The Financial Bubble Experiment

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The end of financial bubbles can be predicted, say researchers of the Chair of Entrepreneurial Risks. (Photo: kai / flickr)

Professor Didier Sornette from the Department of Management, Technology and Economics (D-MTEC) at ETH Zurich is convinced that financial markets are not just random. Consequently, his Financial Crisis Observatory conducted a daring experiment to prove that you can forecast financial bubbles. Today, Professor Sornette presented the results of the experiment at a press conference.

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Didier Sornette, Professor of Entrepreneurial Risks at ETH Zurich, has two hypotheses: firstly, bubbles can be diagnosed in real time before they end; secondly, the termination of these bubbles can be bracketed using probabilistic forecasts with a reliability better than chance. As a controversial debate surrounds the two hypotheses and proof was needed, Professor Sornette and his team from the Financial Crisis Observatory (FCO) launched an extraordinary experiment: they forecast that four selected assets would form a bubble in the following six months, and when this would happen. To guarantee the seriousness and integrity of the experiment, the forecasts were announced and encoded.

As yet, nobody has any reliable quantitative methods to ascertain whether the market or a particular asset is in a bubble state. One problem here is that none of the various economic theories and models provides a universal and quantifiable definition of a bubble. New, multidisciplinary approaches are therefore needed in the face of the complexity of the financial market. Consequently, Didier Sornette works with a portfolio of methods from very different fields, such as economics, physics and mathematics.

Identifying "regime shifts"

The results of the Financial Bubble Experiment (FBE) show that the dynamics of financial markets actually exhibit an identifiable structure. And that's not all; the results also prove that the dynamics of financial markets are subject to a so-called "regime shift". This means that phases of strong growth are replaced by ones only exhibiting moderate growth or even declines, or vice versa. A crash is an extreme example of a regime shift. The following data was used in the FBE as indicators of a regime shift: firstly, the scale of the drop in prices; secondly, the proportion of "good days" (positive return days); and thirdly, the growth rate of the price.

The assets selected

Out of all the assets observed by the FCO, the scientists selected the four for which they expected such a shift within the following six months: IPOVESPA Brazil Index, the Merrill Lynch bond index, the gold spot price and cotton futures. The forecasts for the first three assets were announced on November 23 2009; that for the cotton futures on December 23 2009.

In accordance with Sornette's theory, the four assets exhibited a clear regime shift. As a static fuzziness is inherent in the system (see box), the FCO states its forecasts in the form of probabilities and within two time windows. In the one, the turning point is anticipated with a 60% probability; and in the second, with a 90% probability.

Forecasts and results

Sure enough, all four assets exhibited a regime shift either within the forecasted time window (Brazil IBOVEST, gold and cotton) or shortly before it (Merrill Lynch corporate index). By November 2 2009 there were already bubbles in two of them (IBOVESPA and gold).

Brazil IBOVEST

Forecast: between 10.19.2009 and 12.17.2009 the probability of a regime shift is 95%; between 10.27.2009 and 11.29.2010 it is 60%.
Result: the regime shift began within the forecast window. Within this window, the proportion of "good days" started with a peak and declined steeply; also within the window, the growth rate of the price dropped sharply. A large draw-down of 11% in 30 days occurred approximately two weeks after the end of the forecast window.

Merrill Lynch bond index

Forecast: between 10.11.2009 and 2.9.2010 the probability of a regime shift is 95%; between 10.27.2009 and 1.16.2010 it is 60%. Result: the regime shift already began 1-2 months before the forecast window. It was confirmed that the Merrill Lynch Index had been in a bubble, but that it had ended before the start date. It was only detected in retrospect on account of the analysis conducted in the last six months. The recently developed bubble index confirms that the asset was actually coming out of the bubble. Today, the asset definitely is no longer in a bubble.

Gold

Forecast: between 10.13.2009 and 9.7.2010 the probability of a regime shift is 95%; between 11.5.2009 and 2.25.2010 it is 60%. Result: the regime shift occurred within the forecast window: the price dropped by 11% in 20 days and 13% in 68 days in all. The other indicators confirm this.

Cotton

Forecast: between 12.5.2009 and 4.9.2010 the probability of a regime shift is 95%; between 12.31.2009 and 3.16.2010 it is 60%. Result: the metrics implemented thus far did not yield any clear conclusions for the price of cotton future. However, the research team's bubble index did diagnose an existing and intensifying bubble. The moment of the cotton drawdown (12% in 30 days) happened within the forecast window. This can be perceived as a partial success or a failure, however, since the FOC's present indicators say that the bubble has not yet ended; this suggests that a "baby bubble" was identified and is still growing.

Evaluation of the experiment

This test is the first in a whole range of experiments. The results obtained are intended to be used in further experiments. First and foremost, the scientists are looking to refine the diagnosis methods and metrics, and improve the selection algorithm. "We'll continue to conduct experiments at regular intervals", explains Professor Sornette. "Next week, we're publishing new forecasts for seven new financial bubbles. These experiments will be based on better metrics because we'll have recourse to the new results we obtained in the last six months."

Furthermore, assets that are candidates for a regime shift are also to be determined fully automatically in future. Until now, the researchers have had to provide an individual expert report. They have already succeeded in developing suitable filters and implementing them in the new algorithms, which are necessary to scan large quantities of assets and identify bubbles.

As the traditional economy follows the paradigm of the fundamental unpredictability of the financial markets, the FBE could trigger a paradigmatic shift: "The financial crisis was regarded as unpredictable, and consequently no one was blamed; this suited many down to the ground. If we can prove we're right, how-ever, the textbooks will have to be rewritten", says Professor Sornette.

How does a financial bubble develop?

Whilst the behavior of individual actors cannot be predicted, their collective behavior certainly can. Individual investors do not behave independently of one another, but rather are influenced by collective mechanisms like imitation, herd instincts or the media. Imitation and herd instincts trigger an increase in collective actions: if increasing prices are expected, it leads to even higher expectations of increasing prices and so on. Through this self-acceleration, growth, which on

average is typically presumed to be exponential on average in a stable economy, is faster than exponential in such phases. According to Didier Sornette, this hyper-exponential growth is one of the indicators of a bubble. Moreover, price movements are not irregular at such times, but rather oscillate at a lower frequency, which becomes increasingly bigger the closer you get to a regime shift; based on the manner in which this frequency changes, the possible turning point can be predicted. However, the data is always subject to static and therefore has an intrinsic element of chance; this means that only statistical assertions can be made as to the turning point.

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