

Aalto University

MS-E2177 - Seminar on Case Studies in Operations Research

Interim Report

Optimal investment strategy for nonlinear life insurance liabilities

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1 Changes in project scope and objectives

The project scope and objectives have remained unchanged since the beginning of the project and the creation of the project plan. Additional tasks, such as building a pipeline for creating yield curve simulations, have not been added into the project scope.

Fennia's contact person Timo Salminen has been active in the project since the beginning, giving guidance on pain points and helping us understand how to approach the problem.

Currently, we have implemented the model architecture and designed a modular model that can easily have assets or liabilities added from it or to it. The next steps are to implement some nonlinear assets to the model (for example caps, floors, swaptions) and see how the hedging results change. After this, the analysis can be conducted.

2 Project status

This section will cover the current status of the project: Already completed tasks, current tasks, and remaining tasks. Overall, the project is well on schedule based on our preliminary timetable seen in Figure 1.

2.1 Completed tasks

The model has been implemented in Python using the scipy-package for the optimization, and pandas and numpy for general matrix operations. The overall architecture of the Python model has been implemented. The model currently has the ability to take in data provided by Fennia, add a certain amount of liability contracts, buy assets based on the NPV of the liabilities (or the cash flows of the liabilities) and then plot the resulting cash flows across simulations.

2.2 Current tasks

Currently, there are a few tasks: we want to add more assets to the model, especially nonlinear ones for better hedging results. We also want to enhance the analytical results of the model. To do this, we want to return and plot the results of singular simulated price paths.

2.3 Remaining tasks

We want to analyze the results of the simulations with different asset combinations to see how using different assets affect the hedging results and the worst- and best case scenarios. The final report needs to be done as well. Work on it has already begun in tandem with the remaining tasks, and will be priority number one as soon as the analysis is done and the model is validated.

3 Updated project schedule

The project schedule has been kept as is as currently all tasks are on schedule. In case of unforeseen circumstances the Python implementation can be extended by at least one week.

Activity	Month	March					April				May		
	Week	9	10	11	12	13	14	15	16	17	18	19	20
Project Initiation													
Initial Client Interaction													
Planning													
Literature reviews & diagrams													
Model Implementation													
<i>Rudimentary Excel model</i>													
<i>Python Implementation</i>													
Validation of the model and verifying results													
Writing the final report													

Figure 1: Updated schedule

4 Updated risk management plan

The risk management plan has been kept almost unchanged. We believe all of the previous risks still exist, even though none of them have realized thus far. However, the risk of the goals being too ambitious has been lowered to "Low", since the current goals are on schedule and no more goals have been introduced to the project.

Risk	Probability	Effect	Impact	Prevention
Team member inactivity, group dynamic problems	Low	Loss of motivation & cohesion, unsatisfactory results	High	Weekly meetings and touchpoints, goodwill
Result does not satisfy client	Low	Unsatisfied client	High	Active communication with client
Members lack time to work on project	Low	Missed deadlines	Medium	Weekly meetings and continuously set running goals
Not understanding complex financial concepts	Medium	Method's and models may be implemented incorrectly	High	Continuous check-ups and validation with client, rigorous self-screening
Too ambitious goals	Low	Time wasted on too complicated models or overly detailed analysis	Medium	Active communication and expectation management with client, developing a minimum viable product first

Table 1: Risks related to the project, along with an assessment of the impacts and possible measures to mitigate the risks.