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An insurance contract with a low compensation period under adverse selection

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ABSTRACT

Adverse selection has a significant influence on trading efficiency in insurance markets. Inspired by the quality identification function of the probation period in the secondhand car market, an insurance contract with a low compensation period is designed. It is proved that the contract can distinguish the risk types of the policyholders to achieve a separating equilibrium. And it can make a strict Pareto improvement to the traditional partial insurance contract under certain conditions. Finally, an example is given to demonstrate the conclusions.

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1. Introduction

Adverse selection is a universal issue that has a significant influence on trading efficiency. In the insurance market with asymmetric information, insurance companies have to decide the premium of insurance contracts based on the average risk degree because of the unknown risk types of the policyholders. Therefore, high-risk policyholders prefer to accept the contract and buy more insurance, while low-risk policyholders get worse and tend to reject the contract. The adverse selection leads to an increase in the average degree of risk and compels insurance companies to increase premiums. Consequently, more and more policyholders may withdraw, and the insurance market gradually shrinks.

Akerlof (1970) is the first to discuss the adverse selection problem under asymmetric information. He analyses secondhand car markets and notes that private information could be the major reason for the trading failure. Subsequently, many scholars began to research whether adverse selection exists in the insurance markets. Finkelstein and Poterba (2004) test for adverse selection using data from the U.K. annuity market. They conclude that individuals have private mortality information and use this information to make annuity purchase decisions. And Ilayperuma Simon (2005) tests the existence of adverse selection in health insurance markets. Puelz and Snow (1994) and Cohen and Siegelman (2010) offer some evidence for adverse selection in U.S. automobile insurance markets.

In addition to the empirical research, there are also many theoretical papers. Rothschild and Stiglitz (1976) build a standard model of pure adverse selection in the insurance market, which indicates that under ex-ante asymmetric information, low-risk policyholders should only be partially insured and the Pareto-optimal equilibrium might not exist. Wilson (1977) investigates how a competitive market allocates insurance policies if firms are not able to distinguish the risk types of individual

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consumers and comes to a similar conclusion. Wambach (2000) and Villeneuve (2003) extend the Rothschild–Stiglitz model by allowing individuals to realize not only the probabilities of suffering a loss but also the degrees of hidden risk aversion.

The typical model considers the case that policyholders incur an accident at most once, and the contracts derived from it are also single period. However, there are a large number of multi-period contracts in the markets. Dionne and Lasserre (1985) try to eliminate the inefficiency caused by adverse selection with multi-period contracts, the self-selection mechanism and commitments, which can help the insurer identify the actual risk types of the insured. Coopesr and Hayes (1987) study a similar problem in a multi-period model. Then Dionne and Doherty (1994) examine the role of commitment in long-term contracts. They derive a semi-commitment contract with renegotiation, which can also decrease adverse selection. Further, Janssen and Karamychev (2005) take a dynamic perspective on insurance markets under adverse selection and investigate the dynamic version of the Rothschild–Stiglitz model. They argue that the multi-period insurance contract, compared with the Rothschild and Stiglitz single-period contract, can yield welfare improvement if the insurer changes the terms of the contract based on the past performance of the individual. As opposed to Janssen and Karamychev (2005), we design a single-period contract that can also yield welfare improvement without referring to the past performance of the individual.

In the process of researching adverse selection problems, we find that both monetary deductible and time deductible play important roles. There are many researchers studying the differences between them. Eeckhoudt et al. (1988) investigate the characteristics of the probationary period and conclude that the majority of the basic properties of the monetary deductibles do not carry over to the probationary periods. Spreeuw (2005) demonstrates that using a deductible period in a monopolistic insurance market may lead to a pooling equilibrium that both high- and low-risk individuals buy full coverage, which would never be possible with a monetary deductible. Spreeuw and Karlsson (2009) also find that the time deductible is a relatively poor instrument. When it comes to a separating equilibrium, the low risks do not purchase insurance. Their result is markedly different from the equilibrium derived in Rothschild and Stiglitz (1976) that low risks always obtain some degree of coverage.

As opposed to the research described above, we design a single-period contract with a low compensation period that is a strict Pareto improvement to the partial insurance contract of Rothschild and Stiglitz (1976). The low compensation period is different from the deductible period: an insurance contract with a low compensation period means that if an accident occurs during this period, the policyholder can only obtain a low compensation from the insurance company instead of zero compensation. However, if policyholders can pass this period with no accident, a complete insurance contract with higher utility and ex post subsidies will be offered. And the ex post subsidies can be viewed as a reward to the policyholders who are not involved in an accident during the low compensation period, which is the main reason why low risks can achieve higher utility from our contract. Considering the small probability of incurring no accident during the low compensation period, high-risk policyholders tend to drop out of these policies. When it comes to a separating equilibrium, low risks can obtain higher utility from our contract compared to that from the Rothschild and Stiglitz contract. Clearly, our result is quite different from Spreeuw and Karlsson (2009).

The rest of this paper is organized as follows. In Section 2, we will introduce the traditional partial contract from Rothschild and Stiglitz (1976) under ex-ante asymmetric information. In Sections 3 and 4, we will build contracts with low compensation periods for the insurance markets in which the policyholders represent two or more risk types. Then, we will discuss the sufficient condition that ensures our model is a strict Pareto improvement to the traditional partial contract in Section 5. In Section 6, we will give an example to demonstrate the discussion in Section 5. Finally, we will draw some conclusions and note the direction of future research in Section 7.

2. Partial insurance contract model under ex-ante asymmetric information

First, we introduce the Rothschild and Stiglitz partial insurance contract in the mathematical form.[1]

Suppose the market consists of two types of policyholders: high-risk policyholders and low-risk policyholders. These policyholders face two possible states: no accident or accident. If there is no accident, their incomes are all x_1; if there is an accident, their incomes are x_2 ($< x_1$).

Let $p_H(t)$ and $p_L(t)$ represent the probability of having an accident during time t for high risks and low risks, respectively. Function $f_i(x)$ represents the probability density of $p_i(t)$, $i \in \{H, L\}$, $p_H(t) = \int_0^t f_H(x)dx$, and $p_L(t) = \int_0^t f_L(x)dx$.

Assume the insurance period of our contract is T, and for any $0 < t < T$, $p_H(t) > p_L(t)$. Set $p_i = p_i(T)$, representing the probability of having an accident during the whole insurance period for individuals. Thus $p_H > p_L$, $0 < p_H$, $p_L < 1$.

Suppose their utility functions are $u_i(\cdot)$ and $u_i' > 0$, $u_i'' < 0$, which means they are all strictly risk averse. In addition, there are two other hypotheses:

(1) The accident happens at most once during the insurance period. Once an accident happens, the insurer will make the compensation and end the contract.
(2) The insurance market is fully competitive, which means the insurance company's profit at the equilibrium point is zero.

If the information in the insurance market is symmetric, the risk types of the insured can be easily distinguished, and the insurance companies will offer contracts $(k_H^*, \Delta x^*)$ and $(k_L^*, \Delta x^*)$ to high-risk and low-risk policyholders, respectively. Here, $k_i^* = p_i(x_1 - x_2)$ denotes the premium of contracts designed for class i ($i \in \{H, L\}$), and $\Delta x^* = x_1 - x_2$ represents compensation that should be paid

[1] Rothschild and Stiglitz (1976) mainly use qualitative analysis to draw their conclusions, with little use of mathe-matical models.

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