Pricing and Hedging Guaranteed Minimum Benefits in Variable Annuities

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The shift from defined benefit to defined contribution superannuation schemes within developed countries has correspondingly increased the importance of retirement savings and investment plans.

Variable annuities (VAs) with guaranteed minimum benefits (GMBs) are gaining in popularity as products that can meet the demands of the ageing population. However, guaranteeing policyholders a minimum level of return exposes insurance providers to equity risk.

This risk is particularly evident during periods when investment returns are lower than expected, such as during the global financial crisis (GFC). Moreover, the fall in interest rates that followed the GFC led to the value of future guarantees exceeding previous price estimates.

In the absence of reinsurance markets, insurers bear the risks associated with guaranteed minimum benefit variable annuities.

Hedging GMB exposures entails a trade-off between transaction costs and hedge effectiveness. The continuous rebalancing of the hedge portfolio in dynamic delta-hedging strategies is not readily achievable due to transaction costs and liquidity constraints.

This study demonstrates a static hedging strategy, which entails the insurer hedging their position only at inception. A static hedging approach is found to be quite effective until two to three of the assets in the portfolio mature.

For an unhedged portfolio, the insurer faces unlimited liability and limited profit. However, after hedging, the distribution of potential losses takes on a more normal shape.

A comparison of hedged and unhedged performance simulations suggests that a static hedging strategy reduces tail risks and provides some benefit. Such a strategy can nevertheless be improved through additional rebalancing, referred to as semi-state hedging strategies.

Over a 15-year timeframe, it appears that a static hedge should be rebalanced after no more than 10 years.