

Abuse of numbers in financial markets

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"Innumeracy and pseudoscience are often associated, in part because of the ease with which mathematical certainty can be invoked, to bludgeon the innumerate into a dumb acquiescence."

- John Allen Paulos

Numerical skills are invaluable in asset management but unfortunately innumerate analysts produce swathes of garbage which is peddled as valid research. This article does not touch on good quants (such as risk management, inferential techniques and derivatives research) but rather takes a bit of a poke at some surprisingly poor yet perennially popular perversions of proper quantitative tools.

It is quite possible to make a success of investing without being an accomplished mathematician. On the other hand, a good grounding in mathematics can be gainfully deployed in the pursuit of superior risk adjusted returns. But beware of falling between those two stools: analysts with a rudimentary knowledge of mathematical statistics (AKA "Stats 101") are best advised to burn their textbooks and never to attempt to recall the tools they learnt at that elementary level. Here are some examples:

Correlation (or, where do babies come from and who will win the Super Bowl?)

Correlation is perhaps the statistic most subjected to misinterpretation. It is the simple idea that two things move together to some extent. A correlation coefficient succinctly calibrates this as a number between -1 (perfectly negatively correlated) and +1 (perfectly positively correlated). Most analysts have an insatiable desire to discover what is driving a share price and in the investment industry, no effort has been spared in hypothesising some relationship and then testing the idea by means of a correlation calculation. Does the price of oil drive Sasol's share price, or is it the exchange rate, or a combination, or a host of other things too? Every statistical textbook warns very strongly against believing that correlation is the same as causality: it is NOT, but this little inconvenience is repeatedly overlooked by analysts who want to believe they have uncovered something valuable.

At some point most parents will be confronted with the awkward question: "Where do babies come from?" Parents who are not keen on a vivid physiological explanation may use the time honoured answer that storks bring babies. Now as it happens, the correlation between the annual number of storks nesting and the annual human birth rate in Copenhagen is positive and strong, for the 12 years after World War II anyway, but only the staggeringly naive and perhaps some poor spinsters would leap to the conclusion that storks do indeed bring babies.

A famous example of what can happen when hundreds of thousands of data series are tested for correlation is that spurious results can occur: some years ago, it came to light that there was a strong correlation between the winner of the Super Bowl (NFC or AFC) and whether the Dow Jones went up or down in the same year. The simple fact was that stocks go up far more than they go down, and that the NFC *usually* wins the Super Bowl. Again, no self-respecting investor would actually try to use this as an investment tool. As an aside, even if you were foolish enough to believe that there was some fundamental linkage, you would still be left with having to predict the Super Bowl. Pity about that!

Sadly, in the investment world, instinctive ideas that are crudely tested often do not receive even a smidgen of circumspection. Two years ago, Business Day published an article with an eye-catching headline along the lines of "PE does not matter for future returns". To at least some of us, this was anathema. The researcher being quoted even boasted that it took him just two minutes to calculate the correlation coefficient between the historical PE of the S&P500, and the contemporaneous price series. In truth, given modern spreadsheets, one does have to wonder what took him so long. More importantly, he was using a hopelessly inappropriate tool (by correlating a nominal, rising series with a series that is a mean reverting ratio between two nominal rising series). Actually, a correct analysis will show a remarkably good association between starting PE ratios and subsequent average returns: high PE's beget low returns and vice versa.

A persistent myth in the South African markets is that if foreigners become net buyers (sellers) then our markets will go up (down). Contemplation of this notion, rather than instinct, should reveal that this should not actually be the case. Better, a correctly calculated correlation coefficient will *demonstrate* that it is not the case. And guess what: the correlation coefficient between foreign activity and either local equity or bond markets is lower (nearly zero) than that for storks and Danish babies!

Technical analysis

The only thing we know for certain about technical analysis is that it's possible to make a living publishing a newsletter on the subject - Martin S. Fridson

Technical analysis, or charting, is a terrible pseudo-science very rich in examples of how NOT to use statistical techniques. The world's best known practitioner, Richard Russell, has been writing a newsletter called Dow Theory Letters for over 50 years. One of the first things you will see on his website is "Send your money in now". In April 2007, he wrote:

"We saw something that is extremely rare, in fact I can't remember ever having seen this before. What I'm referring to is that on those two dates all three Dow Jones Averages - Industrials, Transports and Utilities - closed at simultaneous historic highs. To me, a fellow steeped in Dow Theory for over half a century, this was like a clap of thunder... My take on the situation is that the stock market (and the Dow Theory) told us that an unprecedented world boom lies ahead."

Soon afterwards the S&P500 began a 56% slide. More astonishing is that he had been consistently bearish throughout the bull market that had prevailed until then. But this is a digression; what of his technical analysis per se?

In one edition, his breathtaking failure to grasp the basics of tools he himself chooses to engage and to endorse, contained a truly astounding tautology. A moving average simply plots, at any time t , the average of a selected number, n , of immediate past observations. In this way it is not much different to an ordinary average, and yet Richard Russell proclaimed (with an admonition to readers!):

"Now this is very important. Note how gold tends to group around (above and below) the MA [moving average]. The MA acts as a magnet as far as the price action is concerned".

Well, even random numbers group around their own averages, rather unsurprisingly. In the same edition, he wrote, still on the topic of gold:

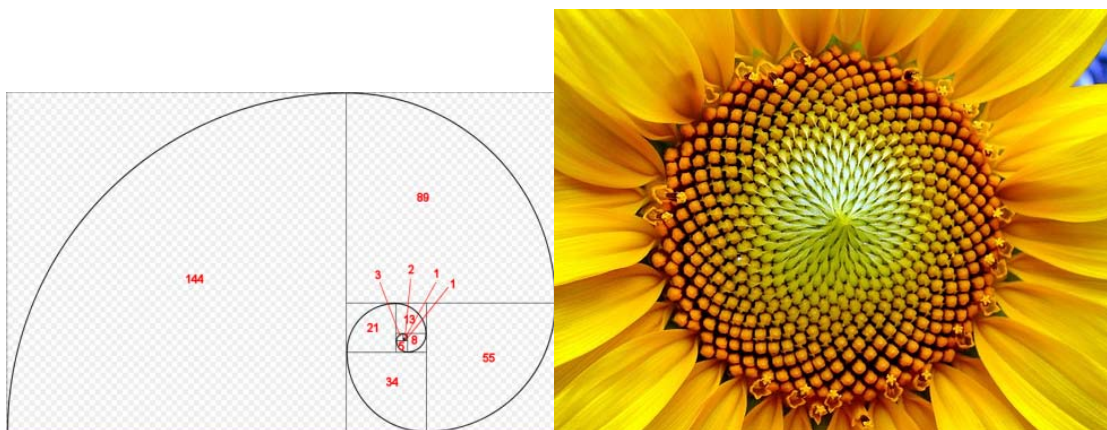
“Momentum usually turns up before price”.

In both cases, we have a violent abuse and a woeful misunderstanding of numbers. Moving averages have their use. For example, they are a reasonably effective and very simple way of de-seasonalising data to remove seasonal distortions. But even a cursory glance at the actual formula for a moving average, or a momentum indicator, will show that they do not even pretend to take the form of a forecasting tool. His second statement quoted here is quite simply a mathematical impossibility.

Leonardo of Pisa, nicknamed Fibonacci, was an Italian mathematician born in Pisa in the 12th century. The following sequence of numbers, obtained simply by adding the two prior results, is named after him:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89...

The ratio of successive numbers soon converges to $\frac{1 + \sqrt{5}}{2} = 1.618034$, the so-called golden ratio because of its amazing occurrence in nature. For example, it can accurately model snail shell spirals, the arrangements of seeds in flowering plants, the family tree of honeybees and so on:



What it can't do is predict share prices, but chartists often use this sequence of numbers and derivatives thereof to try anyway. It is said that Fibonacci himself thought the sequence could be used to predict the cumulative population of rabbits, given their legendary libido and short gestation cycles. It's not very good at that, yet better at that than forecasting share prices.

One problem seems to be that charting can throw up optical illusions of prescience. Perhaps chartists are themselves deluded by this, or perhaps they just cunningly exploit the under-inquisitive minds of their clients. Here, we will not delve into the more arcane technical tools, but note that many are abhorrent abuses of mathematical techniques designed for completely unrelated purposes. Sceptical readers may wish to ask chartists for an academically valid assessment of their forecasts.

It would seem that probability theory does not come naturally to many people. Sadly, this does not always seem to deter everyone from making emphatic but hopelessly incorrect statements. A well known South African fund manager once proclaimed, in reference to a listed technology company:

“The risk of the company failing is higher than the risk of the share de-rating”.

Meaning, a share price fall of 100% is somehow more likely than a fall of a lower percentage.

Mathematics is the purest science. Irrefutable proofs of theorems can be generated. An “equals” sign means just that, unlike an economist’s “equals” sign which conveys no more than an optimistic view on how things might work, some days. But abused mathematics, whether intentionally so or not, can be very harmful to your portfolio, and mistakenly beguile you into a sense of comfort.

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For more examples see my chapter titled *Really Bad Research* in the book *The Effective Investor* by Franco Buseti, scheduled for publication in early July 2009.

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