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Efficient Greek Calculation of Variable Annuity Portfolios for Dynamic Hedging: A Two-Level Metamodeling Approach

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Abstract

The financial risk associated with the guarantees embedded in variable annuities cannot be addressed adequately by traditional actuarial techniques. Dynamical hedging is used in practice to mitigate the financial risk arising from variable annuities. However, a major challenge of dynamical hedging is to calculate the dollar Deltas of a portfolio of variable annuities within a short time interval so that rebalancing can be done on a timely basis. In this article, we propose a two-level metamodeling approach to estimate the partial derivatives of the dollar Delta with respect to the parameters of the underlying asset price process. The first-level metamodel is a neural network, and the second-level metamodel is a Markov chain Monte Carlo method. Numerical results show that the proposed method can calculate the dollar Delta accurately and efficiently.

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http://www.limra.com/uploadedFiles/limra.com/LIMRA_Root/Posts/PR/Data_Bank/_PDF/2005-2014-Annuities-Estimates-Alternative.pdf

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