Research on Estimation and Stochastic Simulation of Ruin Probability of Insurance Company

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Abstract: The problem of risk analysis has become the most concerned problem in the insurance industry, and it is a problem in the actual operation of insurance company. The probability of bankruptcy is usually based on a mathematical tool, and the probability is predicted for a variety of actual situations. By comparing the generalized models with the classical models, it is found that the generalization model can reduce risks and stabilize faster, which is also the result we want to see in actual operation.

1. Introduction

There are some other representative research directions in the contemporary theory of risk. One is a completely discrete classical risk model [1]. Most of the research on the classical risk model is about continuous time, but some scholars have also studied the completely discrete classical risk model. The other is the risk theory of heavy tailed distribution. Most of the study of the classical risk model is about the bankruptcy theory of "small claim", which requires the existence of the regulation coefficient. For the study of the ruin theory of heavy tailed distributions must enable new mathematical tools, such as exponential distribution. This research is used for fire, storm and flood disaster insurance insurance insurance. Another is the risk theory of compound assets. So far, most of the researches on risk theory do not consider interest rate premium income unchanged, that is, it does not adjust to the amount of instantaneous earnings, nor does it involve investment income. Until recently, interest in the risk theory of investment gains has soared. One is the cross study of insurance mathematics and financial mathematics. By using the traditional actuarial tools, discussed the contingent claim and permanent option pricing, published a series of important articles caused widespread repercussions, so as to inject new vitality into the classical ruin theory research, their research has also attracted researchers attention in financial mathematics, financial mathematics and Actuarial Mathematics interdisciplinary research has become a new hotspot of actuarial theory, the research are generally optimistic about the prospects. In recent years, with the development of economy, the insurance industry occupies in the world in the financial system more and more insurance companies can play an important role in the healthy development and stability of the whole economy, so the insurance company bankruptcy risk measurement and management has attracted people's attention. We know that the insurance company is built to reduce the impact of some accidents [2].

2. Basic Theory of Estimation and Stochastic Simulation of Ruin Probability of Insurance Company

2.1 Ruin Theory

The theory of bankruptcy is the theory of risk management. It is mainly applied to the stability analysis of risk management process, to predict the possibility of the operator in the limited time and the final bankruptcy, so as to play a guiding role in business strategy. In the risk decision-making,

stability analysis has important practical significance and theoretical significance of the risk management process should be carried out in the future, especially in investment and insurance industry, its practical significance is more obvious, the estimation and prediction of the ruin probability, can decide whether to invest in a project, the stability of a new insurance business in the future in the process of analysis, can determine whether the development of insurance, but also has a guiding role for the insurance premium, the possibility of bankruptcy risk reduction can be achieved by adjusting the business process to the premium. The operation mechanism is the insurance company that sells certain insurance functions to the insured by a certain amount of premium. If the relevant accident or damage occurs during the validity period of the policy, the insurance company will pay the indemnity to the insured according to the policy. The goal of the insurance company is to establish an insurer's surplus in a long period of time. The so-called surplus refers to the part of an initial fund plus the premium that exceeds the claim. If the surplus is negative, it is called bankruptcy in actuarial theory. Once bankruptcy occurs, it doesn't mean that the insurance company has lost its viability, but it also explains the solvency of the insurance company in a certain sense. Therefore, for the insurance company, the solvency is not strong, when the payment crisis occurs, the insurance company is liable to go bankrupt. The so-called payment crisis refers to the fact that the liability reserve of an insurance company is not enough to fulfill its liability, and it must be made up of other sources or new premium income. In the high speed development stage of insurance companies, especially the life insurance companies, the cash flow is far more than the outflow of cash, so the payment crisis will not appear. But the growth of the insurance premium income of the life insurance company has the inherent law, and it is impossible to maintain the supernormal development for a long time. Therefore, the long term shortage of liability reserves and the reliance on new premium income make it difficult to maintain in the long run, so insurers are more likely to go bankrupt. Different people on the basis of the risk model, aiming at the problems encountered in the operation of the insurance company, based on the probability or statistics model is modified, the additional necessary conditions, all in different aspects of the insurance risk model perfect, which makes the model closer to the actual operation of the insurance company, which makes the research of risk model has become very challenging therefore, the study of ruin probability for different risk models in the world has been a focus of attention [3].

2.2 Risk Theory

In the emerging markets, the operation of insurance companies is still in the stage of fund accumulation, and the large-scale payment stage has not yet come. At this time, premium income is increasing rapidly and the burden of payment is relatively small. Therefore, the company's cash flow status can meet the high commission expenses and large-scale fixed assets investment in the near future. However, if reserving long-term shortage, unreasonable use of funds, so to benefit future stage, between the reserve and the actual payment is likely to accumulate large gap, and the premium income when the growth rate has stabilized, in this case, a possible outbreak of payment crisis. The solvency refers to the ability of an insurance company to compensate for its liability and to pay a few debts to maturity. It contains two layers of meaning: first, under normal circumstances, the insurance company has the ability to fully bear the responsibility of giving. For example, a life insurance company, in theory, if a normal year no major casualties occurred, as long as the insurance company to determine an appropriate and reasonable premium rate, extract the reserve, and reasonable investment, the funds of an insurance company value according to a predetermined speed, the insurance company will have enough funds to pay, to maintain its solvency. As a result, the solvency depends mainly on the establishment of sufficient reserves by the insurance company for its obligations. Another implication is that in the abnormal years, the balance of the actual assets of the insurance company after deducting the liabilities must be kept at a minimum level, so as to cope with the possible adverse situations. But in this paper is to consider the ruin probability when the insurance company's premium income is not enough to cope with a large number of claims incurred, and the insurance company will not consider a premium for investment, and did not consider the rate of inflation and the reason for this is to be a relatively simple model to calculate the ruin probability.

Research on the ruin probability of risk model, according to the different risk model, aiming at various problems encountered in the operation of the insurance company, based on the probability or statistics model is modified, with strings attached, which makes the model closer to the actual operation of the insurance company. Therefore, the study of the probability of bankruptcy has become very challenging and has been the focus of attention. At the same time, the rate of premium income is no longer a constant, but a random variable which is closer to the actual situation. Most of the surplus of insurance companies comes from the income of investment, so the risk model with interest rate is getting more and more attention [4].

3. Estimation and Stochastic Simulation of Ruin Probability of Insurance Company

3.1 Estimation of Ruin Probability of Insurance Company

The insurance industry itself is a high-risk industry. The main source of risk is the number of claims and the amount of claims when claims occur. Once the risk becomes a reality, it will directly damage the interests of the insured. An important measure to ensure the stable operation of insurance companies is the probability of bankruptcy. It is found that the initial gold has great influence on the ruin probability in the initial time period, and it is easy to get to bankruptcy quickly. But with time going forward, the probability of ruin will slowly converge to a certain probability value. Assets and liabilities are important factors that affect the stable operation of insurance companies. The difference between assets and liabilities is called the surplus. But this preliminary model is too simplified, lacking a lot of practical factors, and the amount of the surplus is also unstable. The classical theory model: we get that if the initial reserve fund of the insurance company is 0, the probability of the insurance company's survival is the mean value of the random number of the distribution used, so that the investment significance of the insurance company is more clear. In order to solve the specific simulation form of insurance company's ruin probability, we have got the form of integral probability equation in the previous work, if we use 1-P (x) to express the g of survival probability (x). It is called the probability of bankruptcy. The classical risk model plays a crucial role in the promotion of ruin probability. However, because there are many improvements in the initial amount and premium, there are many improvements. We compare the classical risk model and the generalized stochastic model. A general insurance products, the premium is often fixed, so use fixed to accord with the reality, and the amount of claims are often based on the severity of the accident. The requirements of the distribution is roughly corresponding to the high probability of small claims, low probability of large claims. In the common probability distribution, the exponential distribution satisfies this characteristic well. This paper also gives some reasoning for classical risk model and its improved risk model. Because of the lack of real data, we simulate many random simulation data by tools, which makes the result more intuitive. The ruin probability of insurance company is a complex, multi factor problem, for analysis of multiple factors, give intuitive data and image analysis results for clearer, but because the model is based on the great ideal, in the actual operation may have some errors, in order to give theoretical guidance.

3.2 Stochastic Simulation of Ruin Probability of Insurance Company

The initial gold, premium amount, the number of insurance policies, and the amount of claims in the ruin probability model have an important impact on the probability of ruin in the actual operation of insurance companies. Assets and liabilities are important factors that affect the stable operation of insurance companies. The difference between assets and liabilities is called the surplus at the time of the surplus, that is, the initial surplus. By simplifying the preliminary theoretical model and setting some assumptions on the basis of the actual situation, many different models of the surplus process will be obtained. Because the model in actual operation still lacks a lot of factors, such as the initial amount of liquidity, the insurance product is not single, the premium arrival is a discrete process with maple, in order to be more in line with the actual situation, the number of quantity and claims of general policy arrived with Poisson distribution to describe, and according to the amount of claims

should be serious the degree of the accident to set high probability of small claims, low probability of Dali compensation, usually the probability distribution, the exponential distribution is used to meet this characteristic. Input the known data and the preparation name, and the blank is left for the result. By mapping above, all the values that have been filled in the form are fixed values. The arrival rate of the policy will be generated by normal distribution random number in the following blank, and the total guarantee number at a certain time will be chosen as a reference. In the premise of the policy, the initial capital can be very small, or even zero, but with the increase of the initial amount of U was decreased in the ruin probability of random simulation of the generalized model, the initial amount will affect the size of the ruin probability results, in accordance with the actual operation of the insurance company reserves more, the possibility of bankruptcy the lower. In actual operation, when a large number of reserves have surplus, some funds can be taken to invest. We conclude that the number of investment funds has an impact on the results of ruin probability. The larger the investment funds from the principal, the lower the probability of ruin probability. As the higher the investment funds of the insurance companies, the amount of income is relatively high. The rate of return equals the ratio of the amount of income to the investment funds, and the rate of return increases with the increase in the amount of income. Only when the average premium of the policy is higher than a certain value, the probability of bankruptcy is reduced. If the premium is too low, the insurance company can't operate normally, the premium is too high, but there is no customer's insurance, so the insurance company should have a premium membership to define the sum of the premium. In addition, because each insurance company has different business conditions, the number of insurance policy arrival times of each company will be different. For different policy arrival times, the ruin probabilities are not the same. Therefore, we may choose the probability value of a certain day from the probability value of five arrival times of different policies. Based on the earnings premium, Monte Carlo count, randomly generated ten thousand surplus value, because of the surplus value is more, the ruin probability of insurance company is relatively lower, so the surplus value in the total value of a positive earnings ratio by this paper to simulate the ruin probability of insurance company.

4. Conclusion

In the actual operation of insurance industry, there are many factors that will affect the ruin probability of insurance company. In view of this problem, the parameters in the extension model are discussed separately. First, for different initial funds, the higher the initial amount is, the lower the bankruptcy risk of insurance company is, and the probability of ruin gradually decreases with the long time operation and eventually becomes a steady trend. The investment coefficient and the rate of return, to a certain extent, have the influence on the volatility of the insurance company's bankruptcy probability.

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