LIFE INSURANCE AND METHODS OF CALCULATING THE CORRESPONDING PAYMENTS.

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Annotation : Life insurance is a very common asset that figures into many people's long-term financial planning. Purchasing a life insurance policy is a way to protect your loved ones, providing them with the financial support they may need after you die. For example, you may purchase life insurance to help your spouse cover mortgage payments or everyday bills or fund your children's college education.

Key words: short-term and long-term life insurance, risk, mean, variance, standard deviation.

Life insurance is a comprehensive type of insurance and is divided into two types according to the term of insurance. A) short-term life insurance B) long-term life insurance: Both of these types can be divided into several types depending on the type of insurance contract. We will consider these two types of insurance separately.In short-term life insurance, the insurance period is usually one year. In this insurance option, the insurance company pays an insurance sum in the amount of UZS to its relatives if the insured client dies within a year (from the period of the contract), if the insured person does not die during this period. the company pays nothing. If there is a possibility of an insured event, the insurance payment is as follows can be expressed

$$X = Ib \qquad (1)$$

Here is the indicator of the insured event I, meaning $I = 1$, if the insurance risk situation occurs, $I = 0$, if the insurance risk situation does not occur.

So X is the insurance premium

$$P(X = x) = \begin{cases} 1-q, \; if \;\; x = 0 \\ q, \quad if \;\; x = b \\ 0, \quad another \; position \end{cases}$$

is a distribution function of a random variable

$$F_X(x) = P(X < x) = \begin{cases} 0, \; if \;\; x \le 0\,; \\ 1-q, \; if \;\; 0 \le x < b\,; \\ 1, \; if \;\; x \ge b \end{cases}$$

will be. Using formula (1) above

$$EX = bq, \;\; EX^2 = b^2 q, \;\; DX = b^2 q(q-1)$$

equations can be written .

In actuarial mathematics, the mean is EX ,in addition to the variance DX , the standard deviation $\sigma_X = \sqrt{DX}$ and the coefficient of variation

$$C_X = \frac{\sigma_X}{m_X},\ m_X = EX$$

characteristics are also widely used.

One of the main components of an insurance company's financial payments is the individual payment. Depending on the status of the payment under study, an individual payment is a payment made by any specific insurance contract. In most cases (in our case life insurance) the contract results in only one payment, while in other cases (e.g. in car insurance) a single contract may result in multiple payments during its validity period (e.g. , repeated car accidents may occur). Within the limits of risk theory, we are only interested in the values of the individual payment, measured in some currency.

It is natural to think of this payment amount as X as a random amount, and since $P(X=0)>0$ (no payment will occur if the insured event does not occur), X is a random variable of discrete type.

In simple schemes of the insurance system, the individual payment X random quantity takes a limited number of $b_0 = 0, b_1, \dots, b_n$ values and its distribution is expressed in the table

X	b_0	b_1	$\dots$	b_n
P	p_0	p_1	$\dots$	p_n

Here $P(X=b_k)=p_k,\ k=0,1,2,\dots,n$.

Take, for example, one-year life insurance. In this scheme, the client pays the insurance company a certain amount as an insurance premium (this amount is called a "premium" in actuarial mathematics). The insurance company, in turn, is obliged to pay sums to the relatives of the insured if he dies within a year (the insured will not pay anything if he lives until the end of the year).

Individual payment in the insurance scheme is X

$$P(X=0)=p,\ P(X=b)=q=1-p,\ 0 \le p \le 1$$

q can be understood as the probability that an individual will die within a year.

It goes without saying that this probability depends on the age of the person at the time of insurance x and is defined in actuarial mathematics as q_x , and the set of its values is called the "life expectancy" table. This means that the table is used as a source of information when concluding an insurance contract. In addition, separate "life expectancy" tables will be created for the study of demographic processes in the country.

In particular, insurance contracts that take into account the cause of death are more complex. In simple terms, such agreements mean:

The person pays a certain amount of money to the insurance company, and the insurance company says that if the insured person dies as a result of an accident (for example, a car accident), b_1 sum, his death for a year " natural (i.e. not related to any accidents) ", b_2 pays .

It is usually considered $b_1 > b_2$. Payment for the insurance option provided

$$X = \begin{cases} 0, & \text{probability } p, \\ b_1, & \text{probability } q^{(1)}, \\ b_2, & \text{probability } q^{(2)}; \end{cases}$$

will be a random quantity. If the age of the insured is x at the time of the breach of contract, it is self-evident that the probabilities $q^{(1)}$ and $q^{(2)}$ relate to the probability q_x $q_x = q^{(1)} + q^{(2)}$ entered earlier.

Analysis of empirical data shows that the probability of a "death" within a year is q_x, the age of the person depends on x $q_x = A + Be^{ax}$ (Meykham model) represented by the function. Here, the joining A corresponds to the death of the person as a result of an accident, which does not depend on the person's age, and the joining Be^{ax} corresponds to the occurrence of "natural death", taking into account the effect of the person's age on his death. will come. A clear analysis confirms that there is a certain correlation between the events that occur as a result of accidents and the age of the individual, in the first approximation of the Mackham model presented. $q^{(1)} = A,\ q^{(2)} = Be^{ax}$ can be considered.

The numerical X characteristics of the individual payment play an important role in practical matters. These include the mean value $m_X = EX$, the variance $VarX = EX^2 - (EX)^2$, the standard deviation $\sigma_X = \sqrt{VarX}$, the coefficient of variation $C_X = \sigma_X / m_X$, and others.

The distribution of a discrete random quantity X
$p_0 = P(X = b_0), \dots, p_n = P(X = b_n)$
according to the general formulas of probability theory

$$EX = \sum_{k=0}^{n} b_k p_k, \qquad (1)$$

$$EX^2 = \sum_{k=0}^{n} b_k^2 p_k \qquad (2)$$

For the simple one-year life insurance listed above

$$EX = 0 \cdot p + b \cdot q = b \cdot q, \qquad (3)$$

$$EX^2 = 0^2 \cdot p + b^2 \cdot q = b^2 \cdot q, \qquad (4)$$

$$VarX = EX^2 - (EX)^2 = b^2 q - (bq)^2 = b^2 pq. \qquad (5)$$

As an exercise, let's look at the following examples.

Exercise 1. In the simple one-year life insurance model, the probability of an individual's death within a year is $q = 0,0025$, and the insurance premium is $b = 100000$. Find the average value and variance of the individual payment.

Solution. According to formula (1) above

$m_X = EX = b \cdot q = 10^5 \cdot 25 \cdot 10^{-4} = 250$ sum

1. According to formula (2) $VarX = b_2 \cdot p \cdot q = 25 \cdot 10^6$

2. So the standard deviation is $\sigma_X = \sqrt{VarX} = 5000$.

3. Variation coefficient $C_X = \sigma_X / m_X = 5000/250 = 20$.

Exercise 2. Find m_X and $VarX$ for one-year life insurance, the insurance premium of which depends on the type of death. In this case, the insurance premium for "natural causes" is $b_2 = 100000$ sum, and the insurance premium for accidents is $b_1 = 500000$ sum. The probability of death due to an accident is $q^{(1)} = 0,005$, and the probability of death due to "natural causes" within a year is $q^{(2)} = 0,02$.

Solution. (1) According to the formula $m_X = EX = b_1 \cdot q^{(1)} + b_2 \cdot q^{(2)} = 450$ sum.

(2) According to the formula, $VarX = 145 \cdot 10^6$. In this case, the standard deviation $\sigma_X = \sqrt{VarX} = 12042$, the coefficient of variation $C_X = \sigma_X / m_X = 16,76$.

In actuarial mathematics, it is accepted to structure the random quantity X, which represents the insurance payment, in a sense. For example, in the simplest case of life insurance seen above, a random amount

$$X = IY \qquad (1)$$

can be written as.

This is a random variable

$$I = \begin{cases} 1, \ if \ an \ insured \ event \ occurs, \\ 0, \ if \ the \ insured \ event \ does \ not \ occur, \end{cases}$$

The random amount Y is the amount of insurance payment required in the event of an insured event.

Understandably,

$$I = \begin{cases} 1, \ \text{if} \ X > 0, \\ 0, \ \text{if} \ X = 0, \end{cases}$$

that is, the $I = I(X > 0)$- random event is an indicator of $\{X > 0\}$. It follows that the distribution of a random quantity I can be determined by the distribution of insurance premiums by the following formulas:

$P(I=0)=P(X=0)=p_0,\ P(I=1)=P(X>0)=1-P(X=0)=1-p_0$

.

The distribution of a random quantity Y is a conditional distribution of the X insurance premium relative to the condition $X>0$, or

$$P(Y=b_i)=P(Y=b_i|X>0)=\frac{P(Y=b_i,X>0)}{P(X>0)}=$$

$$=\frac{P(Y=b_i)}{P(X>0)}=\frac{p_i}{1-p_0},i=1,2,..,n$$

Conversely, if the distributions of the random quantities I and Y are known, then the distribution of X individual payments can be determined. First of all, let's face it, it's $P(X=0)=P(I=0)$. Then, with $b_i>0$, we can write the following equation:

$$P(X=b_i)=P(IY=b_i)=P(IY=b_i|(I=1))P(I=1)+$$
$$+P(IY=b_i|(I=0))P(I=0)=P(Y=b_i|(I=1))P(I=1)$$

The latter uses the full probability formula and $P(Y=b_i,I=0)=0$. Understandably, it only makes sense to study the distribution of real Y risk when $(I=1)$. Therefore, in the following considerations, this condition $(ya'ni,I=1)$ is omitted. It follows from the above that

$P(X=b_i)=P(Y=b_i)\times P(I=1)$.

This means that the two comments on the individual payment are equally strong. Here are some specific examples for practice.

Exercise 3. We see the insurance premium (payment) $b=100000$ and the insurance contract with the probability of death of the insured person for a year $q=0,0025$. Let us find the distributions of the random quantities I and Y for this contract.

Solution. Random quantity I takes the possible values of 0 and 1 with the following probabilities:

$P(I=1)=P(X>0)=q=0,0025,$

$P(I=0)=P(X=0)=1-P(X>0)=1-q=0,9975$

The random variable Y is a constant $P(Y=b)=P(Y=100000)=1$.

Exercise 4. $b_1=500000$ (insurance probability $q^{(1)}=0,0005$) if the death occurred as a result of an accident, if the death is due to "natural causes" when $b_2=100000$ (the probability of occurrence of this event is assumed to be $q^{(2)}=0,0020$) the insurance contract consisting of the amounts is studied. Let us find the distributions of the random variable I and Y for this contract.

Solution. Random variable I takes the possible values of 0 and 1 with the following probabilities:

$$P(I = 1) = P(X > 0) = q^{(1)} + q^{(2)} = 0,0025,$$

$$P(I = 0) = P(X = 0) = 1 - P(I = 1) = 0,9925.$$

Random quantity Y has two $b_1 = 500000$ and $b_2 = 100000$ values

$$P(Y = 500000) = P(X = 500000 | X > 0) = \frac{P(X = 500000)}{P(X > 0)} = \frac{0,0005}{0,0025} = 0,2$$

,

$$P(Y = 100000) = P(X = 100000 | X > 0) = \frac{P(X = 100000)}{P(X > 0)} = \frac{0,0020}{0,0025} = 0,8$$

,
with probabilities.

Sometimes, in insurance options, a single contract can create multiple risks (for example, when a car is insured). In these cases, the random quantity (risk) is X

$X = Y_1 + Y_2 + \dots + Y_n$ (2)

can be written as a sum.

In this case, the random variable n determines the number of risks incurred during the contract period $Y_1, Y_2, \dots$, and the random variables determine the amount of risk actually incurred.

Note that the life insurance model (1) is a special case of the model where the insurance risk is determined by formula X (2). To believe this, it suffices to consider $P(n = 1) = 1$ in (2).

Typically, in model (2), the number of joins is a random quantity n that does not depend directly on any of the joining Y_i's, meanly

$n, Y_1, Y_2, \dots$

assumed to be a sequence of unrelated random variables. However, a more accurate analysis of model (2) shows that in some cases the interpreted condition of independence does not hold. For example, a repaired car may be more likely to break down and incur more costs.

Determining an individual X risk by formulas (1) and (2) is characterized by the convenience of quantitatively studying the effect of various factors on it (X), since I and n are expressed in terms of random quantities. While the real risk, which is characterized by Y_i and random quantities, can be affected by other and other factors in the recurrence of events. Based on the above, formulas (1) and (2) can be considered as structured (directed) variants of payment X.

Reference

1.Sh.Q. Formanov "Aktuar matematika" ―Universitet‖ 2018y.
2. Булинская Е. В. ―Теория риска и перестрахования Част2 Москва 2006.
3. Е. М. Хитрова ―Актуарные расчеты в страховании Иркутск издательство БГУ 2015г.

4. О. Б. Окунев —Страхование в Российской федерации МГИМО университет 2009 г.
5. Г.И.Фалин —Теория риска для актуариев в задачах, Изд-во «Мир», Москва, 2004.