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Rationale of underwriters' pricing conduct on competitive insurance market☆

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HIGHLIGHTS

- We model underwriters' pricing conduct on the competitive insurance market.
- We do an expansion, revenue and solvency analysis.
- We determine when charging price lower than the market price is useless or dangerous.

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ABSTRACT

Underwriters' desire to show a good annual review is known to be a rationale of the aggressive pricing conduct. On the competitive insurance market, it impacts the global insurance processes and can lead to the competition-originated underwriting cycles. Applying Lundberg's model of the annual probability mechanism of insurance, we model the influence of a price reduction on migration and consequently on the company's annual expansion, revenue and solvency.

1. Introduction

The standard incentives, provided by the owners of the insurance company to the managers employed by them, encourage the managers to seek for a good annual review. Usually, it is considered good if at the end of the year both the company's profit and the company's portfolio volume are increased. On the competitive insurance market, such a result is largely related to the pricing policy and to migration of policyholders.

The policyholders seek to pay less for the same services and tend to switch insurers in a search of a better price. Thus, reduction in the company's price generates the immigration of policyholders. It may yield a growth in both company's profit and portfolio volume, if the additional revenue from the immigrating customers will more than offset the money lost due to the premium reduction which caused the immigration.

Managers typically compete with each other in attracting policyholders by charging lower prices. This relationship is direct and inverse over the years: insureds seeking for better prices and prone to migrate, stimulate insurers to reduce prices, and vice versa. If the aggressive premium policies are applied by many companies, and for many years, lowering the prices may be detrimental for the whole market, this gradually leads to a situation where the market price falls below the marginal cost of producing the product. When it happens, and a profitable market becomes unprofitable, clustered insolvencies occur as a by-product of dismal earnings.[1]

Some behavioral explanation of a self-inflicting, if it goes too far, management's pricing conduct on a competitive insurance market is presented by Fitzpatrick (2004). Quoting from him, "a disconnect between the incentives provided to underwriters and the long-term interest of the insurer (and its capital providers) in generating profitable premium growth is a key element in creating market cycles. Many companies seek to mitigate this tension by designing long-term incentive compensation plans for underwriters that are tied to profitability, but such speculative potential compensation does little to motivate the vast majority of underwriters. First, underwriters – like most people – are more sensitive to short-term

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[1] See e.g. Feldblum (2001); for modeling of this multi-year process, see Malinovskii (2010) and Malinovskii (in press).

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incentives (Will I get a year-end bonus? Will a poor annual review cost me that promotion?) than they are to more speculative, deferred benefits. Moreover, the structure of the employment market in property–casualty insurance provides regular opportunities for "good producers" to move from company to company in search of greener financial pastures. In fact, the absence of significant barriers to entry in the insurance market makes for a robust employment environment and all but guarantees that an underwriter can parlay a talent for short-term premium production into a series of ever higher paying jobs at different companies.

Thus, short-term incentives to produce top-line growth and a "sellers'" job market combine to ensure that few underwriters in long-tail lines stay in one job long enough to suffer for, or even learn from, their past mistakes".

This paper is devoted to a risk theory quantitative insight into the underwriters pricing conduct on a profitable competitive insurance market. This approach was sketched in Malinovskii (in press) under the name of expansion, revenue and solvency (ERS) analysis. In the framework of Lundberg's classical risk model, we will show that charging price P lower than the market price P_M, while a good annual review is sought, may be

- useless, if too small is the amount by which the portfolio can grow due to immigration, or too low is the proneness to migration of those policyholders who seek for a better price;
- detrimental, if too large becomes the increasing probability of ruin.

Moreover, even if charging price P less than P_M is neither useless nor yet detrimental, the benefits of this management may be overestimated. It may happen when the year-end income is compared with an incorrectly selected baseline capital.

This understanding may curb irresponsible managers.[2] This is a way to promote a gentle regulation aimed to mitigate the deplorable consequences of too deep competition-originated underwriting cycles. This may also contribute to design of sound competitive strategies of individual companies, the same way as it was done in Malinovskii (2010).

The rest of the paper is arranged as follows.

Section 2 is devoted to the annual migration rate functions, i.e. to the rates of increase or decrease over time of a portfolio of unit volume. These functions depend on price P. By ultimate migration rate functions we mean the limit functions, as time goes to infinity. We briefly touch upon the important problem of construction of realistic migration rate functions, which in-depth study lies beyond the scope of this paper.

To analyze annual revenue of the company, we concentrate on convex (concave) with respect to P immigration (emigration) rate functions. This means that the share of those customers who decided to immigrate (emigrate) is the greater, the smaller (larger) than P_M is taken P.

Section 3 deals with expansion, revenue and solvency consequences of selecting the price P satisfying the inequalities[3] $\mathsf{E}Y \leqslant P \leqslant P_M$. Taking $0 < \mathsf{E}Y < P_M$, we assume throughout this section that the market is profitable.

Section 4 contains auxiliary results.

2. Annual migration rate functions

Essential for migration within a single insurance year is the annual market price P_M assumed in this paper fixed and known.[4] Indeed, emigration of insureds is induced by excess of insurer's annual price[5] P over P_M: this implies that customers can find a better price with another insurer. Immigration is induced by excess of P_M over P.

By $\mathsf{E}Y$ we denote the marginal cost of insurance. Call $\varkappa = P_M/\mathsf{E}Y$, $g(P) = P/\mathsf{E}Y$ and $d(P) = P/P_M$ year's index, price to real costs of insurance ratio and price to market price ratio. The inequality $\varkappa = P_M/\mathsf{E}Y > 1$ means that the insurance market is profitable. If $d(P) > 1$, then customers are emigrating from the insurer's portfolio. If $d(P) < 1$, customers are immigrating in the portfolio. Further in this section, we omit the argument P and write for brevity d instead of $d(P)$.

By $l \geqslant 0$ we denote migration factor representing annual proneness of insureds to migration. Otherwise, it may be called price sensitivity of policyholders.[6] If l is zero, insureds are rigidly attached to insurers and never migrate. The larger l, the higher is the customers' mobility. By c_U (by c_L) we denote the upper (lower) limit to which the unit-volume portfolio may increase (decrease) due to immigration (emigration). Plainly, $0 \leqslant \mathsf{c}_\mathsf{L} < 1 < \mathsf{c}_\mathsf{U}$.

Definition 1 (*Migration Rate Functions*)**.** By migration rate functions (m.r.f.) we call the family of functions $r_s(d, l)$ of three variables, time $s \geqslant 0$, migration factor $l \geqslant 0$ and price to market price ratio $d > 0$, which satisfy the following conditions. In any of these three cases: $s = 0$, or $d = 1$, or $l = 0$, m.r.f. is identically unit. For $s > 0$ and $d > 0$ fixed, the function $r_s(d, l)$ of the variable $l > 0$

- being unit, as $l = 0$, is monotone increasing, as l increases, and is bounded from above by c_U, if $0 < d < 1$,
- being unit, as $l = 0$, is monotone decreasing, as l increases, and is bounded from below by c_L, if $d > 1$.

For $s > 0$ and $l > 0$ fixed, the function $r_s(d, l)$ of the variable $d > 0$

- is monotone decreasing, as d decreases, being bounded from above by c_U and bounded from below by c_L, and passes through the unit, as $d = 1$.

For $l > 0$ and $d > 0$ fixed, the function $r_s(d, l)$ of the variable $s > 0$

- being unit, as $s = 0$, is monotone increasing, as s increases, and is bounded from above by $r(d, l) = \lim_{s\to+\infty} r_s(d, l) \leqslant \mathsf{c}_\mathsf{U}$, if $0 < d < 1$,
- being unit, as $s = 0$, is monotone decreasing, as s increases, and is bounded from below by $r(d, l) = \lim_{s\to+\infty} r_s(d, l) \geqslant \mathsf{c}_\mathsf{L}$, if $d > 1$.

We call $r(d, l) = \lim_{s\to+\infty} r_s(d, l)$ ultimate migration rate function (u.m.r.f.).

Monotonicity in the above definition may be, generally speaking, non-strict, and the function $r_s(d, l)$ (w.r.t. s, l and d) may be piecewise constant. However, the most interesting is the case of

[2] The rather trivial rule that a manager, even striving to achieve mercantile objectives, should focus in its pricing conduct not only on the behavior of the neighbors, but on its own particulars, is not always observed in practice, where the individuals blindly follow the leader, in spite of the consequences.

[3] The notation $\mathsf{E}Y$ for marginal cost of insurance comes from the Lundberg model for the annual probability mechanism of insurance (see Eqs. (3.1)–(3.3)), where it denotes the mean of i.i.d. individual claim amounts. According to these inequalities, price P lies above the marginal cost of insurance and makes a profit and lies below the market price and makes immigration into the portfolio.

[4] Bearing in mind the complexity of the notion of market price, this is a simplifying assumption. An approach to genesis of the market price in different stages of a competition-originated underwriting cycle, relying on the concept of reflexivity, was discussed in Malinovskii (in press).

[5] By insurer's price P we mean premium income per unit of time and unit of volume. Though it is price rate rather than price, we call it price for brevity.

[6] Quoting Daykin et al. (1996, p. 343), "one of the relevant factors is the price sensitivity of policyholders. This obviously depends on the extent to which brokers are used and can be very different for commercial policies and personal lines policies". Over time, there are new factors, e.g. price-sensitive policyholders are now surfing the internet to find the best deals, but the essence is largely unchanged.