4. Risk: uncertainty, risk sharing, risk transfer

Risk is an opportunity of *loss* as the word "chance" is preferably used when the opportunity is one of *gai*n.

· Risk is measurable or immeasurable

Risk sharing: *sharecropping* as an example. In agriculture, fishing, etc. risk is shared between the owner of the resource (landlord) and the worker (sharecropper)

Risk transfer: the purpose of insurance sector

Risk creation: speculation as an example of unwarranted risk creation

The principle of insurance is as old as time: Ulpian, a third century jurist mentioned an annuity table, an annuity being a type of contract where the beneficiary pays the insurer a lump sum at the inception of the contract, the terms of the agreement being that from that moment on, the insurer will grant the insured a set amount every year either for a set period (a number of years agreed upon) or for perpetuity, i.e. until the death of the beneficiary, or of the last surviving beneficiary in case the annuity is a joint one. In 1800 BC, the Code of Hammurabi mentioned mortgages on boats, which would be voided if they were lost at sea, thus the equivalent of an insurance. The emperor Claudius (10 BC – AD 54) took personal responsibility for all Roman merchant ships lost in storms.

When states were granting such annuities, they were counting on the lump sum paid by the insured. But this was a shot in the dark as far as they were concerned as, for lack of a proper methodology when determining the proper cost, there was no way for them to assess whether the whole operation would turn out to be beneficiary for the State or lead to a loss.

In England in the 17th century the price of an annuity would be the same whatever the age of the insured, his or her life expectancy at the time of the contract being ignored. It is not before 1789 that age would be regarded as a relevant type of information and actual mortality tables being used to set the annuity down payment.

Until the end of the 17th century, insurance would be a simple bet on the part of both the insurer and the insured as there was no objective ground whereupon to set the premium. Then things changed.

The early landmark was when, in England, John Graunt (1620-1674), a haberdasher, a trader in buttons and needles, compiled the first mortality tables from evidence he gathered from a variety of sources. He soon benefited from the help of William Petty (1623-1687) a Member of Parliament and of the Royal Society and an able mathematician. Edmund Halley (1656-1742), the Astronomer Royal, would join the effort and add some rigour into the calculations.

The turning point was however a few years later when in the Netherlands, Johan de Witt (1625-1672), a prominent statesman who ended up lynched by a mob, and Johannes Hudde (1628-1704), mayor of Amsterdam, started using empirical mortality tables as the evidence wherefrom to properly assess what should be the price for annuities such that states could make a reasonable profit when selling them.

The name of Richard Price (1723-1791) is often mentioned as the founder of the actuarial science. Price was an influential theologian and moral scientist who was once asked to advise one of the early insurance companies called *The Equitable*. However, his computations are now known to have been widely off the mark, nowhere near the accuracy which had been obtained nearly a century earlier by de Witt and Hudde.

Proper insurance companies, typically "fire offices", were founded in Great Britain at the end of the 17th century. The *Hand-in-Hand* was established in 1696. The most famous of all: *Lloyd's* was founded in 1716. It started as *Lloyd's News* then *Lloyd's list*: information about arrivals and departures of merchant ships and advice given by captains about hazards associated with particular maritime routes.

Most new insurance companies were unreliable, trying essentially to fool the credulous, the circumstances being very much symmetrical as many insured were trying themselves to swindle the insurer.

"It is the insurance companies' size which allows them to perform their task. The loss for instance for a renter of having set his apartment on fire exceeds in most cases by far his financial means. Due to their size, *Property & Casualty* insurers are able to manage such risks on a statistical basis: historical data are collected over the years

about the occurrence of such events as fires and associated damages whenever they occur. An actuarial assessment by an insurance company in terms of average and maximum loss tolerable before insolvency allows the calculation of an insurance premium level which will not only cover for losses but will allow the company a profit. However costly individual fires might be, they become by this method collectively manageable as their individual occurrence remains at a degree of rarity which has been accurately assessed.

Value at Risk

The question which needs to be solved by an insurance company is calculating premium levels such that no payment due to a casualty will lead to its insolvency. The methodology used is that of VaR : *Value at Risk*, a method the principles of which were first set out in the 18th century by several mathematicians, most prominently by Condorcet (1743-1794) and Laplace (1749-1827). The principle of the method is that a maximum level of loss for the insurance company is set (representing a manageable proportion of its assets) and a probability that such a loss occurs over a set period (usually one month) is chosen also, making sure that it is very small (the probability in Solvency II is a 0.5% occurrence).

A common misunderstanding however with the VaR methodology, the victim of which being as well the regulators as the users, is that the loss amount associated with a chosen probability is that of a *threshold* value and not of a *maximum* value: what the methodology indicates is that there is a probability **P** that over a chosen period **p**, a loss will take place "which is of *at least* **X**", and not as commonly understood "which is *at most* **X**", the actual figure for that loss being possibly much higher than **X**. The misunderstanding is so pervasive that the standard French definition of VaR is the incorrect "perte maximale à ce seuil" instead of what would be correct "perte minimale à ce seuil".

The common use nowadays of the VaR methodology is thus based on a flawed representation of what it actually means. This is unfortunately a very far from unusual occurrence in finance: the common representation of a methodology used is far removed from what it actually means!

An additional serious issue is the fact that a corporation's off-balance sheet items are not taken into account in the VaR calculations on the assumption that these are immaterial to loss, this being in line with the definition of the concept of "off-balance sheet". Let us remember however that it was the sudden need to consolidate some off-balance sheet losses with those of the mother-company that led to the downfall in 2001 of the Enron corporation, a major player in the energy sector, over a mere 46 days.

Life insurance operates from similar principles. Life expectancy rests however on simpler probabilistic assumptions than other types of damage. As for the investment part of life insurance, it is but a variety of intermediation between the insured and the issuers of the debt products in the insurer's portfolio.

Solvency II

As far as regulation is concerned for the insurance sector, it is now covered by the Solvency II agreement.

Solvency II presents every one of the shortcomings of financial models and some more in addition. As with all financial models the picture it offers is very remote from reality: simplifications are a-plenty and consistency with empirical facts comes only second to consistency with well-established economic dogmas. In addition, the validity concept as such is not regarded as a crucial criterion for acceptance of the methodology: concerns linked with convenience for the financial milieu, vested interests of different stakeholders, take precedence, and by far.

This by itself questions of course the validity of the model in measuring risk appropriately.

For example, the statistical distribution of all phenomena being modelled is regarded as "normal" or "Gaussian", a very tame brand of randomness indeed where the *mode* (the most common occurrence) is a priori supposed to be identical to the *median* (the case being on the cusp between half of the cases having a higher value and half of the cases having a lower value) and the *average* or *arithmetic mean* (the case the value of which is the average of all cases). The randomness of financial data is actually not as neat as that, *variance* being for instance not finite as with a Gaussian distribution but infinite.

The validity of the model relies then on historical data, the series of data for innovative financial products being invariably too short for statistical significance and covering most often only periods when the markets were upbeat.

Solvency II models rely also massively on *correlation matrices*, these being made out of the correlation coefficient of price behaviour between two different financial products. Such correlations are only meaningful at times of a rosy economic climate. Should that not be the case, prices for all products drop and are therefore necessarily correlated. Such drops happen of course instantly in a crash and correlation matrices which were painstakingly built over the years become then useless for a while within a split of a second.

An error common to all risk management approaches involving the VaR methodology such as Solvency II is of course the confusion I've mentioned earlier about the threshold associated with a loss probability, which is that the threshold in question signals a *minimal* loss and not a *maximal* loss as universally assumed by the parties involved.

Specific to Solvency II is the fact that it relies entirely on the major rating agencies' ratings when assessing credit risk, the shortcomings of such ratings being by now well-known (they focus on individual businesses, ignoring the risk involved with industrial sectors as a whole); also that the underlying philosophy of the approach is *procyclical*, meaning that it unwillingly encourages unjustified carelessness in times of plenty and will then turn brutally punishing in times of dearth.

Further issues:

Securitisation: a flawed transpose of the actuarial principle

Structured finance: should financial products for which risk cannot be measured be banned altogether?

Further reading:

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