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Hedging with a Correlated Asset: An Insurance Approach

Hedging a contingent claim with an asset which is not perfectly correlated with the underlying asset results in an imperfect hedge. One example arises in the case of segregated funds. These are guarantees provided by insurance companies on mutual fund investments. In many cases, the underlying asset is a mutual fund managed by the insurer providing the guarantee. As the insurance company cannot take a short position in its own fund, the guarantee would typically be hedged using index futures, which will lead to an imperfect hedge. We price the residual risk from hedging with a correlated asset using an actuarial standard deviation principle in infinitesimal time, which leads to a nonlinear partial differential equation. A fully implicit, monotone discretization method is developed for solving the pricing PDE. This method is shown to converge to the viscosity solution, provided certain grid conditions are satisfied. An algorithm is devised to ensure that these conditions hold. Monte Carlo simulations are used to illustrate features of the profit and loss distribution from hedging a contingent claim with an imperfectly correlated asset.

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