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Fireworks

"A key prediction of traditional economics.. is that the economy as a whole must at some point reach equilibrium – a prediction made by both the general equilibrium theory of microeconomics as well as by standard macroeconomics. So how long does it take for the economy to reach that equilibrium ?

"In the 1970s, the Yale economist Herbert Scarf determined that the time to equilibrium scales exponentially with the number of products and services in the economy to the power of four. The intuition behind this relationship is straightforward: the more products and services, the longer it takes for all the prices and quantities to adjust… if we optimistically assume that *every* decision in the economy is made at the speed of the world's fastest supercomputer (currently IBM's Blue Gene, at 70.72 trillion floating-point calculations per second), then using Scarf's result, it would take a mere 4.5 quintillion years (4.5×10^{18}) for the economy to reach general equilibrium after each exogenous shock. Given that shocks from factors such as technological change, political uncertainty, weather and changes in consumer tastes buffet the economy every second, and the universe is only about 12 billion years old (1.2×10^{10}), this clearly presents a problem."

- From *Investing Through the Looking Glass – a rational guide to irrational financial markets.*

A common practice among financial advisers is to run through a risk questionnaire with new clients. These questionnaires tend to ask investors how they might respond to certain hypothetical market movements – a correction, say, of 20 percent or more. As Morgan Housel points out in this (excellent) interview, rather than extrapolate out from what will typically be the relative calm of the current environment, investors – and their portfolios – might be better served in preparing for tough times ahead by recalling their emotional responses to prior incidents of heightened market volatility. Memories of a hard reality are far more tangible than speculations about future travails.

Towards the end of last month, George Cooper of Equitile Investments wrote as follows:

> October is not yet over, but it already qualifies as the worst single month for equity market performance since the global financial crisis of 2008..
>
> Despite the dramatic market moves, we do not believe this is an especially unusual event. Indeed, we believe it is a rather typical market panic. The question is: Does this

panic become a new Minsky Moment, triggering a downturn in the real economy, as occurred with the global financial crisis ?

The following extract on the inherent wildness of markets is from *Investing Through the Looking Glass*:

> The failure of Long Term Capital Management in 1998 can be traced back to [Harry] Markowitz and, for that matter, to [Leon] Walras himself. The market volatility experienced in stock, bond and currency markets in August 1998 should, according to Finance World's standard risk models, never have occurred.
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> On 4 August of that year, the Dow Jones Industrial Average fell by 3.5%. Three weeks later, as the news out of Russia got worse, stocks fell by 4.4%. On 31 August, they fell by 6.8%. Other asset classes fared worse – notably bonds. Bank bonds fell by a third in value relative to Treasuries. LTCM was on the wrong side of both trades (it was long credit and short government debt, in all markets, using leverage of 200:1).
>
> Standard risk modelling theory had estimated the odds of that final, 31 August collapse at one in 20 million – something that, if you traded daily for almost 100,000 years, you would not expect to encounter once. The odds of experiencing three such declines in the same month were even more minute – roughly one in 500 billion. In the parlance of risk modelling and the normal distribution curve of standard deviation (the bell curve), August 1998 was a succession of *fat tails. Or was it?*
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> A year beforehand, the Dow had fallen by 7.7% in a single day. Probability: one in 50 billion. In July 2002, the Dow recorded three separate, steep falls within seven trading sessions. Probability: one in four trillion.
>
> On 19 October 1987, the Dow fell by 29.2%. Based on the standard financial theory, the probability of the October 1987 crash was less than one in 10^{50} – odds so small that they have no meaning whatsoever in reality.
>
> Let's consider further the normal distribution curve of standard deviation – the bell curve. The bell curve shows variation in probability distributions.
>
> Consider the adult male population in the USA. The average height of an American male adult is roughly 70 inches. The standard deviation from average height is two inches. So 68% of all American men are between 68 and 72 inches tall (that is, they stand within one standard deviation either side of the mean). 95% of all American men are between 66 and 74 inches tall (within two standard deviations either side of the mean). And so on.
>
> The standard bell curve doesn't disprove the existence of giants or dwarves – rather, it simply suggests that their populations are going to be very small. Which, in real life, is precisely the case. But in the financial markets, the standard bell curve does not exist. It is not a good map for those navigating financial market reality.
>
> Between 1916 and 2003, for example, the daily index price movements of the Dow do not fit neatly on the bell curve. The tails are too fat. Theory suggests that over that time period, there should have been 58 days when the Dow moved more than 3.4%.

In fact, there were over 1,000 of those events. Theory predicts six days of index swings beyond 4.5%. In fact there were 366 of them. Index price swings of more than 7% should, according to theory, come once every 300,000 years. In reality, the 20th century saw 48 separate occasions of them.

It looks very much as if the bell curve and the normal distribution, which form part of standard financial theory, are not an appropriate way to predict market movements.

Market behaviour is stranger than we thought

Markowitz didn't deserve his Nobel Memorial Prize in Economic Sciences. That award should have gone instead to the Polish-born scientist and mathematician Benoit Mandelbrot. But Mandelbrot died in 2010, so will sadly never get his chance.

Mandelbrot, father of the Mandelbrot set, of never-ending fractals, is co-author, with Richard Hudson, of a book entitled *The (Mis)Behaviour of Markets*. Mandelbrot's book is, to the best-selling author and financial theorist Nassim Nicholas Taleb, "The deepest and most realistic finance book ever published."

If you happen to look at price records, as Mandelbrot did, especially in relation to the market in cotton, you find a different kind of distribution to that of the bell curve. The tails in the market price curve do not flatten out into irrelevance. Rather, they follow a *power law* that happens to be quite common in nature.

In a power law relationship, a relative change in one quantity triggers a proportional relative change in another. If you double the length of a square, for example, its total area is multiplied not by two times, but by four.

The same type of power law holds for income distributions (the so-called Pareto principle, the 80-20 rule, shows that roughly 20% of the population accounts for 80% of its wealth). And it also holds, somewhat ominously for those who believe in stable or easily controllable markets, for earthquakes, volcanic eruptions, landslides, and forest fires.

Unlike Markowitz, who conjured up a square theory in blissful intellectual isolation and then hammered it into the round hole of the market, with little bits of relevance flying off the theory each time, Mandelbrot developed his own theories having already spent a good deal of time assessing historical prices. Here are some of his conclusions:

Rule 1: Markets are riskier than we think. And certainly riskier than conventional financial theory thinks.

Price movements do not happily track the bell curve. Extreme price swings are not the exception. *They are the norm*.

Rule 2: Trouble runs in streaks.

Or as Shakespeare put it, "When sorrows come, they come not single spies / But in battalions!" Market turbulence does not arise out of a clear blue sky and then disappear. It tends to cluster. A wild market open may well be followed by an equally

desperate full trading session. A chaotic Monday may well be followed by an even more chaotic Tuesday.

Rule 3: Markets have their own personality.

The father of value investing, Benjamin Graham, famously created the manic depressive character Mr Market to account for the stock market's constant oscillations between greed and fear. But when individual investors, institutional fund managers, hedge funds, day traders and sovereign wealth funds come together in a real marketplace, a new kind of market personality emerges – both greater than, and different from, the sum of its constituent parts.

Mandelbrot suggests that market prices are determined by endogenous effects specific to the inner workings of those markets, rather than by exogenous, external events. For example, his analysis of cotton prices during the last century showed the same broad pattern of price variability when prices were unregulated as they did in the 1930s when cotton prices were regulated as part of Roosevelt's New Deal.

Rule 4: Markets mislead.

In Mandelbrot's words, "Patterns are the fool's gold of financial markets." The workings of random chance create patterns, and human beings are pattern recognition experts. We see patterns even where none exist and financial markets are especially prone to statistical mirages. Following from this, bubbles and crashes are inherent to financial markets and "the inevitable consequence of the human need to find patterns in the patternless."

Rule 5: Market time is relative.

Just as the market has its own personality, so it has its own time signature. Professional traders often speak of a *fast* or *slow* market, depending on their assessment of volatility at the time in question.

In a *fast* market, things like market-, stop- or limit orders have limited utility. Prices don't necessarily glide smoothly within narrow ranges. Sometimes they gap down or leap up, effortlessly vaulting beyond price limits presumed to protect portfolios from ruin..

To resort to technical jargon, October 2018 was a doozy. George Cooper of Equitile answers the question he posed earlier as follows:

> On balance, while the global economy faces challenges in certain regions, we believe.. October's sell-off will prove to be just another temporary market wobble.

Regardless of how the stock markets evolve over coming months, we will try to remain focused on identifying high quality businesses with principled, shareholder-friendly management where we can purchase shares in those businesses at a discount to their inherent worth. We will also try to remain diversified at an aggregate level, namely by using uncorrelated investments such as systematic trend-following funds, along with the monetary

metals and related real assets, for the purposes of inflation protection and portfolio insurance. Beyond that, we won't even try to forecast the stock market's direction a) because it's impossible and b) because it frankly doesn't matter.

www.pricevaluepartners.com  @timfprice

Tim Price is co-manager of the VT Price Value Portfolio and author of 'Investing through the Looking Glass: a rational guide to irrational financial markets'. You can access a full archive of these weekly investment commentaries here.

Price Value Partners manage investment portfolios for private clients. We also manage the VT Price Value Portfolio, an unconstrained global fund investing in Benjamin Graham-style value stocks and specialist managed funds.