Study and application of an Asset Sufficiency Test and an Asset-Liability Management model for a life insurance product

Francisco González-Piedrahita and Sebastián Rincón-Montoya
Mathematical Engineering
EAFIT University
fgonzal6@eafit.edu.co and *srincon2@eafit.edu.co*

Ledwing Osorio-Cárdenas   Francisco Zuluaga-Díaz
Suramericana S.A.   EAFIT University
lgosorio@sura.com.co   *fzuluag2@eafit.edu.co*

March 4, 2016

1   Problem Statement

When insurance companies offer policies that protect an individual or business of any risk they assume liabilities with these clients. Companies' assets suffer transformations which are usually related to customers needs. This project proposes different approaches to manage the risk associated with life insurance products.

In Finance and Economy, 'solvency' is the word used to express the stage where a company exceeds his liabilities with their current assets. Solvency is also described as an indicator or a relation that represents, for each monetary unit of debt, how many monetary units the company haves for deal with his debts [1]. Therefore, to calculate the solvency that a life insurance product needs to support the portfolio at any moment, is quite important to achieve the stability that this business want.

Solvency problem is a concern to all insurance companies, this is why the European Union established a set of rules and practices that guarantee the right measurement of the claims update named Solvency I [1], but, with the evolution of the insurance market, Solvency I became outdated in the appropriate regulation, so the European parliament declare a new directive for the insurance market called Solvency II, [2] the key objectives of this regulation are the consumer protection, modernize the supervision and increased international competitiveness. This new set of practices were founded around three pillar, these are, the financial requirement that involves Solvency I, the governance and supervision that specify the effective risk management system and the reporting and disclosure, this is oriented to make the insurers reveal valuable information around the risk facing and the transparency that the published information must have [3].

All this framework of solvency propose an environment of development for the guild of insurers that seeks a uniform evolution of the business that provides an optimal performance of the assets, to achieve this objective is important to make a tracing for financial behavior of the company products, this is why is necessary to apply the theory of sufficiency, to know if the products accomplish the requirements of Solvency II and if not, evaluate other alternatives that produce the fit between assets and liability [3].

Asset Sufficiency Test is not enough for representing all the assets management that the product requires. It is then necessary to implement an

Asset-Liability Management (ALM) model to administrate policies and procedures that add financial risks associated with changing interest rates, trying to anticipate possible changes in the portfolio [4]. ALM gives the complement to the sufficiency test, using techniques for coordinating the management of assets and liabilities, expecting that an adequate return may be earned.

2 General and Specific Objectives

General: To measure the minimum profitability from future investments to be able to meet financial commitments through time using different methodologies.

   Specifics:

- To find the optimal point where the assets and liabilities fit, avoiding this way, the overruns of the reserves, releasing the excess of retained capital and, by this way, providing the company more resources to invest.

- To approach the problem of the mismatches between the assets and liabilities of a life insurance product, applying the AST model

- To analyze different risks tied to asset and liabilities in life insurance products.

3 Preceding Research

After defining the research project, it is necessary to understand different approaches with several methodologies which can be useful to accomplish the objectives mentioned above. Nowadays these topics are being increasingly used not only by the insurance market but any company that must manage risks subject to mismatches of assets and liabilities. However, as expected, these organizations keep their information confidential and it can become a barrier.

   AST methodologies have been lately used by life insurance companies in Chile in order to establish a financial balance. This market has grown meaningfully on the past few decades, becoming one-fifth of the economy of the country, which means an obligation to systematically supervise organizations solvency, which can be seen in [5]. On the one hand, there have been approaches using discrete time stochastic ALM models in life insurance products, one of them describes the most significant characteristics of these products in order to simulate its balance sheets [4], and the other one optimizes by Monte-Carlo the pricing of the embedded options in life insurance contracts [6]. On the other hand, there is another approach using Mortgage Backed Securities as an asset and testing the cash flow as an ALM in order to guarantee that MBS supports an amount of liabilities [7].

   ALM models can also be applied demonstrating how solvency elements make a huge impact on the capital requirements, also showing that reducing short-term risk the long term expected returns may also decrease [8]. Because of solvency implementation, objections were not long in coming, proposing to assess the costs of longevity risk management using indemnity based longevity swaps, its cost should be lower than the capital required under solvency regulations [9].

4 Justification

One of the main concerns of insurance companies is to assess the financial viability and long term stability. This is why they are forced to establish a solvency structure to accomplish these goals. It requires a coherent and comprehensive vision of the risk factors to which a person is exposed, as well as the possibility this risk may materialize.

   Since 2000's in Colombia there has been an arrival increase from multinational companies which are global leaders in the market, such as, Metlife, MAPFRE, AXA, AIG and so on. Even though Suramericana S.A. is leader in the life insurance market, this simplifies more competition which also means lower premiums, forcing an improvement in management of liabilities and risks.

5 Scope

The insurance company has a considerable number of products in the market, each product or type of policy, has a different financial structure that produces a variety of changes that impact the assets and liability behaviors, therefore, to achieve a complete approach to AST and ALM, this project will be applied to one product that belongs to the set of life insurance from Suramericana S.A, which is called Plan Vida Personal.

6 Methodology

This project has five main stages that will be fully accomplished: the first phase encompass the state of art review of the methodologies proposed (AST and ALM). Afterwards, there will be an extraction of the information from the company databases, followed by the scrubbing of collected information. once all information is consolidated, AST will be applied to the data and ALM model will be executed to validate and analyze the results.

For the ALM and AST, is necessary to recognize the distribution of the hazards in the company, including variables such as, the constitution of the reserves, monetary flows, governmental taxes, fixed administrative costs and the interest rate that affects the study product, to know these variables require additional tasks that will be made along the research, but these tasks belong to the five main stages.

7 Activity Schedule

Activity schedule of the project through this semester is described in Table 1.

8 Budget

This project does not have a financial assignment or any sponsorship from the EAFIT University. However, during the project execution, the plant and the infrastructure of the University are going to be used, such as, software, computer rooms, scientific data bases, internet, among others, these needs are covered by the University matriculation.

Activity	Duration/Date
Study of AST state of art	Week 1-2
Proposal report writing	Week 3
Proposal report	February 12
Study of ALM state of art	Week 4-5
Proposal presentation	February 19
Database extraction	Week 6-7
Apply AST to data	Week 8
Build ALM model	Week 9-10
Progress presentation	April 8
Model tests	Week 11-12
Collect results	Week 13
Project report writing	Week 14-16
Project report	May 20
Project presentation	June 7

Table 1: Time schedule.

9 Intellectual property

Given that the authors of the project are related to the EAFIT University and Suramericana S.A., the developments and advances during the project execution will be adjusted at the intellectual property regulation from the University and Suramericana. The first one establishes a confidentially and nondisclosure agreement of the information used in any academic project [10].

References

[1] E. M. del Pozo García, "Regulación del margen de solvencia en seguros no vida," in *Anales del Instituto de Actuarios Españoles*, no. 2, pp. 173–210, Instituto de Actuarios Españoles, 1996.

[2] V. Peleckienė and K. Peleckis, "Solvency ii assumptions for increasing the international competitiveness of the insurance industry," *Procedia-Social and Behavioral Sciences*, vol. 110, pp. 822–831, 2014.

[3] Lloyds, "What is solvency ii? - lloyd's - the world's specialist insurance market. also known as lloyd's of london; is a market where members join together as syndicates to insure risks.," 2016.

[4] T. Gerstner, M. Griebel, M. Holtz, R. Goschnick, and M. Haep, *Numerical simulation for asset-liability management in life insurance.* Springer, 2008.

[5] L. Figueroa and E. Parrado, "Compañías de seguros de vida y estabilidad financiera en chile," *Informe de Estabilidad Financiera*, vol. 2, no. 2, pp. 75–82, 2005.

[6] Y. Li *et al.*, "Asset liability management in a life insurance company," *(Master thesis)*, 2010.

[7] O. Nteukam and F. Planchet, "Stochastic evaluation of life insurance contracts: Model point on asset trajectories and measurement of the error related to aggregation," *Insurance: Mathematics and Economics*, vol. 51, no. 3, pp. 624–631, 2012.

[8] D. Van Bragt, H. Steehouwer, and B. Waalwijk, "Market consistent alm for life insurers—steps toward solvency ii*," *The Geneva Papers on Risk and Insurance-Issues and Practice*, vol. 35, no. 1, pp. 92–109, 2010.

[9] R. Meyricke and M. Sherris, "Longevity risk, cost of capital and hedging for life insurers under solvency ii," *Insurance: Mathematics and Economics*, vol. 55, pp. 147–155, 2014.

[10] U. EAFIT, "Reglamento de propiedad intelectual."