TOPICS FOR A BACHELOR/MASTER THESIS

1. Fair valuation of equity-linked life insurance contracts with rachet/cliquet guarantees

Equity-linked (or participating) life/pension insurance contracts are usually provided with interest rate guarantees. There are different forms of guarantees: roll-up guarantees, guarantees with Rachet feature, cliquet (periodic) guarantees. The goal of a bachelor/master thesis is to value these contracts in a Black-Scholes economy (ignoring mortality risk) and to analyze the fair combinations of different parameters. Since the valuation of roll-up guarantees is quite straightforward, one thesis can tackle guarantees with Rachet (or cliquet) feature and compare it with roll-up guarantees.

2. Fair valuation of equity-linked life insurance contracts under stochastic interest rate

Consider a pure endowment equity-linked insurance contract with roll-up guarantees. Compared to the first topic, the contract payoff is less complex and the focus is more on the valuation under stochastic interest rate. The goal here is to value the contract under Gaussian term structure models (e.g. Vasicek and Ho-Lee model) and under deterministic mortality.

3. Analysis of equity-linked life insurance contract under insolvency risk

Given an equity-linked life insurance contract, we incorporate insolvency risk of the contract-issuing insurance company in the valuation/risk analysis of the contract. The insolvency risk is modelled as the first time that the company's assets fall below or hit an exogenous regulatory threshold (a barrier option framework), where the assets evolves according to a Geometric Brownian motion.

4. Portfolio insurance: CPPI vs. OBPI

Constant Proportion Portfolio Insurance (CPPI) and Option-Based Portfolio Insurance (OBPI) are two conventional portfolio insurance strategies. The goal of the thesis is to understand how these two strategies provide insurance. Furthermore, the performance of these two strategies will be compared by examining the distribution of the terminal payoffs or by a utility-based comparison.

5. Optimal investment with constant risk aversion

The thesis shall analyze a utility maximization or an optimal investment problem under exponential utility (constant absolute risk aversion) or power utility (constant relative risk aversion) in a complete market setting. Such problems can be solved by the dynamic programming approach which requires a Markovian assumption on the state process, or a martingale (sometimes also called dual, or static) approach where the assumption of Markovian asset prices can be avoided to solve the optimal investment problem.