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Things should be made as simple as possible, but not simpler.
ALBERT EINSTEIN

Complexity (Chaos) Theory and Natural History

Not far to the west of Wyoming's vast Bighorn Basin, lies the Yellowstone National Park one of Americas' most beautiful natural parks. There have been many fires in this park but in June 1988 an ordinary fire turned out to have an extreme effect. At first it looked like it had the characteristics of a normal fire and the authorities in charge were not overly concerned. Then another fire in the region broke out and a few weeks later another fire started. Over the next two months, more than ten thousand fire-fighters from across the country struggled against raging fires with more than 1.5 million acres finally being consumed, only the winter rains could eventually put a stop to this devastating act of nature.

In the 1970's scientists formally discovered Chaos Theory which has now become widely known as Complexity Theory. It describes systems that are highly sensitive to small movements away from equilibrium, which often result in major events. The most commonly used example is the "butterfly effect", whereby the butterflies flapping their wings in Australia might lead to the cause of a thunderstorm over Vancouver. With this we have a complex system developing from simplicity. Long term predictions of chaotic systems, are virtually impossible to make. However, when it comes to explaining MAJOR events there is one important ingredient in the complexity equation that plays an explanatory role and that is history.

How are we to understand the term "history" in the context of this explanation? Science has learned during phases of disequilibrium that a **Critical State** is observed, i.e. a natural structural process follows during movements away from equilibrium that result in a tendency for sudden and extreme change. History reveals the essential element that underpins complexity in all cases. A timeless system simply does not provide information; complexity only emerges out of strings of historical accidents and when we combine all these historical accidents we observe an amazing mathematical phenomenon a **Power Law**. A power law is a measure of how two different quantities relate to one another, and the amazing thing is that the relationship remains the same no matter what degree of time or scale one is looking at.

In 1998, geologist Bruce Malamud from Cornell University gathered extensive data on forest fires over the last century to see if these power laws in fact exist, and remarkably they do. By simply doubling the area covered with a fire, it becomes about 2.48 times as rare, and the pattern holds for fires varying in size up to a factor of a million. In other words, despite the immensely complex picture of how fires spread, a startlingly simple pattern emerges when you look at how often you find fires of different sizes.

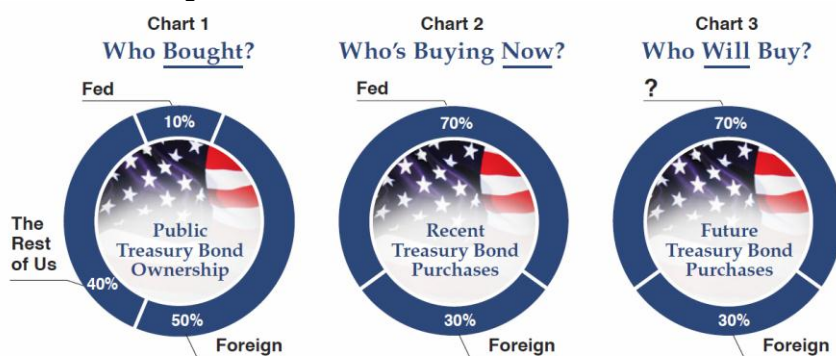
The details described above are my adaption from a fascinating book by physicist Mark Buchanan called *Ubiquity* (2001). Now let us try and learn something relevant to our financial world from the findings of Professor Malamud. By the way since the 1990's scientists have been trying to explain financial markets by way of Chaos Theory.

Through history there have been many fires, and these fires tend to be smaller in nature with the bigger ones coming less frequently as per our understanding of power laws. In more recent decades there has been a drive towards heavy legislation penalising those responsible for fires, which has resulted in a reduction in the number of fires. The question one needs to ask oneself is whether this is a good or bad thing.

There is an argument to be made that by reducing the smaller fires, the forests are becoming over grown and in essence ripe for a more dramatic type of fire such as the one in Yellowstone in 1988. This is precisely what I believe the meddling central banks have done with their quantitative easing, aka (QE1 & QE2). By interfering with nature's natural process of boom and bust, they are taking us further up the power law scale with implications for a far greater and more extreme bust, once the implications of this excessive monetization are processed.

By artificially bringing short term money rates down close to zero the US central bank has in effect brought down the investment hurdle rate with which investors are typically willing to invest and in so doing they have once again reduced the risk premium in equity markets.

To illustrate my point take a look at some analysis by Bill Gross from PIMCO, the world's largest bond fund. As you can see in Chart 2, the Fed has been the buyer of 70% of the debt issuance since the beginning of QE2. The question that remains, who will be the buyer when the Fed is no longer in the market?



Source: Federal Reserve, PIMCO estimates

Then we have the issue of the size of debt, according to the latest projection for US Treasury funded debt for fiscal year, 30 September 2011, which comes in at a whopping \$US15.476 TRILLION, that is 102.6% of US GDP.

"In 2009, two US establishment economists - Carmen Reinhart and Ken Rogoff - published a book they called - *This Time It's Different: Eight Centuries of Financial Folly*. The book was a sensation, praised by luminaries from Ben Bernanke to Paul Krugman. One of the controversial contentions made in the book is that once a nation's gross sovereign debt passes 90 percent of GDP, it "hinders" any further economic "growth".¹

There was no coverage of this potential tipping point in the mainstream press when President Obama delivered his budget speech on February 15. One needs to ask oneself if the 40 year US bond bull market is coming to an end. Could it be that natural history will prove the bond market to be a victim of the power law and will it be the Fed's manipulation with the monetization of the Federal debt that provides the "critical state" that pushes the event higher up the fractal scale to a MAJOR event? The long end of the bond market is already starting to answer this question by continuing to show weakness despite all the Fed's purchasing. When the Fed is no longer a buyer and the Treasury continues to issue debt paper to fund its budget deficit then the probabilities grow larger for continued higher interest rates and higher mortgage costs. REITs need to become more aware of the potential dangers lurking around the debt corner, Bill Gross is and this is what he says, "PIMCO's not sticking around to see"

Michael Berman, Ph.D.

¹ The Privateer, issue 672, 20 Feb 2011