The insurance company: time and probability

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1 - Introduction: The company as a risk factor

The extension of the types of insurance contracts to many different has transformed our society in the "risk society". But, while not denying this evidence, we can reverse the concept and also affirm the existence also of a "risk society", that is, consider that today the company itself is a risk factor, because the media amplify and distort the reality and people are not so gullible, for which themselves are continually excited and multiplies the entropy, that is the risk.

The risk is the raison d'etre of the insurance.

There are people who have frequent need of adrenaline. These are the worst customers of insurance companies, in fact they are not even customers because companies refuse to insure.

However, there are subject, though naturally conservative, who cannot stand the idea of risk, willing to cover translating other and they are the best customers of the insurance companies, because they are willing to give up any potential event risk, that can become a reality. These subjects have pushed companies to devise policies of any kind (such holiday insurance, etc.).

But, we must consider that the mere translation of the risk attenuates the attention of the insured, which is rooted in the consolation of the "so I am covered by the company." This mentality, very harmful, is opposed by the insurance companies with the open insurance overdraft and various forms of franchise.

The insured must be a "member of the risk", not just a seller.

2 - Notes on risk management

The insurance company runs the risk, but fears him: truth is that it resorts to co-insurance and reinsurance and, regardless, based on the probability of the negative event occurs purchased; in fact, an insurance policy is a contract whereby you buy a deferred charge and receive the current revenue. The time lag between immediate revenue and cost (if any) deferred is an indirect measure of probability: in the case of insurance indefinitely, as in life insurance (death) is the certainty (probability 100 of 100) of the occurrence of the event (death of the insured); in the case of life insurance and term life insurance, time plays an important role, because as soon as the deadline is approaching, that time goes by, the probability of the event will occur decreases in the case of life insurance, while it increases for the term life insurance for the natural aging of

the insured (actuarial tables of life expectancy). But at this point, and always in terms on the subject of fixed-term contracts, playing the law of large numbers, that does not matter of the contracts life indefinitly, in which there is the certainty of the event and it does not matter that the company has taken a thousand or a hundred thousand contracts of this kind, because there is a certain negative event (the death of the insured in any case). However, even for this time plays a decisive role, because it reflects revenues, that is, the number of annual premiums (a part of the case with a single premium) will be achieved between the assumption of the risk and its occurrence. Sooner (or later) death occurs more importance has the probability that the number of premiums is such as to make positive or negative the contract. Here in hindsight, even the "law of large numbers" is not without importance. In fact, if the number of contracts is small, the negative probability becomes a certainty (which in this case is longer concerns the single event, but its distribution on the number of contracts), and if it is high, court returns the probability calculus; then on the mass of contracts the probability reprises his role, but on the whole the management and not on the event, that is certain in the insurance case of whole life after death.

Premiums (revenues) are affected (this is the circularity or cause-effect relationship), is that the negative event happens or not. The probability is a march towards the certainty of an event occurring or not. But the perception and evaluation of the degree of probability is based on the law of large numbers, that is the wider is the population, probability becomes a certainty, so valuable, in fact calculated with the use of mathematical probability. These mathematical analysis pours it in the determination of the actuarial reserve for life insurance companies.

The insurance company has assessed its profits must take into account three main variables:

a) the fairness of the premium

b) the investment rate of premiums collected

c) the number of policies taken necessary to limit the likelihood of the negative event.

The fairness of the premium is primary as if the premium is not reasonable, it means that, regardless of the financial policies of the insurance company, profits will be always negative.

The investment rate of the premium income is a variable of equal importance. In fact, if an insurance company does not handle properly the investments relating to premiums paid, no matter how reasonable the

premium, it risk of losing profit or take it to a negative values because of financial policy reckless or completely wrong or unlucky for a trend unpredictable or unexpected financial markets.

Policies number is a variable, that can overcome the probability of a negative event, or the death of the insured, because the greater the number of policies taken annually, the higher the revenues collected. In an industrial company we could say that the higher the revenues and costs have less impact on the income statement.

The mathematical representation of the concepts be expressed just might:

CASE 1: The insurance company stipulates a single life insurance policy. Collects the premium at time 0 and at time t will pay the compensation to the insured person's death. What is the expected profit?

It is assumed that profits are equal to revenues minus costs. Revenues from an insurance company are the proceeds of the policies and costs are disbursed as a result of death of the insured.

So the expected profit is equal to:

$$\pi_t^1 = R(1+\vartheta)^t - p(t)C \qquad [1]$$

where:

π = expected profit

θ = rate of return

p (t) = probability function of the time that the insured die

R = revenue

C = cost

This hypothesis is an extreme version of the concept of life insurance which allows to explain that the profits of an insurance company always depend on the financial component resulting from the investment over time at a given rate of interest and the probability of death of the insured. Later in time the insured dies the higher the profits of the insurance company. Since it is not possible to predict with certainty the date of death of the insured, the insurance company can obtain a profit margin of only the statistical law of large numbers, i.e. highest grossing annually premiums that help to cover up any disbursements. All, obviously, accompanied by a sound financial management, which, coupled with the law of large numbers, allowing insurance companies to maintain adequate profit margins. Precisely from this premise, the hypothesis 2 will

demonstrate, mathematically, that only with a large number of contracts you can get a higher expected profit in insurance companies.

CASE 2: the insurance company enters into contracts k, all with probability disjoint *p(t)*. What is the expected profit?

$$\pi_t^k = kR\,(1+\vartheta)^t - \sum_{s=1}^{k} s[p(t)]^s\,C \quad [2]$$

This equation, similar to that referred to the hypothesis 1, shows that the expected profit is equal to the revenues invested over time at a certain rate of return ϑ, multiplied by the number of policies k, less the sum of the costs as a function of the probability of death the insured.

If you compare the two situations, it is possible to show that the profit per policy is higher in the hypothesis 2. Specifically, we compare:

$\pi_t^1\ with\ \frac{\pi_t^k}{k}$

$\pi_t^1 = R(1+\vartheta)^t - p(t)C$

$\frac{\pi_t^k}{k} = R(1+\vartheta)^t - \frac{\sum_{s=1}^{k} s[p(t)]^s C}{k}$

Where $\sum_{s=1}^{k} s[p(t)]^s < p(t)$

Because $p(t)\ \in [0,1]$

In fact, for example, if $p(t) = 0{,}2\ e\ k = 3$

$\frac{\sum_{s=1}^{3} s(0.2)^s}{3} = 0.101$

$0.101 < 0.2$

Therefore it is demonstrated that in the presence of a high number of contracts the probability of the negative is reduced, and consequently increase the profits per unit of contract.

In summary, it is clear that:

a) the law of large numbers applies in any case of an insurance contract, albeit in different ways depending on which:
   i) it is open-ended contracts (case of whole life after death) in which passing of time approaching the certainty negative event (death) and the probability calculation of which is reflected in the number of revenues (premiums) can be displayed;

ii) in the case of fixed-term contracts (damage and temporary life), in which the passing of time reduces the probability of negative albeit to a different extent for the case temporary death, which, instead of revenues, will discharge the possibility of costs ;

b) the law of large numbers, that only the companies of considerable size are able to manage, allows a standardization of the probability, in the sense that, the larger is the basis of the number of contracts more than the negative event can be appreciated and managed;

c) the role of time in any case is the defining element of risk management by the insurance companies. But, it is not characteristic of him, because time is the soul of every economic management in any industry. One could say that, although almost metaphorically, time and chance are the two sides of the same coin;

d) in economics of insurance stating that there is correlation between costs and revenues, meaning in terms of the opposition, but the concept should be clear: revenues are, certainly or probabilistically waiting for their costs, and between them there is a relationship of cause effect.

This explains why the Authority tends to absorb small companies in other larger and feature of capital and number of contracts, because only the latter can make use of the reference to the law of large numbers and have the opportunity of better risk government, giving stability to the system in the general economy. So no stigma to the imposition or moral suasion, because the concept is, even before the policy of the Authority responsible for checking, economic and applies regardless, if you want to have a sound business, efficient and effective.

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