ThetaSuite»

Hedging of Variable Annuities

Challenge

Specification of a variable annuity with cliquet or ratchet guarantees under consideration of the risk/reward profile after hedging.

Customer

An insurance company

Background

A market study had shown that customers in the addressed market demanded an annuity with attractive returns and various minimum guarantees. The insurance company wanted to design a new and innovative life insurance product that meets customer requirements and business needs alike. A major goal was to optimize the risk/reward profile.

It was decided that the product should have its performance linked to an equity index with cliquet or rachet type minimum guarantees. The customer should be given the opportunity to cancel the product early and receive the value of the paid premium. Furthermore, the product embedded a live insurance component, paying a fixed amount in the case of death.

Open questions

While the overall product features were known, the insurance still had to pin down the exact specification: Which type of guarantee should be offered?

Also, a number of technical questions remained open, e.g.:
- What is a quick and reliable solution for pricing the product?
- How should early lapse be modeled?
- What's the best way to hedge the product's risk?

To answer these questions the insurance needed a suitable tool and development approach that supports comparing different product designs, stochastic models and hedging strategies efficiently.

Histogram of Portfolio Value (Pi_obs)
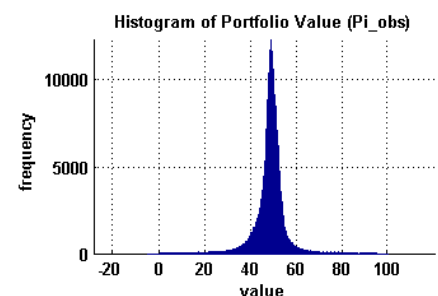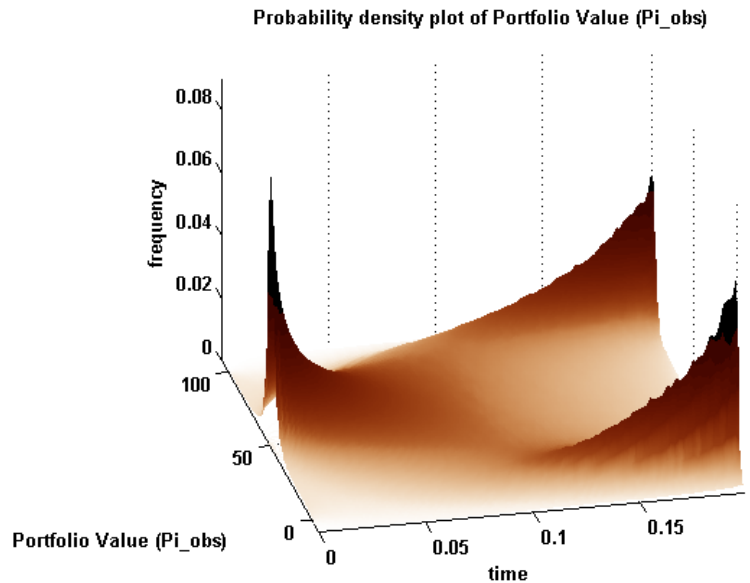
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Solution

The Theta Suite was the software of choice, because it allows rapid prototyping of products and trading strategies. Its paradigm of separating between the product model and stochastic model fosters innovative product ideas and secures the maintainability of different model aspects.

Various possible designs featuring cliquet or ratchet guarantees were quickly modeled in ThetaML. Each product model was then tested using simulation with the insurer's stochastic model. In the first stage of the analysis each product was evaluated from the customer's point of view, choosing a physical market model for equity returns. Lapse probabilities were extracted from records of previous customer behavior with similar products. Projections for mortality rates were available at the insurance, so that it was straightforward to come up with a risk/reward profile.

As a next step, the risk/reward ratio had to be optimized. The option to reinsure was discarded due to low reward expectations. Therefore the insurance decided to hedge the involved risks itself. As it was important to consider complex derivatives for hedging, Theta Suite was used to be able to quickly model a range of different hedging instruments. Equity options and plain bonds can be used to cover market risks. Sudden lapses can be covered by tailor-made American options, which would then be bought as OTCs.

Conclusion

The use of Theta Suite was optimal to model different insurance product designs as well as hedging instruments and strategies in a transparent way. It allowed the customer to quickly develop an innovative and attractive insurance product. Gaining insight into the risk profile and the effects of hedging enabled the customer to secure profits.

Probability density plot of Portfolio Value (Pi_obs)

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Theta Suite. Tools financial engineers really need.

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