Re-Think the Risk: Use and Misuse of Statistics

By Sylvestre Frezal

Are insurers risk management professionals? Should we use statistics to manage risk? We tend to make conflation when we speak about risk. Let's clarify its meaning to stop misusing powerful tools.

When an insurer and a policyholder sign a contract, they see the same phenomenon, but they do not face the same situation. Thanks to the law of large numbers, the insurer knows that 1,000 of its 10,000 policyholders will develop cancer, while the policyholder does not know if he will have a cancer. In other words, the policyholder is facing risk whereas the insurer is not: the business of insurance is not to manage risk, but to manage heterogeneity—the heterogeneity of outcomes, the heterogeneity of its clientele where some customers will have a cancer and some will not.

A MATTER OF PERSPECTIVE

A given phenomenon can have different natures. For example, consider a glacier. For the geologist who analyzes the flow of the ice tongue in a valley, the correct description is that of a viscous fluid. For the mountaineer climbing a crevasse, the correct description is that of a solid. The glacier, oil or granite? It depends on the observer, and mathematical modeling must differ.

And it's not because the geologist has distance compared to the climber that the last would gain by adopting the point of view of the first: the geologist does not have a better understanding of the material in the absolute: it would thus be irrelevant for the climber to listen to the geologist and exchange his ice ax for a wetsuit.

Similarly, an insurance contract is a given phenomenon but of a different nature as it is seen by an insurer or a policyholder (globally deterministic vs. individually random): representations of each must be adapted. Thus, from the standpoint of the policyholder (individual viewpoint), using statistics (global viewpoint) to understand his situation may not be relevant.

To manage heterogeneity, statistics proved their efficiency. As a matter of fact, insurers and actuaries have used statistics successfully for two centuries to price products efficiently, routinely making money. Shall we therefore conclude that statistics are efficient to manage risks? In other words, do statistics make sense from the policyholder point of view, to make a decision? Or, similarly, do statistics make sense for an insurer when he thinks not about his everyday recurring profit but about his potential risks? To these questions, our answer is no.

However, many stakeholders seem to consider that the answer is yes.

For example, a former quantitative analyst who worked in a large bank in London in 2008 once told me: "After 2008, we had to account for 2 billion in losses. That is to say, we had to find models that would have enabled us to avoid those losses. We tested several complex models–stochastic volatility … and it didn't work. We realized that we'd get creamed every time." These demands are symptomatic of a pervasive conflation in the financial industry, whether banking or insurance, whether investment strategies or regulation: a conflation between the business tools monitoring the profitability (quants' statistical models to make money every day), and risk management tools (to avoid losses during the worst crisis of the century); conflation between their properties, and, therefore, between the expectations, one may have vis-à-vis them.

To avoid such conflation, we shall characterize the distinction between the two natures of situations: randomness vs. heterogeneity. It will allow us to establish the scope of relevant statistical tools (statistical distribution functions and related variables) and then to examine the consequences of using these tools outside their scope of relevance and propose an alternative method to face risk.

THE TWO DISTINCT SITUATIONS

A decision maker is placed in a **random situation** if he faces a phenomenon which he does not know the realization in advance, and which will only happen a few times, typically only once. Conversely, he is placed in a **heterogeneous situation** if he faces a phenomenon that happens often enough so that even if he does not know in advance every realization, he knows in advance the overall outcome: thanks to the law of large numbers, it can neglect the difference to anticipation and consider the whole phenomenon as deterministic.

Typically, when signing an insurance contract, the insurer is in a heterogeneous situation while the policyholder is in a random situation. When choosing a strategic asset allocation, the insurer is in a random situation: if the performance is bad and it goes bankrupt or loses many customers, he cannot play again. Our question is: in random situations, are statistics a relevant tool to rely on for decision-making?

When In A Random Situation, Statistics Are Meaningless

Let's consider the simplest statistics: expectation. Should you explain its meaning to somebody, could you provide any intuitive description without using a formula such as "assume that we play several times, then that's what we would get on average"? I guess you cannot. When explaining concretely what mathematical expectation is, you have to impose hypothesis of repetition of the phenomenon, and afterwards to refer to an average.

But when you are in a random situation, the hypothesis of repetition on which you rely cannot be verified. Your reasoning is based on hypothesis which is not verified: this is a fallacy. If ifs and buts were candy and nuts, wouldn't it be a merry Christmas? From a psychological point of view, one can appreciate the soft cocoon of a virtual world, but from a logical point of view, it is nonsense. When in a random situation, expectation is meaningless. Then, relying on expectation or on any other statistics leads to a flawed reasoning.

When In A Random Situation, The Use Of Statistics Distort The Understanding Of The Situation

Why do we tend to appreciate this psychological cocoon? Because it gives us the comfortable illusion that we detain information on the future, on what will happen. This has consequences.

In 2008 for example, Alan Greenspan explained in the FT that he was in a state of shocked disbelief. However, he still hoped risk models would allow to identify periods of euphoria from speculative fever breaks. As if risk management tools could predict uncertainty. As most of us do spontaneously, he seemed to forget that when taking a decision under uncertainty, what is at stake is that we do not know what the future will be. Why such a misunderstanding?

Because a quantified world is a world that feels deterministic. This is natural: statistics can be interpreted only through a virtual positioning into a heterogeneous situation; that is a situation where randomness has been pooled and has disappeared into the law of large numbers. Using statistics therefore places the decision maker into a mental scheme where the world is deterministic. This leads to disillusionment, e.g., when people regret that "risk models did not anticipate that," forgetting that the essence of risk is the impossibility of forecasting.

When In Random Situations, No Accountability Can Be Enforced Through Statistics

When in random situations, we do not know what will happen. An expert tells us that "there is a 30 percent chance that there is a recession"? Big deal! He could say 1 percent or 90 percent, in one case as in the other, neither the recession nor its absence was excluded: whatever the outcome, the assessment was not wrong. One expert tells us that "stock market expected return is 4 percent"? So what? Whatever ultimate yield is observed, it will not be inconsistent with his initial statement. Again, it is never wrong.

If, whatever they say, these experts cannot be proved wrong, then believing them is not an act of science, but an act of faith. From an epistemological point of view, these quantities are not scientific. From an operational point of view, they do not allow for any accountability.

MEASURING (OR NOT) THE MODEL ERROR

When facing a heterogeneous situation, you can compare, afterwards, the distribution function anticipated ex ante to the distribution function observed ex post: you can measure the model error. A dispersion model can be challenged. It is science, and it commits an accountability.

When facing a random situation, you cannot do such comparison. There is a full fungibility between the risk model and the related model error. As you cannot distinguish them, you cannot challenge any risk model. Risk model is not science. And there is no accountability.

When In Random Situation, Statistics Do Not Provide Mathematical Objectivity

One could, however, argue that taking a step back, it would be possible to shift from a **random situation** to a **heterogeneous situation**, and as a consequence to challenge a statistical assessment. For example, if the insurer provides me a probability of cancer of 10 percent, I could then compare this probability to the proportion of these who were given this estimate and actually got a cancer. But why would it be objective to compare me to these other people? Perhaps 10 percent of us had a 100 percent probability and the others 90 percent and 0 percent probability. My personal probability has been necessarily defined by reference to a given population. Which one?

Those of my age? Of my gender? Of my corpulence? Of my sports habits? Of my cell phone utilization frequency? Of my post code? Of my medical history? Of my DNA analysis? Of my profession? Etc. Should I answer yes to all these questions, I would be unique and there would be no reference to determine a probability. It is therefore necessary to answer no to some of them. And the choice of these questions is a qualitative judgement which cannot claim for mathematical objectivity. In other words, quantitative statistics is necessarily the outcome of previous qualitative judgements. And in statistics as anywhere, subjectivity in, subjectivity out!

What To Do Then?

In random situations, statistics are just like whisky. It helps facing a difficult decision where we have no good choice. It gives us courage, but it does not improve the quality of the decision we make. Quite the opposite, since it misleads us, generating illusions of objectivity and preventing us from apprehending the risky nature of the situation.

THE MYTH OF "BETTER THAN NOTHING"

When hearing criticism against reassuring quantitative tools, a question comes spontaneously, "What's the alternative?" Is this question legitimate for operational decision?

Consider a man lost in the desert. He is thirsty. He has a beer available. He is about to drink it when a physician tells him that alcohol will only increase his dehydration. Would it be sound to ask the doctor, "What's the alternative?" if the doctor has no alternative to beer? Should the walker drink it because it is "better than nothing," rather than continuing to move forward while thirsty, as far as his legs will carry him, in search of water he may not find?

Similarly, being able to rest on statistics is reassuring and nice, but if they are "not wrong" and degrade the judgment, it may be better to do without, even without palliative. However, we have an alternative to offer!

As a consequence, the first step is to stop using statistics when dealing with random situations.

According to Machiavel, the Romans went so far because they accepted their fear. So, should the decision-maker do the same; face uncertainty rather than trying to hide it behind a ribbon of math, assuming the subjectivity of his vision (a subjectivity which a leader has legitimacy for) rather than tacitly delegating it to the experts who calibrate the tools (and who have no legitimacy for enforcing their subjectivity)?

How To Put Such An Ambition Into A Decision Method?

Prof. of Sociology Andreu Solé gives us a clue when explaining that people make their decision relying on their oblivious vision of the future: we tend to split the different potential futures (the situations we may be confronted with, the decisions we could make) into three categories. The Possibles, which could happen, the Impossibles, which cannot, and the Ineluctables, which shall happen. For example, most global CEOs would consider a presence in China as an Ineluctable, a presence in Africa as a Possible, and a presence in Afghanistan as an Impossible.

OUR DECISIONS ARE DETERMINED BY OUR PERSONAL, UNCONSCIOUS REPRESENTATIONS OF THE FUTURE

We obliviously split the future in three categories: the Possibles, the Impossibles and the Ineluctables. Our decisions result from this personal vision.

For example, at dawn on Dec. 7, 1941, the radar operators in Pearl Harbor observing points on their screens saw a dysfunction of this recent technology as a Possible, and an attack without declaration of war as an Impossible. Such a representation of the future led them to spoil two hours checking their radar rather than alerting and drifting the ships out of the harbor.

Obviously, the Japanese pilots, at the same moment, did not have the same representation of the future.

To face uncertainty and favor awareness in decision-making under risk, we should exploit this natural way of thinking, turning it into an explicit process of analysis:

- First, enrich our spectrum of Possibles by identifying the largest set of future scenarios. This is the time for challenging and rebutting our oblivious Impossibles, for benefitting from the experience of experts to enlarge our vision of the futures.
- Second, sort out what we will consider as Impossible. By Impossible, I mean here that we agree to neglect its consequences, to take the risk of such an outcome. This selection is not the task of an expert: this is the time for acting as an aware decision-maker assuming its subjective risk appetite.
- At this stage of the analysis, the decision maker has clarified his vision and, de facto, the decision is already made, as it will be a straightforward, mechanical outcome of the decision makers accepted vision. From now on, it is only a technical matter: the experts will determine which action provides the best pay off in the central scenario, under the constraint of providing acceptable (as defined by the decision-maker) output in the remaining Possible scenarios.

THE CORE GOVERNANCE POINT

The representation of the potential futures cannot be delegated to the experts, as good as they may be. Tthe decision is embedded in the analysis, and hence the subjectivity of the analysis is the prerogative of the entitled decision-maker.

The Price To Pay

Being objective while facing the unknown is a chimera, but abandoning such an ambition and such a psychological cocoon is a hard price to pay. However, awareness, explicitness and responsibility, as tough as they are, are a necessary grounds for better decision-making. ■

Sylvestre Frezal is the founder and co-director of the chair PARI (ENSAE ParisTech & Sciences Po), focusing on the apprehension of risks and dangers. He can be reached at *sylvestre.frezal@datastorm.fr*.