SOLUTIONS OF SOME PROBLEMS ON RISK AND ITS INSURANCE OPPORTUNITIES IN ACTUARIAL MATHEMATICS

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Abstract
This in the article actuary of mathematics important joint calculated insurance risk models light up given , some issues seeing developed _

Keywords : Risk, insurance object , Life Insurance , Non-life Insurance , accidental quantities , competence , contract .

Actuary math (insurance mathematics) as a science of the 20th century during was formed . This is science insurance activity with depends has been issues will be seen . Insurance of activity based on happened to give in advance telling to give possible didn't happen unhappy from events protection , this events brought damages reduce issues lies _

First insurance companies present from the period about 300 years before organize Ethyl started _ Current period insurance activity the world scale big industry appearance took _

Risk (risk-French) is a basic concept in actuarial mathematics , and it is not defined. Most encyclopedic dictionaries give the following interpretations of this word.

1) In insurance activity: the risk to be insured, sometimes the size of the insurance payment, in turn, with the risk of death, losses caused by fire and floods and other risk situations are insurance will be paid. The insured person pays an insurance premium (contribution) to the insurance organization (company) for the insured risk.

2) The amount of accidental damage related to business activity, loss caused by price changes occurring in the market conjuncture, etc.

3) Actions related to the psychological characteristics of the person: taking risks, believing that the started work will bring good (beneficial) results, hoping to be lucky. Risky action - testing oneself in random (unsteady) and risky processes, not being afraid to engage in activities with uncertain results, etc.

It follows from the above that the concept of risk is used in different senses. For example, him

a) Insurance facility;

b) The part of the property not included in the insurance contract , i.e. the property for which the insured person remains a risk;

c) Characteristics that are important in matters of defining risk situations (that is, evaluating it as large, medium, small);

d) The occurrence can be understood as an event leading to large losses .

Natural to ask the question, " Is it necessary to insure any risk ?" Of course, it is not necessary, in order to implement it (for insurance), the following conditions must be met :

1) Only future events can be insured . For example , a burning house or a crashed plane cannot be insured.

2) The insured event must be accidental, that is, it is impossible to predict whether this event will occur or not (for example, car theft, a pedestrian being hit by a car, a person falling ill stay events, etc.) or if not, the occurrence of the event is inevitable, but it is not known when it will occur (death of the insured person).

3) The outcome of the incident should not be completely dependent on the insured person's decision. For this reason, insurance companies have the opportunity to verify with the help of special experts that the insurance event that occurred was specially organized (for example, that the fire that occurred in the company building was not the result of arson, as a result of murder that the death that occurred was not the result of an assassination attempt).

Taking into account that the object of insurance (source) is an accidental risk, all insurance activities can be divided into two types: life insurance, non-life insurance, and their respective names in English - Life Insurance and Non-life Insurance are called.

The mathematics of life insurance is, in a sense, simple because the randomness of risk is embodied in the instants of death. In this regard, it can be noted that familiarity with the basic concepts of probability theory, the probability of an event, and the mean values of random variables, is enough to solve many problems of life insurance mathematics.

Contrary , the methods used in non-life insurance mathematics are of a more serious nature, they are familiar with calculus of variations, optimal control, limit theorems of probability theory, and stochastic extremal problems . requires being. This type of insurance comes in various forms, and in addition to property, it is responsible for protecting citizens from risks in the legal and medical fields of a humanitarian nature. For example, in the economy, they serve to create a state of stability (stagnation).

The complexity of non-life type insurance is due to the fact that both the moments of occurrence of the risks that are the source of insurance and the payment for them are random amounts.

From the point of view of mathematics, the source of insurance - the moments of occurrence of risk events - life-Life insurance are such random quantities (because the risk event (death) will definitely happen sooner or later). For non-life insurances, these random amounts are unique (since the risk event may not occur). In addition, the payment (insurance payment) for the damage caused by the risk event occurring in the Life Insurance category will be a definite (deterministic) amount without randomness. On the other hand, Non-life insurance and the number and size of insurance payments are random amounts, because the number of occurrences of risk events and the amount of damage cannot be predicted for these insurances. . In addition to the above, these two types of insurance are fundamentally different from each other in terms of operating principles: in the case of Life Insurance, it is the principle of capitalization or, in other words, the principle of aggregation, and in the case of Non-life Insurance, the principle of distribution is the priority. In the first case, the insurance contributions (premiums) received under the given contract are collected to make the insurance payment until the occurrence of the risk event. In the second case (Non-life) insurance premiums received from someone can be distributed (distributed) as insurance payments to other customers in the event of a risk event, i.e. in other words, the collected insurance premiums are redistributed . The mentioned principles cause the legislation of these two types of insurance to be different. In many countries, for example France, one company cannot (prohibited) deal with Life and Non-life insurance at the same time, because otherwise the interests of life insurance customers will be abused and their insurance premiums will be reduced. money would have been spent to cover the necessary payments for property insurance. Below actuary mathematics according to some issues and their solutions given .

Problem 1. Company 32 insurance contract created _ Har one contract for insurance event happened to give probability $\frac{1}{6}$, insurance payment while B(insurance event happened from giving after) continuous type random amount being his _ density function

$$p_B(y)=\begin{cases} 2(1-y), \text{ agar } 0<y<1, \\ \quad 0, \quad \text{aks holda.} \end{cases}$$

Water tank portfolio everyone contracts according to total payment S if _ $P(S>4)$ probability be evaluated .

Solving . Insurance portfolio according to everyone payment

$$S=X_1+...+X_N$$

the amount organize does _ Here _ $N=32$, X_i- i - nchi contract according to payment expression which random amount , so _

$$ES=EX_1+...+EX_N=N\cdot EX_1$$
$$\text{Var}S=\text{Var}X_1+...+\text{Var}X_N=N\cdot\text{Var}X_1.$$

Random amount X_i the

$$X_i=I_iB_i$$

in appearance designation comfortable will be Here _ I_i - i - nchi contract according to insurance event indicator , B_i- i - nchi in the contract insurance event happened when giving payable payment _ Full probability formula according to

$$EX_i=P(I_i=0)E(X_i/I_i=0)+P(I_i=1)E(X_i/I_i=1)=$$

$$=0+P(I_i=1)E(B_i/I_i=1)=qE(B_i),\ q=P(I_i=1),$$

$$EX_i^2=P(I_i=0)E(X_i^2/I_i=0)+P(I_i=1)E(X_i^2/I_i=1)=$$

$$=0+P(I_i=1)E(B_i^2/I_i=1)=qE(B_i^2).$$

So so , matter B random of the amount the first and second in order moments to count is quoted :

$$EB=\int_0^1 up_B(u)du=2\int_0^1 y(1-y)dy=\left(y^2-\frac{2y^3}{3}\right)\Bigg|_0^1=\frac{1}{3},$$

$$EB^2=\int_0^1 u^2p_B(u)du=2\int_0^1 y^2(1-y)dy=\left(\frac{2y^3}{3}-\frac{y^4}{2}\right)\Bigg|_0^1=\frac{1}{6}.$$

Now individual damage X_i s moments we calculate :

$$EX_i=\frac{1}{18},\ ES=\frac{32}{18},$$

$$EX_i^2=\frac{1}{36},\ \mathrm{Var}S=\frac{64}{81},$$

$$\mathrm{Var}X_i=EX_i^2-(EX_i)^2=\frac{2}{81},$$

the Central Limit Theorem mainly _

$$P(S>4)=P\left(\frac{S-ES}{\sqrt{\mathrm{Var}S}}>\frac{4-ES}{\sqrt{\mathrm{Var}S}}\right)\approx 1-P\left(\frac{S-ES}{\sqrt{\mathrm{Var}S}}>\frac{4-ES}{\sqrt{\mathrm{Var}S}}\right).$$

So ,

$$P(S>4)=P\left(\frac{S-ES}{\sqrt{\mathrm{Var}S}}>\frac{4-ES}{\sqrt{\mathrm{Var}S}}\right)\approx 1-\Phi\left(\frac{4-ES}{\sqrt{\mathrm{Var}S}}\right)=1-\Phi(2,5)\approx 0,62\%$$

Problem 2. A life insurance contract with a term of 1 year is considered. The sum insured is $b=100000$ soums, the probability of the client's death within 1 year $q=0{,}0025$. Find the coefficient of variation of the insurance payment . X

Solving. In this case

$$EX=bq=10^5\cdot 25\cdot 10^{-4}=250\,(\text{soum}),$$

$$VarX=b^2(1-q)q=10^{10}\left(1-25\cdot 10^{-4}\right)\cdot 25\cdot 10^{-4}\approx 25\cdot 10^6$$

X mean squared deviation of

$$\sigma_x=\sqrt{Var\,X}\approx 5000\,(\text{soum})$$

hence the coefficient of variation

$$C_x=\sigma_x/EX\approx 5000/250=20.$$

Problem 3. Individual insurance loss (a contract concluded for a certain period) is a random amount

$$X=I\cdot Y$$

expressed in appearance. Here is the I insurance event indicator, Y the amount of loss caused by the insurance event.

If the following:

1) net premium is equal to 2,
2) Y the variance of the random variable is 16,
3) X the variance of the random variable is equal to 30,

if known, find the probability of occurrence of the insurance event and the average value of the insurance payment.

Solving. Let's assume that the probability of occurrence of an insurance event $q = P(I=1)$ is the average value of the $m = EY$ insurance payment Y.

In this case, it is based on the mathematical expectation formula

$$EX = P(I=0)E(X/I=0) + P(I=0)E(X/I=1) =$$

$$= 0 + P(I=1)E(Y/I=1) = P(I=1)EY = qm,$$

$$EX^2 = P(I=0)E\left(X^2/I=0\right) + P(I=1)E\left(X^2/I=1\right) = 0 + P(I=1)EY^2 = qEY^2$$

And so,

$$VarX = EX^2 - (EX)^2 = qVarY + q(1-q)m^2$$

we will have equality. From the latter we get the following system of equations:

$$\begin{cases} qVarY + q(1-q)m^2 = 30 \\ qm = 2,\ VarY = 16. \end{cases}$$

about the system q

$$8q^2 - 17q + 2 = 0$$

is equal to the quadratic equation will be strong. The solutions of the last equation will be $q = 2$ and $q = 1/8$. Therefore, since - is a probability, q the probability of occurrence of the insurance event $1/8$ is equal to . Using this and the above system of equations, we get that the average value of the $m = EX = 16$ insurance premium is X

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