A Management Rule of Thumb in Property-Liability Insurance

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1 Introduction

Due to substantial changes in competition, capital market conditions, and supervisory frameworks, holistic analysis of an insurance company's assets and liabilities takes on special relevance. An important tool in this context is dynamic financial analysis (DFA). DFA is a systematic approach to financial modeling in which financial figures are projected under a variety of possible scenarios by showing how outcomes are affected by changing internal and/or external factors. The discussion in Europe about new risk-based capital standards (Solvency II project) and the development of International Financial Reporting Standards (IFRS), as well as expanding catastrophe claims, have made DFA an useful tool for cash flow projection and decision making, especially in the non-life and reinsurance businesses (for an overview, see [2]).

Some issues in implementing a DFA system have not been considered in the DFA literature yet. One of these is the integration of management strategies in DFA, which is the aim of this paper. Although addressing this issue has been recognized as necessary in the quest to improve DFA (see, e.g., [4], pp. 11–12; [2], p. 518), there is very little literature on the subject. [5] and [3] present theoretical discussions of the issue, but their aim is not to show practical implementations or to evaluate implications for DFA decision making.

The aim of this paper is to implement management strategies in DFA and study their effects on a property-liability insurer's risk and return position. We use performance measures that reflect both risk and return of these strategies in a multi-period context. Thus, the aim is to compare DFA with and without the implementation of specific management strategies so as to provide insight for an insurer's long-term planning process.

Our starting point will be a DFA framework that encompasses only the main elements of a property-liability insurance company (Sect. 2). Then, in Sect. 3, we develop typical management reactions to the company's financial situation. Sect. 4 contains a DFA simulation study to test the management strategies and examine their effects on risk and return. We conclude in Sect. 5.

In this paper, we present the findings for a basic model framework only. For an extended version of the model, and additional management strategies, the reader is

referred to [6], which also provides a detailed description of the applied performance measures as well as exhaustive numerical results and robustness tests.

2 Model Framework

With EC, we denote the equity capital of the insurance company and E stands for the company's earnings. For a time period $t \in T$, the following basic relation for development of the equity capital is obtained:

$$EC_t = EC_{t-1} + E_t. \tag{1}$$

The earnings E_t per period are comprised of the investment result I_t and the underwriting result U_t:

$$E_t = I_t + U_t. \tag{2}$$

On the asset side, high-risk and low-risk investments can be taken into account. High-risk investments typically consist of stocks or high-yield bonds; low-risk investments are usually government bonds or money market instruments. The portion of the high-risk investment in the time period t is given by α_{t-1}. The rate of return of the high-risk investment in t is denoted by r_{1t} and the return of the low-risk investment in t is given by r_{2t}. The rate of return of the company's investment portfolio in t, r_{pt}, is denoted by:

$$r_{pt} = \alpha_{t-1} r_{1t} + (1 - \alpha_{t-1}) r_{2t}. \tag{3}$$

The company's investment result can be calculated by multiplying the portfolio return by the funds available for investment, i.e., the equity capital and the received premiums P_{t-1} less the acquisition expenses Ex^P_{t-1}:

$$I_t = r_{pt}(EC_{t-1} + P_{t-1} - Ex^P_{t-1}). \tag{4}$$

The other major portion of the insurance company's result is generated by the underwriting business. We denote β_{t-1} as the company's portion of the associated relevant market volume in t, assuming that $\beta = 1$ represents the entire underwriting market accessible to the insurance company. The volume of this underwriting market is denoted by MV. Hence, the total premium income can be obtained from:

$$P_{t-1} = \beta_{t-1} MV. \tag{5}$$

Claims are denoted by C; expenses by Ex. Expenses consist of the acquisition costs Ex^P_{t-1} and claim settlement costs Ex^C_t. Acquisition expenses are calculated as a proportion of the premiums ($Ex^P_{t-1} = \gamma \beta_{t-1} MV$), while the claim settlement costs depend directly on the claims incurred ($Ex^C_t = \delta C_t$). Thus, we obtain the underwriting result with the relation:

$$U_t = P_{t-1} - C_t - Ex^P_{t-1} - Ex^C_t. \tag{6}$$

This model has two variables that management can change at the beginning of each period t—the proportion invested in the risky investment (α) and market share in the underwriting business (β).