Decisions about insurance: An application of the expected value rule

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Insurance and the expected value principle

Every business and individual faces decisions about which insurance products to buy. Equally, insurance companies must decide the nature of the products which they will offer for sale. These two decision situations have important similarities. The expected value (EV) principle is applicable in both situations because they involve risk and also the "law of large numbers" (LLN). For the buyer of insurance, the LLN applies because the buyer typically faces a repeated annual decision as to whether to continue to buy insurance for the risk in question. For the seller of insurance, the LLN effect arises not just because of the repeated time periods but because within a single time period there is a portfolio (risk reduction) effect, e.g., from insuring a large number of properties.

In a single period, the EV of the payout from insurer to customer is: Prob (Payout) * Policy Amount.
For example, assume that the reinstatement value of a commercial premises is €200,000 and that it is insured for this amount. Assume also that there is a 1% probability of a payout under the insurance policy (i.e., 1% is the "joint probability" that the premises is destroyed and the insurer honours the policy). The EV of the policy is therefore simply €2,000, i.e., 1% of €200,000. It is likely that the customer will be willing to pay a price somewhat more than €2,000 for this policy (assuming that s/he has some degree of risk aversion) and the insurer's profit margin is the difference between this price and the €2,000 "cost of goods sold". The risk is not simply transferred from customer to insurer but is in fact largely eliminated because of the diverse range of risks which the insurer provides cover for.

Does buying insurance always reduce the customer's risk?

In a word,no. Four situations can be identified:

Where buying insurance provides no reduction in risk:

From the customer's perspective, this is the "dead money" situation. It arises where the customer pays an insurance premium but there is a zero probability of receiving any payout in return. Two examples will illustrate. First, the reinstatement value is typically the maximum amount which an insurer will pay out in compensation when a property is destroyed, so the additional premiums involved in insuring it for any greater amount will bring no extra payout and are therefore a waste from the customer's point of view. Second, a number of years ago I received the renewal notice for a multitrip travel insurance policy which I had been paying for about three years. When I read the notice carefully, it was clear that – given the "exclusions" from the policy and my own (unremarkable!) typical travel patterns – there was no realistic chance of my ever being able to make a claim under the policy, so I decided not to renew it.

Where buying insurance actually increases risk:

Consider the case of a painting or similar artefact which the owner values because of its sentimental or cultural significance, rather than because of its monetary value. If the item were to be insured, and then stolen or destroyed, what would the significance of the insurance payout be? It would not compensate the owner for his/her main (i.e., sentimental or cultural) loss, so the insurance would not have achieved the reduction of this risk. In fact, payment of the insurance premium would simply have been a form of betting – a bet which the owner "wins" if the item is stolen or destroyed! Making this bet by buying insurance is a form of risk-increasing behaviour, in exactly the same way as betting on a horse. Insurance does not (and cannot) provide protection against the main risks in this situation because of their non-financial nature.

Where buying insurance completely eliminates risk:
In principle an insurance policy could eliminate the customer's risk by transferring it entirely to the insurer, but this never happens in practice. First, the contract typically specifies a "policy excess", e.g., the customer is not covered for the first €500 of loss or damage in any claim situation. Second, no claims discounts provide a financial disincentive for customers to claim in some situations even though they are entitled to do so. Third, the customer may perceive that there is some possibility that the insurer will simply refuse to honour the claim, e.g., because the of the insurer's interpretation of some of the terms of the contract.

Where buying insurance reduces risk, but does not completely eliminate it:
There is no real reason to buy insurance in Situations (1) or (2) above, and Situation (3) does not exist in practice. In analysing the decision to buy (or sell) insurance, it is important to recognise that the only real-world space in which we are operating is Situation (4), where the policy can reduce (but not completely eliminate) the risk which the customer faces. Fortunately, it is in this situation that the EV principle can be applied.

Buying insurance: The customer's perspective
In this example, GL Ltd. exports to a wide variety of countries and sometimes finds it impossible to collect payment from overseas customers. In particular, 20% of sales to customers in X-Land tend to become bad debts. GL Ltd. has decided to purchase export credit insurance (ECI) so that the insurance company will have to compensate GL for any bad debts experienced on sales in X-Land. GL has asked two insurers to provide quotes for the cost of providing ECI for €1,000 of sales. Mortar Insurances PLC has quoted a price of €225, while Hardball.Com has quoted a price of just €200. On further investigation, GL has found that Mortar Insurances pays out on 95% of ECI claims, but Hardball.Com has a much more robust attitude to assessing claims and pays out on only 60% of ECI claims.

Assessment:
From GL's perspective, the probability of receiving a payment from the chosen insurer is: Prob (Claim) * Prob (Payout when a claim is made).
We can assess the value of each insurer's product (from GL's point of view) as follows:

	Insurance bought from Mortar Insurances	**Insurance bought from Hardball.Com**
Probability of receiving a payout from the insurer	(0.2 * 0.95) = 0.19	(0.2 * 0.6) = 0.12
EV of €1,000 ECI cover	0.19 * €1,000 = €190	0.12 * €1,000 = €120
Price of cover	€225	€200

Buying insurance always involves a degree of paying for risk reduction, since the insurer's profit margin can only come from selling the cover at a price higher than its expected value. If it insures with Mortar Insurances, GL pays €225 including €35 (i.e., €225 minus €190) for risk reduction. Insuring with Hardball.Com is superficially cheaper (€200 < €225) but actually involves paying a much higher cost of risk reduction (€200 - €120 = €80). In this sense, the product offered by Mortar Insurances is actually much better value.

Selling insurance: The insurer's perspective

It is entirely possible that both types of insurer – as exemplified by Mortar Insurances and Hardball.Com – will find distinct market niches and will trade successfully and profitably in them. On the one hand, Mortar Insurances PLC can convincingly argue that its product ultimately offers better value. On the other hand, Hardball.Com can point to its lower "headline price", and this may be the deciding factor for some customers.

But what if a company wishes to make a strategic change? To illustrate, suppose that Hardball.Com decides to take a different and more generous approach to managing claims, so that in future 95% of claims will be honoured (the same as Mortar Insurances). Clearly this will result in more payouts and a higher cost base. An important compounding factor is that Hardball.Com also faces the challenge of winning new customers who would not have been attracted by its previous approach. A feature of these new customers is likely to be that a disproportionate number of them may be engaging in particularly risky sales transactions (and are therefore quite likely to make a claim) and are attracted to Hardball.Com precisely because of its new-found generosity in managing claims. This is the "adverse selection" problem.

To illustrate, assume that 30% of sales to X-Land by firms seeking to buy ECI from Hardball.Com become bad debts (rather than 20% as in the case of GL Ltd.). From Hardball.Com's perspective, the probability of making a payout on any ECI sold is:

Prob (Claim) * Prob (Payout when a claim is made)
= (0.3) * (0.95)
= 0.285

Therefore, in providing insurance cover for €1,000 of export sales, the expected cost to Hardball.Com would be (0.285 * €1,000 = €285) and its selling price would have to be higher than this to provide a profit. This is uncompetitive, since Mortar Insurances sells insurance of the same "quality" (i.e., with the same 95% payout probability) for €225 and earns a €35 profit in doing so.

What can Hardball.Com do in this situation? One possibility is to stay in its existing niche, maintaining its lower payout ratio and thus keeping its costs down and competing on the basis of selling price. Another is to try to tackle the adverse selection problem head-on. If some risk-profiling of each customer is carried out before a price is quoted, then the prices offered can be tailored to the risk level of the individual customer. In this way, low-risk customers can be offered low prices while still being profitably for Hardball.Com, while high-risk customers are accepted only if they are willing to pay a price commensurate with their risk level. This approach avoids the problem of cross-subsidisation between customers and is designed to ensure that each individual customer contributes to (rather than acts as a "drag" on) the profitability of Hardball.Com.

Conclusion

The EV rule is based on the principle of determining the weighted average of possible outcomes, using probabilities as the weights in the calculations. A useful guideline for anyone buying insurance is to compare the expected value of the possible payoffs with the price charged for the insurance cover. The difference between these two numbers is (in effect) the cost of achieving the risk reduction and is the most relevant number in comparing alternative insurance products. Firms which sell insurance can also use the expected value principle to assess the impact on their cost base of repositioning their product in the marketplace, e.g., so that the risk profile of customers and/or the proportion of claims honoured is changed.