



# Optimal premium pricing strategies for competitive general insurance markets



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## ABSTRACT

Non-life insurance pricing depends on different costs including claim and business acquisition costs, management expenses and other parameters such as margins for fluctuations in claims experience, expected profits etc. Nevertheless, in a competitive insurance market environment, the company's premium should respond to changes in the level of premiums being offered by competitors. In this paper, two major topics are being investigated. More specifically, it is crucial to explore the ways a company's optimal strategy can be determined in a competitive market and then establish a connection between this strategy and market's competition. Under this perspective, a general functional equation for the volume of business is proposed, which is related to the past year's experience, the average premium of the market, the company's premium, its reputation, and a stochastic disturbance, as a non-straightforward extension to the ideas proposed by Pantelous and Passalidou (2013). Then, using a linear discounted function for measuring the company's wealth, an optimal premium strategy can be found which maximizes the present value of a wealth function in a discrete-time, stochastic framework. One significant characteristic of our approach is its suitability for both negative and positive effects to the volume of business depending on the company's reputation. Furthermore, analytical solutions for some special and common cases are presented here, where the optimal premium endogenously depends on the dynamics of the market. Finally, an application based on data from the Greek insurance market which illustrates the main theoretical findings is presented for a better understanding of the model.

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## 1. Introduction

### 1.1. Motivation

In most countries in the western world, anti-competitive practices are prevented from competition laws which in turn are ensured by government regulators. In those markets, increasing competition does not permit monopoly profits to be earned and consequently, the gross premium prices for different insurance products are lower, and if anything there is a wider range of products supplied. In contrast to other jurisdictions where competition policy is aimed only at maximizing economic efficiency, the competition policy in the European Union (EU) has another important goal: to facilitate a common integrated

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market, which is a primary objective of the EU. In this context, competition policy gained a quasi-constitutional status, which affects the relationship between competition and regulation (OECD, 2005).<sup>1</sup> For the sake of coherence, in this part of the introduction, it should be mentioned that the competition laws in the EU have some similarities with the laws in the United States antitrust; though there are some key differences. Insurance regulation in the EU also has a community goal aside from the usual regulation justifications: the creation of a single European insurance market [16]. One of the main *prima facie* practice that the European Commission faces in insurance market, which opposes competition, are agreements between insurers concerning the premiums (OECD, 1998).<sup>2</sup> Therefore, the most relevant Article of the EC Treaty is 81(1).<sup>3</sup>

Until the mid 1980's, it was unclear whether the insurance market is subject to the European competition policy: analogous to the special treatment granted to agriculture and transportation, and relying on some national regulations that partially exempted the insurance industry from the application of the competition policy, insurers argued that the insurance market, due to its special characteristics, should not be subjected to the competition rules [15]. In 1985 Commission clearly stated that insurance industry is subject to the competition law, according to its decision of 5 Dec 1984 [O.J. 1985 L35/20].<sup>4</sup> Under this framework, the insurers' union recommends to its members that they calculate the premiums at certain levels in order to stabilize the market segment. Of course, there are some further exemptions to these competition laws such as the premium calculation exemption according to the Regulation of 1992 [Reg.3932/92],<sup>5</sup> which acknowledges the difficulty of an individual insurer to properly assess average risks and the need to have broad statistical databases. The regulation also exempts agreements for joint studies regarding claims frequency and scale.

Practically speaking, the general (non-life) insurance premium pricing strategy is mainly based on the claim and business acquisition costs, the management expenses, the margin for fluctuation in claims experience and expected profits. According to Gulumser et al. [5], companies offering products and services in the general insurance markets are believed to trade under very competitive conditions. As a simple example, the case of Australia has been studied, and the outcome suggests that in the general Australian insurance industry, the firms operate in a somewhat perfect competitive environment which depicts their demand and cost structure as well. Thus, competition affects the equilibrium of the industry changing demand conditions. Consequently, it is clear that the company's optimal premium strategy, depends on the company's demand, which is also affected by competition.

This part of the introduction deals with two interesting questions. Actually, these will be our motivation as it will become clearer in the next sections. Thus, firstly "how can the optimal premium strategy for an individual insurance company be calculated in a particular insurance market?" and secondly "how is this strategy related to the competitive insurance market?"

## 1.2. Literature review

In literature, the first papers concerning competition in the insurance market were written by Taylor [12,13], who successfully explores the relation between the market's behavior and the optimal response of an individual insurer, whose objective is to maximize the expected present value of the wealth arising over a pre-defined finite time horizon. He also assumes that the insurance products display a positive price-elasticity of demand. Thus, if the market as a whole, begins underwriting at a loss, any attempt by a particular insurer to maintain profitability will result in a reduction of their volume of business. Therefore, he states that the optimal response depends upon various factors including:

- (a) the predicted time which will elapse before a return of market rates into profitability,
- (b) the price elasticity of demand for the insurance product under consideration, and
- (c) the rate of return required on the capital supporting the insurance operation.

According to Taylor's results, the optimal strategies do not follow what someone might expect. For instance, it is not the case that profitability is best served by following the market during a period of premium rate depression. In particular, the optimal strategy may well involve underwriting for important profit margins at times when the average market premium rate is well short of breaking even. A paper that significantly extends Taylor's ideas [12,13] into a continuous-time stochastic framework is that of Emms et al. [4], since they use a stochastic process for modeling the market's average premium and more specifically a geometric Brownian motion. Emms et al. [4] handled the problem as a stochastic optimal control problem assuming that the premium policy is a control function and the utility function takes the linear form  $U(w, t) = e^{-\beta t} w$ , where  $\beta$  is the inter-temporal discount rate. Finally, they define the linear maximization problem as  $\max_p \mathbb{E} \int_0^T U(w(t), t) dt$  over a choice of strategies  $p$  and a finite time horizon  $T$ . Emms et al. [4] studies two premium strategies. In the first one, the premium is proportional to the average markets premium and in the second, the premium policy  $p$  is a function of the break-even premium  $\pi$  and the difference of the market's average premium  $\bar{p}$  and the break even premium. In this approach, the important parameters which determine the optimal strategies are given by

<sup>1</sup> OECD: Relationship between Regulators and Competition Authorities, <http://www.oecd.org/newsroom/34711139.pdf>.

<sup>2</sup> OECD: Relationship between Regulators and Competition Authorities, <http://www.oecd.org/daf/competition/sectors/1920556.pdf>.

<sup>3</sup> European Commission, Competition, Financial Services, Insurance [http://ec.europa.eu/competition/legislation/treaties/ec/art81\\_en.html](http://ec.europa.eu/competition/legislation/treaties/ec/art81_en.html).

<sup>4</sup> Official Journal of the EC, Commission Decision <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1985:035:FULL:EN:PDF>.

<sup>5</sup> Commission Regulation (EEC) No 3932/92 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1992:398:0007:0014:EN:PDF>.

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