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Study of Ruin Probability in Double Poisson Risk Model

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Abstract

The research of this paper is of theoretical significance. Bankruptcy probability is an important basis for insurance companies to measure the risk, help insurance companies to prevent and resolve financial risks. Bankruptcy theory as a risk theory of the main research topic, of course, requires consideration of the model used as close to reality as possible factors. In this paper, the double Poisson model is closer to reality on the basis of classical composite Poisson model.

Keywords: Poisson Risk, mathematical model, Finance Management

1 Introduction

Looking at the world's insurance market, the insurance industry crisis is frequent. In recent years, how to prevent and defuse financial risks has been paid attention to at home and abroad, and become a hot topic in the theoretical circles. But the domestic financial sector is one of the important components of the insurance industry, risk prevention and supervision and management research is not a lot. Insurance industry itself is a high risk characteristics of the industry, once the risk into reality, not only directly harm the interests of policyholders, but also endanger the insurance industry's own security, thereby affecting economic development and people's lives and stability. Therefore, foreign developed countries and some developing countries have always attached great importance to the risk prevention and supervision of the insurance industry. China's insurance business since 1979 began to recover. While the real entry into the normative development is nearly a decade of things, risk management is still in a basic stage of the Enlightenment. With the accession to the WTO organization, the insurance

industry will also face a wealth of experience, the strength of foreign companies in the fierce competition. Therefore, to strengthen the research and measurement of risk, to provide early warning data for enterprises to improve their competitiveness, has become the protection of China's financial and insurance industry, sustainable development and stable operation of the urgent needs. In recent years, how to prevent and defuse financial risks has been paid attention to at home and abroad, and become a hot topic in the theoretical circles. Bankruptcy theory, as the main research topic of risk theory, has developed rapidly in the past century. It has become an important theoretical basis for financial enterprises and insurance companies to measure the risk, which is attracting the attention of insurance and financial industry. The theory of bankruptcy has become the main topic of the theory. On the one hand, due to the practical function of the probability of ruin in the insurance companies measure the risk, on the other hand should be attributed to the past century, the perfect mathematical progress. In practice, people measure the risk by choosing easy-to-use methods such as ruin probability, VAR, conditional expectation loss. Our theorists should provide more effective and more simple and feasible risk measurement methods, and requires the model to be considered closer to reality.

2 Poisson Risk Model

One of the important assumptions of the classic risk model is that the insurer obtains the policy at a constant rate and the premium rate of each policy is the same, both of which are the same as those of the classical risk model. Many of them have studied the related content and results of classical risk models. Is a constant c. This assumption is very easy to mathematical operations and processing, but in practice has some limitations. The number of policies received per unit time is not necessarily the same as the premium charge, they are a random variable. On the basis of classical risk model, if the process of premium collection and claiming is considered as Poisson process, this model is closer to the reality, and the theoretical research on it will have new content. The risk model of the relevant content of the analysis is meaningful.

If the model has the following structure: (1) The claim amounts iX, i = 1, 2, 3, and they have a common distribution F and can form a sequence of independent identically distributed positive random variables; (T), it is a Poisson process with parameter λ t> 0, and N (0) = 0; (3) In the period [0, t], the number of times of claim is (0) = 0; (4) Assume that the premium for each policy is a positive constant, denoted by c (t), which is a Poisson process with parameters α t> 0, ; (5) Assume {1,2,3} iX = X i =, N = {N (t): t ⩾ 0} and M = {M (t): t ⩾ 0}

The risk process is defined as:

$$S(t) = cM(t) - \sum_{j=1}^{N(f)} x, t \geq 0$$

Since the above model contains two Poisson processes, we can define it as a double Poisson risk model. In general, where u is the initial capital of the

insurance company, U (t) represents the insurance company's surplus capital at time t. The risk process has the following important properties, and has very important theoretical and practical significance.

If the risk process {S (t): t ⩾ 0} has the following three basic properties, then it is a right continuous random process. (1) $E\left|S(t)\right| = \left(\alpha - \lambda\mu\right)t \geq 0$; (2) has a stable independent incremental; (3) there is a positive r, so that $E\left|e^{-rs(t)}\right| \leq +\infty$

For the risk process {S (t): t ⩾ 0}, the function g (r) exists such that $E\left|e^{-rs(t)}\right| = e^{-tg(t)}$

And the equation g (r) = 0 has a unique positive solution R, we refer to R as the adjustment coefficient.

Therefore, we know that the curve G (r) is convex downward when r> 0. So when the amount of claim X is positive enough, its first derivative value will always be positive. (R) = α + λ contains the only positive root, that is, the equation g (r) = 0 has a unique positive solution, and G (r) has a unique positive solution. Denoted as R. Card completion.

Then, the probability of bankruptcy can be expressed as ϕ (u) = p (T <∞), which is a function of the initial value u.

In the double Poisson risk model, its ruin probability can be expressed as:

$$\varphi(\mu) = \frac{e^{-Ru}}{E\left|e^{-rs(t)}\right|T < \infty}$$

In this case, where R is the non-zero positive root of the equation, $c\alpha(e^{-rc} - 1) + \lambda(M_x(r) - 1) = 0$

3 Ruin probability of Poisson risk model and its generalized model

With the rapid development of society, a single type of insurance has been unable to meet people 's growing material culture, spiritual and realistic needs. Moreover, there are more and more types of insurance, therefore, it is necessary for insurance operators to conduct comprehensive analysis and research on the ruin probability of several kinds of insurance. In the following article, the first consideration is the premium income per unit time is constant c, and the two claims are Poisson process of two types of insurance Poisson risk model ruin probability and related knowledge. However, since the insurer does not always charge at a constant rate c, this process is a constantly changing stochastic process. If we consider the policy income process as Poisson process, the insurance premium model arrives at the process and claims process Is regarded as a Poisson process, and this model is called the double Poisson risk model of the two types of insurance. Then the ruin probability and the related knowledge of

the two-type Poisson risk model are studied. The research in this chapter is a Poisson risk model for two types of insurance. The main difference is that the premium model of the first model collects premiums as a constant c per unit time, while the second model charges a random, The premium for each policy is constant c, but the total number of policies is M (t) and is Poisson process. The following article mainly analyzes the ruin probability problem and the related problems of the two risk models.

In the generalized compound Poisson risk model, the insurance company obtains the policy according to the constant rate per unit time under the condition that each insurance premium is equal. In real life, the number of policies and premiums charged in different units of time is usually not the same and is a random variable, which may be subject to a certain distribution. According to this reality, considering the policy income process as Poisson process with parameter λ, we can denote the premium of each policy as c and the total number of policies M (t) as Poisson process. At the same time, Consider the Poisson process, so that both the premium income and the claim process are Poisson processes. We call this model a double Poisson risk model for both types of insurance, and this section will study the relevant knowledge of this model and the probabilities of ruin.

In the given probability space (Ω , F, P), t ⩾ 0 if

$$U(t) = u + cM(t) - \sum_{j=1}^{N(t)} Y_i^t - \sum_{j=1}^{N(t)} Y_i^2$$

$$S(t) = cM(t) - \sum_{j=1}^{N_1(t)} Y_i^t - \sum_{j=1}^{N_2(t)} Y_i^2$$

(2) M (t) is the total number of policies received by the insurance company at time (0, t). (2) M (t) is the total amount of insurance policy received by the insurance company at time (0, t), and it is a Poisson distribution subject to the parameter α t; (3) (1,2) kN tk = is a Poisson distribution subject to the parameter (1, 2) iβ ti =, respectively, Arrival process, and 1 2N (t), N (t) are independent of each other;

In this case, U (t) represents the insurance company's surplus capital at time t, and S (t) represents the profit of the insurance company at time t. This process is called a double Poisson risk model for both the premium and the two claims process, both of which are homogeneous Poisson processes. {S (t), t ⩾ 0} is the profit process.

4 Conclusion

Research on the problems related to ruin probability has always been a very important issue for insurers. Especially for the study of the ruin probability of new insurance, there are many risk models for single insurance, and many good results have been obtained. However, it is important to provide a more realistic

risk model for the risk management process of insurance companies, considering the expansion of the insurance industry and the development of new insurance. In fact, insurance companies often operate many different types of insurance products, therefore, the insurance company is operating a variety of risk products. Then the insurance company's claims can not be assumed to be independent of the same distribution, and hold different types of insurance policy claims arrival process also need to use a different process to describe. At the same time, the insurance companies in the fierce competition in the market advantage, therefore, the development of new insurance is also imperative, the scale of operation need to continue to expand, and now we study the risk model did not take into account the new insurance Development. Based on this reality, this chapter, based on the discussion in the last chapter, generalizes the two claims process of the double-Poisson risk model of the two types of insurance as the double-Poisson risk model of the multiple insurance types of the Poisson process. And the related theories of this model and the related knowledge of ruin probability are generalized.

On the Poisson risk model and its extension model of the ruin probability and its related problems, the predecessors have made many excellent results. However, in order to keep up with the pace of the times, in the development of progress, as insurance companies continue to increase the insurance business, therefore, on emerging insurance research is necessary to consider the new insurance line with which mathematical model, and the new The mathematical model of the insurance and the mathematical model of the original insurance combination, analysis and research on the insurance company's business development is also very necessary.

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