth for the next 30 years, in a period known as "Les Trentes Glorieuses." Then a significant change took place and after three decades of real growth, in capacity and output, the economy shifted to another regime, starting around 1980, which can be described as the "Illusion of the Perpetual Money Machine." Since that time, two-thirds of the US "productivity" was based in finance and entailed the rapid growth of credit, debt, and financialization. Early on, this new paradigm was interrupted by the global crash of '87. There was another break in 1991-2 and a larger disruption with the dot-com crash, in 2000-2001. Finally we have the most recent bubble that formed in response to the Fed's interest rate policy and derivatives markets expansion leading to the crisis of 2007-2008, and we have seen a number of commodity bubbles as well.

During much of this period before the crisis of 2007-2008, GDP appeared to be predictable and we generally saw mild volatility, decreasing unemployment, and low inflation. However, while people were toasting the "Great Moderation," they were forgetting to look at other signatures, i.e. the bubbles acting as the canary in the financial coal mine, which were telling us that this growth was not obtained from real productivity growth and would not be sustainable. So in spite of beliefs to the contrary, the events of 2007-2008 are not a surprise – in fact, the crisis can be seen as the culmination of 30 years of relying on indebtedness, credit creation, and financialization – not real value and productivity gains.

BJM: When you mention the waves of creation and destruction – Schumpeter came to mind and this type of cycle seems more natural than the idea of an endless period of uninterrupted growth.

DS: Yes, exactly, the point is that during the 25-year story – the belief was that we could have strong growth and no volatility. This is a complete misconception. And yet in spite of the crashes, some bubbles are very beneficial in the longer term. The dot-com bubble produced a lot of hype and investors lost a great deal of money, but it also produced a massive amount of human capital, well educated and experienced young people who were relatively cheap to employ and ready to develop the next boom that we see in Google, Facebook, Amazon, and many others. Such social or tech bubbles create opportunities because they result in creation of excess capacity, in fiber optics and bandwidth, for example; once it is installed it will certainly be reused and enables the next wave of creation. The history of railroads in the UK and the US in the mid to late 1800s is a similar situation. It is an extreme version of Schumpeter – bubbles and crashes can have benefits, but it may take several decades to obtain the return on the investment, not a few years, which is so often the expectation.

BJM: What is happening with the Financial Crisis Observatory and the FCO Cockpit reports?

DS: We are interested in developing experiments in finance just as we are able to do in scientific labs, so we came up with a methodology for the work of the FCO, started in 2009, which has integrity and security built in to the observation and reporting processes. We were watching for the most evident bubbles, documenting the cases, putting the written work aside for six months, sealed and encrypted, and publishing the public key immediately, so that six months later, everyone would be able to check that the document was legitimate and see how accurate it was. We used the best encryption technology of the time and this went very well.

We ran the analytical experiment for two years and then moved on to actual trading through an Interactive Broker account with about $100,000 CHF, so now we were testing it in real time and introducing the operational aspects: risks, transaction costs,

slippage – all of the practical details. We ran the investment experiment for one year, (still as an academic project)–and we did very well. This confirmed to us that there is predictability in the markets and it is possible to create diagnostics that watch for turning points successfully. In order to make this feasible for active investment, it takes a substantial amount of work; our best performance occurred when we had two dedicated senior researchers working full time – like real traders. Even so, this demonstrated that there is something to our analysis in real life.

Since then we have been publishing the FCO cockpit, which is improving over time.

We have a quadrant to classify the universe of assets in a positive bubble-negative bubble, high valuation-low valuation framework and we are running a portfolio on paper to assess the value of this scheme with back tests. In the future, we will publish it as an index for investors.

On a daily basis for the public, we offer fresh bubble indictors for the major markets - indices, commodities, bonds, and so forth, but right now we are only showing 40-50 assets that people can watch and experiment on. In our own research, we are watching 25,000 assets every day, so there is much more in the works for the future.

BJM: Turning to ICBI, you will be speaking about the FCO there in your talk, "Diagnostic Forecasting of Future Bubbles, Crashes, and Crises."

DS: Yes, a part of it will be a diagnostic of the present time, so we will run the cockpit and present a state of the world – where are the bubbles and the opportunities. My first paper on bubbles was published in 1996, so we are celebrating the 20th anniversary and all that we have developed in my group over the past 20 years. Bubbles and crashes are extremely interesting and complex phenomena and are deeply connected with policy, regulation, politics, beliefs, and culture – so they have many facets and we have developed a number of exciting models that offer new ways of understanding them – with recent improvements towards more mathematical rigor and generality while keeping a fundamental anchor in finance.

Thinking specifically about the Global Derivatives conference in May, this field is dominated by financial mathematics and engineering and yet we do not have many relevant models for bubbles and crashes. There is enormous work to be done and I am happy to offer an approach to the challenge in a solid axiomatic way, rooted in extensive empirical works.

Links

Why Stock Markets Crash: Critical Events in Complex Financial Systems, by Didier Sornette (Princeton University Press, 2003) http://press.princeton.edu/titles/7341.html

Didier Sornette TED Talk: https://www.youtube.com/watch?v=C_eFjLZqXt8

ETH Zurich Chair of Entrepreneurial Risks – Financial Crisis Observatory

http://www.er.ethz.ch/financial-crisis-observatory.html

Bio

Didier Sornette
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Didier Sornette is professor of Entrepreneurial Risks in the department of Management, Technology, and Economics at the Swiss Federal Institute of Technology (ETH Zurich), a professor of finance at the Swiss Finance Institute, and an associate member of the department of Physics and the department of Earth Sciences at ETH Zurich.

He uses rigorous data-driven mathematical statistical analysis combined with nonlinear multi-variable dynamical models, including positive and negative feedbacks to study the predictability and control of crises and extreme events in complex systems. This methodology has applications to financial bubbles and crashes, earthquake physics and geophysics, the dynamics of success on social networks, and the complex system approach to medicine (immune systems, and epilepsy, for example) all leading towards the diagnostics of systemic instabilities.

Didier has authored numerous papers and articles on the topics of bubbles, crashes, financial markets, and analytical methodologies. In 2003, he published Why Stock Markets Crash: Critical Events in Complex Financial Systems (Princeton University Press: NJ).

In 2008, he launched the Financial Crisis Observatory at ETH Zurich to test the hypothesis that financial bubbles can be diagnosed in real-time and their termination can be predicted probabilistically.