



Risk Management and the Black Swan

In their day-to-daywork, many actuaries deal with risk management and models. However, when the theme of Risk Management was discussed in the editorial team, everyone agreed that an introductory article around the topic of the Black Swan would be a good idea. What is this concept/notion? As humans, we often tend to forget too soon the lessons learnt from large events that changed the world or severely impacted the economy. Have we wasted many a good crisis?

HISTORY OF RISK MANAGEMENT

In his book *Against the Gods*, Bernstein provides an overview of the development of risk management spanning many centuries. The story starts in ancient Greece. Although the Greeks thought about probability, this remained separate from applying probability to playing games or gambling and they often relied on oracles to take decisions. It took until the 13th century before the Arabic numbering system was introduced by an Italian which many of us will know from its sequences: Fibonacci. This new way of using numbers allowed much better for making all sorts of calculations (which is inherently more difficult than e.g. multiplying VIII with II).

During the following centuries, probability theory developed further and further, initially mostly driven by games and gambling. But also by a number of scholars that enjoyed measuring the height of people, or counting deaths to construct the first mortality tables. Typically, most of the measurements would lead to some distribution that looks like a bell curve. This naturally led to the notion of regression (or reversion) to the mean.

In the century after the First World War, risk management has evolved significantly as the world faced many (new) risks and crises. As more numbers and computing power became available, so grew the need to understand and model the world around us. With our decisions (based on e.g. utility or game theory) people tried to shape or influence the future. However, various events outside of our control continued to impact the world. And as Kahneman and Traversky have shown (a.o. in their article *Prospect Theory*), those decisions we take are typically not as rational as we think they are. And as Jacob Bernoulli stated: *Nature has established patterns originating in the return of events, but only for the most part*. This is key point in the book of Bernstein. If everything would be predictable, there would be no risk, no change and no mystery in life. And therefore no need for good risk management.

According to Bernstein: *the essence of risk management lies in maximizing the areas where we have some control over the outcome while minimizing the area where we have absolutely no control over the outcome and the linkage between effect and cause is hidden from us*. This latter part brings us to the Black Swan.

THE BLACK SWAN PHENOMENON

The well-known book *The Black Swan* from Nassim Nicholas Taleb, a professor who deals with problems of luck, uncertainty, probability and knowledge, provides many examples and stories which speak to the imagination but also clearly show how we so easily draw false conclusions. In the Old World people have seen only white swans. They therefore were convinced that all swans were white and they refused to acknowledge that Black Swans existed. Another well-known example is that of the turkey that is fed each and every day. Based on this past experience of many days being fed, each and every day, there is no reason for the turkey to doubt that tomorrow would be any different. Until Thanksgiving day comes along and the hand that has been feeding him is now there to end his life.

It's not difficult to extend this example to our daily work. In actuarial modelling, historical data is often used to model the total distribution of the risk and to price the insurance product. The more data (and data analytics), the better. And this is perfectly fine for the masses (or what

Taleb refers to as mediocristan). But the example of the turkey also shows that we should never forget that history does not always repeat itself. And that using (limited) historical data can lead to substantial financial gains as long as circumstances remain the same. Such as in the case of the LTCM fund. As most people will know, the fund used small arbitrage opportunities in interest rates and equities. Given the small spreads in such arbitrage opportunities, a high leverage was needed. Although designed by some very smart mathematicians, the consequences of rare or extreme events were not captured in the models. The Asian and Russian financial crises led to the collapse of the fund and a massive bail-out.

However, it is (way) too simple to draw the conclusion that the fund managers should have known better. History is always crystal clear. A concept which Taleb labels retrospective distortion. We are very capable at explaining what happened, what went wrong and why, after the fact. For the ones that like cartoons, please look up Captain Hindsight in the South Park series.

Furthermore, our hindsight explanations are typically accompanied by a reason. Because adding (a) reason(s) to an explanation somehow makes it more credible. Consider the statement that the stock price of company XYZ increases, versus the statement that the stock price of company XYZ increases because the company recently launched a new product. This explanation doesn't make the increase any different, it's also not sure whether this (partially) was the reason. But if told by someone that people perceive to be 'an expert' on the topic, the explanation will be accepted by most. People think they understand what happens and drives various changes in the world, but more often than not this is not the case. And the world is inherently more complex than we think.

This concept of illusion of our understanding also comes back in the use of the Gaussian copula in the years before the credit crisis. Despite the warnings of the man that introduced the formula, David X. Li, the concept was used to create the infamous CDO's. The rest is history. It's very well explained in the article 'The Formula that Killed Wall Street'. We can highly recommend reading that (for those that have not yet).

Now, the concept of the Black Swan might appear grim and all doom and gloom. However, be aware that Black Swans can also bring positive change. Taleb gives the example of the internet. Internet has significantly changed the world. Positive Black Swans typically take a longer time to materialize, whereas negative black swans occur (more or less) instantaneous.

We are aware of the fact that some people might have a different opinion on the 'positive effects' of the internet. Recall however, that a Black Swan is not universal. What is a Black Swan for our unfortunate turkey, is daily routine for the butcher.

Black Swans are considered unknown unknowns by some. A known unknown in such context can also be referred to as a grey swan. Covid-19 would be considered a Black Swan in 2019, but communicable disease would probably be a grey swan now.

Risk brings reward but as Taleb states: It is much more sound to take risks you can measure than to measure the risks you are taking.

