Actuarial study of life insurance

Stéphane Loisel (ISFA Lyon), Matthieu Chavigny, Alexandre Boumezoued

Course : 24 hours - TP : 0 hours

Objectives

Longevity and mortality risks are both at the heart of current events, the former in particular at the center of pension-related issues, and in the wake of the publication of new prospective mortality tables in France, and the latter following the threats of pandemics or localized epidemics.

Part 1 of this course aims to give an overview of the problems and techniques related to these topics. It will therefore focus on certain life expectancy models, most of which can also be used for disability or invalidity maintenance.
We will then look at methods for developing prospective life tables. We will conclude with an introduction to stochastic mortality models and the mechanisms of longevity risk and mortality risk transfer.

In addition, the entry into force of Solvency 2 on 1 January 2016 imposes new prudential rules on insurers, particularly from a quantitative point of view. It is necessary to set up "economic" balance sheets, i.e. with assets and liabilities on the balance sheet valued at fair value, and to measure the impact on this balance sheet of a catastrophe scenario (occurring once every 200 years). In life insurance, these needs create real technical and operational challenges, due to the complexity of the options supported by the contracts (guaranteed rates, surrender options, etc.).

Part 2 will present the major families of life insurance contracts and the associated risks, and will deal with these new calculation needs and the different methods used by insurers.

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At the end of this course, students should be able to describe the main characteristics of the different types of life insurance contracts, as well as the assumptions and algorithms used to calculate the value of the insurer's commitments and the capital needs associated with its activity. At the end of this course, students should be able to describe the main characteristics of the different types of life insurance contracts, as well as the assumptions and algorithms used to calculate the value of the insurer's commitments and the capital needs associated with its activity.

Part 3 aims to provide a technical and practical in-depth study of mortality/longevity and long-term care risks, based on recent research work and the current practice of leading players in the insurance market. It is divided into three parts, which cover the entire risk measurement process, from abstract modelling to operational implementation.

At the end of this course, students should be able to present methods for constructing life tables, prospective stochastic mortality models and multi-state models, and detail the implementation of these models in the current regulatory context. These skills will be assessed in writing in a final exam.

Outline

Part 1 - Stéphane Loisel

1. Service life models
2. Lee-Carter model
3. Development of prospective life tables
4. Stochastic mortality
5. Mechanisms for transferring longevity and mortality risks

Part 2 - Matthieu Chavigny

1. Portfolio valuation
- Examples of life insurance contracts
- Outcome indicators at the MCEV
- Valuation method for an insurance portfolio
- The Solvency 2 yield curve
2. Economic Capital
- Economic Capital Solvency II
- Risk modeling
- Dependencies and risk aggregation
- Implementation of an internal model approach
- Economic capital adjustments
- Going further: ORSA and regulatory developments

Part 3 - Alexandre Boumezoued

Tables and templates for biometric risks

1. Use of national life tables as a basis for calibration and study of their reliability.
2. The different approaches to measuring the risks of interest in this course:
- Stochastic mortality models, their application frameworks and the errors (model and estimation errors) associated with their use,
- multi-state models for measuring dependency risk and estimating impact.
3. The use of these models to measure risk over a one-year horizon within the current regulatory framework.

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