



Business planning for a profit-seeking insurer under deficiency of information



Vsevolod K. Malinovskii *

Central Economics and Mathematics Institute (CEMI) of Russian Academy of Science, 117418, Nakhimovskiy prosp., 47, Moscow, Russia
Gubkin Russian State University of Oil and Gas, 119991, Moscow, GSP-1, Leninsky prosp., 65, Russia

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ABSTRACT

This paper aims to model a profit-seeking firm in a regulated competitive insurance market in an epoch when future annual market prices become poorly predictable. It occurs when more and more non-antagonistic contenders cut their prices seeking for individual success. It aggravates randomness pertaining to insurance casualties. This paper deals with multi-year control strategy of a profit-seeking insurer aiming in this epoch to comply each year with legal solvency requirements, to keep its portfolio size more or less stable, and to keep business attractive for investments.

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1. Introduction

Policyholders seek to get the same services at a lower price. More or less willingly, they immigrate to firms the prices of which lie below a market-wide reference level called market price. On the other hand, they emigrate from the firms the prices of which lie above the market price. In order to increase profit directly proportional to insurer's investment attractiveness, the non-life insurers operating on a profitable market typically seek to attract more policyholders, i.e., to garner a greater market share. Even on a well regulated market, it may lead to a growing price competition which results in unfolding of competition-originated underwriting cycle.

The underwriting cycles, i.e., regular up-swings and down-swings in many-years business process, evolve according to the same general laws as, e.g., bubbles on currency and financial markets. The presence of the cycles is observed in non-life insurance over a long time. There exists vast academic literature (see, e.g., [Lai et al., 2000](#), [Feldblum, 2007](#), and references therein) trying to describe, to explain, to model the cycles and to contribute to reducing their negative effects.

According to [Lai et al. \(2000\)](#), all theories addressing cycles and crises suffer from at least two common deficiencies. First, most theories focus on the supply and ignore the demand. Second, the theories emphasize a single factor as the cause of the crisis or cycle, although exactly what the single factor is, has varied from explanation to explanation.¹

Relying on numerous empirical studies, [Feldblum \(2007\)](#) highlights three main factors encouraging aggressive firms to seek greater market shares. They are the apparent ease of entry into the insurance market, the low price elasticity of demand, and the lack of product differentiation among rival insurers. The industry response of reducing rates, possibly below marginal cost, forces insolvencies among weaker carriers. It shifts strategic goals from market share gains to profitable operations. With this insight, insolvencies are not merely a by-product of dismal earnings; they are a driving force behind the cycle.

This specialized expertise correlates with many aspects of general thinking on complex reflexive and adaptive systems.² Based

* Correspondence to: Central Economics and Mathematics Institute (CEMI) of Russian Academy of Science, 117418, Nakhimovskiy prosp., 47, Moscow, Russia.

E-mail addresses: malinov@orc.ru, admin@actlab.ru.

URL: <http://www.actlab.ru>.

¹ Quoting [Lai et al. \(2000\)](#), "the single-factor theories do not explain enough aspects of the crisis, even though each offers some insight", and "because of the single-factor nature of the current explanations, the literature remains fragmented and unsettled".

² About the philosophy of such systems see, e.g., [Beinhocker \(2013\)](#). It is an overview of recent developments of seminal Soros's reflexivity idea. It provides

on recognition of inherent fallibility of human beings, i.e., managers, customers, investors, and regulators, the reflexivity means a discrepancy between the participants' cognition³ and the situation in which they participate.⁴ It is a double-feedback mechanism which is always present in the competitive business. When it is unnoticeable, and interaction between the market participants yields equilibrium, a more or less reasonable foresight of the forthcoming business regime is possible. When it is noticeable, and the market is far from equilibrium, there is typically no tendency for perceptions and reality to come close together without a significant change in the prevailing conditions, and even a change of regime.

In Malinovskii (2013), the reflexivity concepts were applied to model⁵ business dynamics of non-life insurers on competitive insurance market. The seminal ideas of this paper are

- to consider a firm on a regulated and competitive insurance market as an agent in a complex reflexive system;
- to develop the firm's rational pricing strategy over different phases of the cycle, using an integral model which is a concatenation of specially selected partial models;
- to base the development of rational pricing strategy on expansion, revenue, and solvency (ERS) analysis in every annual model which are the elementary building blocks for all kinds of partial models.

Regarding the first idea, it was checked that a competitive insurance market may be viewed as a complex reflexive system.⁶ Business of a non-life insurer as an agent in this market is evolving according to three main inducements. One is migration of insureds driven by rate cuts. Being of low, medium, or high intensity on different phases of the cycle, this comes from the natural desire of the customers to get the same services at a lower price. The second is striving for the company's investment attractiveness correlated with its profitability. The third is seeking for solvency. Managers are responsible not only for providing competitive capital return, but for long life of the company. In order to safeguard policyholders and other creditors from insolvency of insurers, they are periodically inspected by supervisory authorities. This monitoring relies on minimum solvency standards and moderates the competitive zeal of managers.

Regarding the second idea, to select partial models in successive business epochs that make up the downswing half⁷ of the competition-originated underwriting cycle, we consider

- (A) the epoch where market prices' trend is flat and predictable; all insurers make profitable trades in years of prosperous market,
- (B) the epoch where market prices' trend is smoothly declining but largely predictable; only a few downswing trend provokers start slashing prices,

updated references, gives more precise definitions of fundamental concepts related to reflexivity, and claims that "economics needs to recognize that it made an ontological error when in the nineteenth century it categorized economies as equilibrium systems". This opinion is different from the views of many economists. For example, Dutang et al. (2013) enthusiastically claimed that Nash and Stackelberg's equilibria are appropriate for the study of competition among non-life insurers.

³ By cognition, we mean the process by which knowledge about competitors and about the external business surroundings is acquired. It includes perception, intuition, and reasoning.

⁴ By participation, we mean a wide variety of management actions.

⁵ By modeling, we mean rigorous mathematical modeling and quantitative analysis of a firm's business over the underwriting cycle, rather than its verbal description.

⁶ In Malinovskii (submitted for publication-c), we checked whether a competitive insurance market fits the formal definition of a complex reflexive system. In particular, we found out what are such elements of the system (see Beinhocker, 2013) as Environment, Agent, Goal, Cognitive function, Manipulative function, and Internal model.

⁷ This half cycle consists of two quarters, one of falling hard market, and the other of falling soft market. Both quarters typically consist of many insurance years.

- (C) the epoch where market prices' trend is declining and becomes largely unpredictable; the number of the trend followers increases significantly and they become dominating,
- (D) the epoch where market prices' trend is declining, but predictable; the trend followers become reward seeking⁸ players dominating on the market, and use price agreements.

The models of individual firms operating in business epochs (A)–(D) vary from epoch to epoch and differ for aggressive⁹ A and profit-seeking¹⁰ S firms. With time, these companies may switch changing their goals from aggressive expansion to profit-seeking, and vice versa.

In previous works, we focused on (i) models ($A \cap A$) (or ($A \cap B$)), (ii) models ($S \cap A$) (or ($S \cap B$)), (iii) a number of partial models for large and small insurers, and (iv) a number of partial models in the epochs (B) and (D). For models (i), in Malinovskii (2015) we examined how an insurer expanding its business overly aggressively and being at first successful, may suddenly go bankrupt. For models (ii), in Malinovskii (in press) we built profit-seeking insurer's optimal price. For models (iii), in Malinovskii (submitted for publication-a) we quantified impact of pricing on solvency and profitability of large and small insurers having portfolios of the same quality. For models (iv), in Malinovskii (submitted for publication-b) we considered price-cutting as a defensive weapon of incumbent insurer against an aggressive newcomer. When the portfolio of the former is of a better quality than of its adversary, price-cutting on both profitable and soft markets appears an effective tool forcing an aggressive firm to modify its objectives from market share to profitability.

Regarding the third idea, essential in developing a rational pricing strategy is to consider the expansion, revenue, and solvency triplet as a whole, rather than to focus on some of these factors. From the standpoint of regulation, keystone is solvency. Measured in terms of the probability of ruin, or in terms of its derivatives such as ruin capital, it is a decisive factor when a manager striving to gain more market share and more profit for his company seeks regulation's permission for further reduction in prices. Having fulfilled minimum solvency requirements, the manager is free to care about either revenue, or business expansion, depending on the firm's priority.

The analysis of this triplet, called ERS-analysis, applies complicated mathematical techniques. It starts by selecting the Lundberg collective¹¹ risk model with migration of insureds as archetypical model of the annual probability mechanism of insurance. Its core is an inhomogeneous risk reserve process with monetary, or operational, time proportional to the business turnover¹² of the company, which is modeled. This turnover, typically assumed large, is a balance between claims incurred and premium paid, as time goes on.

In this paper, which continues to study partial models (i)–(iv), we address business planning in (v) model ($S \cap C$), i.e., we focus on profit-seeking insurer S operating in the epoch (C) of the cycle, where the market prices' trend is declining and is largely

⁸ By reward seeking we mean those trend followers who are eager to have persistently, year-by-year, increasing revenue and portfolio size, and deem that slashing prices yields reward.

⁹ By aggressive, we mean a firm seeking to get a greater market share, even at the cost of decline in profits. Typically, the aggressive firm is small.

¹⁰ By profit-seeking, we mean a firm seeking primarily to get profit rather than business expansion. Typically, such firms are large or even incumbent.

¹¹ Though other models, e.g., diffusion, may be applied.

¹² Since time is deemed operational, the year's length means not a calendar duration, but the volume of business throughout the year. In other words, we assumed that the annual business turnover is sufficiently large.

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