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A review of theoretical concepts and empirical literature of non-life insurance pricing

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Abstract

It seems more and more that we live in a society afraid of everything, where everything can be considered as risk taking. This feeling of uncertainty and fear leads many individuals to manifest a great interest for safety. In the context of a risky society, the requirement for insurances is becoming more and more pronounced, the main concerns of the insureds being the guarantee of financial safety and security against a possible loss on a particular event. The entire process of insurance consists in offering an equitable method of transferring the risk in exchange for a predetermined price or tariff. This article is a review paper that describes the fundamental concepts of insurance pricing and reviews the main statistical tools used in insurance to reasonably discriminate the price.

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1. Introduction

One of the major concerns for the insurance companies is the design of a tariff structure that will fairly distribute the burden of claims among policyholders. The task of determining the insurance premium belongs mainly to actuaries who, over time, have proposed and applied various statistical models through which they tried to establish a link between the risk occurrence phenomenon and the risk factors. In this context, econometric modeling aims to

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describe this relationship as realistic as possible in order to determine the probability of risk occurrence, and also to determine the frequency and cost of claims.

The calculation of a differentiated premium within the insurance portfolio is based on the principle represented by a pricing process that involves several stages. In this regard, the risk acceptance of the insurance company is followed by a priori analysis which involves the segmentation of the risks ensemble depending on the influencing factors, so that each group includes the insureds with similar risk profile and pays the same reasonable insurance premium. At this stage of the analysis, the actuary aims to determine the impact of the observable factors or variables of the insured risk and the existence of a data correlation. This step allows determining the basic elements of the pure premium obtained by multiplying the conditional expectation of the claims frequency with the expected cost of claims.

The last stage of insurance pricing process appreciates the predictive power of the individual history of insured, integrating the a posteriori component in the calculation of the insurance premium. In other words, a posteriori analysis allows the correction and adjustment of a priori tariff in order to obtain a reasonable risk classification. Consequently, the pursued result is defined as the product of risk estimation, considering the observable risk characteristics, and the component that summarizes the insured's claim history. Therefore, pricing analysis allows obtaining an equilibrium between the premium paid by policyholders and the risk assumed by the insurance company.

This paper provides an overview of the pricing concept main elements and presents some issues related to the specifics and the methods significance, corresponding to the two-known types of pricing applied in non-life insurance business. Taking into consideration the proposed aim, the paper is organized as follows. Section 2 defines the concept of pricing in non-life insurance, emphasizing the distinction between a priori and a posteriori risk classification. Section 3 proposes a review of the empirical literature, presenting the main statistical techniques that can be practically implemented for pricing risks in non-life insurance. Section 4 presents some concluding remarks.

2. Non-life insurance pricing concept

Etymologically, the term *pricing* comes from the French *tarifaire*, the word designating the tariff action and its outcome. From here, the pricing concept gets the meaning of establishing a price or a tariff. Transposed in insurance business, Denuit (2003) considers that the pricing process designates a procedure for determining a fair premium corresponding to the insured's individual risk profile. Developing this idea, the insurance pricing process can be understood as an ensemble of methods that establishes the price paid by the insureds to the insurance company in exchange for the risk transfer.

Within the insurance business, the necessity of different charging tariffs is emphasized by the insurance portfolio heterogeneity that leads directly to the so-called concept of asymmetrical information. The information problems between the insurance company and the policyholders arise when the insurer has difficulties in evaluating the risk level of the insured. The economics literature presents two aspects of asymmetrical information, namely moral hazard and adverse selection. Denuit (2007) considers that adverse selection occurs when the policyholders have a better knowledge of their claim behaviour than the insurer does and they take advantage of information unknown to the insurer. Chiappori, Jullien, Salanié and Salanié (2006) stressed the fact that moral hazard arises when the probability of risk occurrence depends on the insured behaviour and his decisions. The difference between the two phenomena is remarked also by Dionne, Michaud and Pinquet (2013), who argued that adverse selection is the effect of unobserved differences among individuals that affect the optimality of insurance contracting while moral hazard is the effect of contracts on individuals' unobserved behaviour. In other words, in the context of insurance markets, the information problems can be defined as the effect of applying the same premium for the entire portfolio. This basically presumes that the unfavourable risks are also assured (at a lower price comparing with the real cost of the risk occurrences) and it discourages insuring medium risks.

In recent empirical studies, Chiappori and Salanié (2000) and Dionne, Gouriéroux and Vanasse (2001, 2006) argued that insurance pricing is efficient to combat the asymmetrical information by dividing the insurance portfolio into sub-portfolios, where the risks can be considered independent. This leads to defining risk classes that will have

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