Discussions of Papers Already Published

Discussion of Pricing and Risk Management of Variable Annuities with Multiple Guaranteed Minimum Benefits," Feng Sun, FSA, MAAA, October 2006

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This paper introduces an important topic that has received little attention in the literature. The purpose of this discussion is to introduce a few additional points and discuss how different assumptions will alter the results in some cases. The discussion is brief because the paper is reasonably thorough.

The paper discusses the shortfall of fees under the worst case scenarios. This can be ameliorated by hedging the fees as well as the claims. An insurer is not fully hedged otherwise. If an insurer wants to be fully insulated from the impact of the equity markets with respect to the profitability of guaranteed minimum benefits, then, in theory, hedging the claims converts a distribution of possible outcomes to one single outcome, and hedging the fees does the same. If an insurer hedges only one of the two, then equity risk exposure remains. Alternatively, some products charge fees based on the guarantee rather than the account value. Absent customer behavior dynamics, the fees are locked in, and there is no need to hedge. Customer behavior dynamics, however, will tend to result in higher fees in the worst case scenarios, which slightly reduces the net amount of hedge required.

Stochastic modeling can provide intuition by studying the periodic results of specific scenarios. This can also provide a check on the reasonableness of various assumptions including dynamic customer behavior. This is particularly important when the customer is choosing from multiple benefits. For example, if a contract has both a Guaranteed Minimum Accumulation Benefit (GMAB) and a Guaranteed Minimum Withdrawal Benefit (GMWB), then utilizing the withdrawal benefit reduces the GMAB. At least some customers will make some sort of judgment as to which they value most, and the model should take this into account.

Discounting implicitly assumes there is an asset that can return the discount rates. Because claim costs on unfavorable scenarios may be at later durations, discounting them at 11.5% may understate the true economic impact associated with these scenarios. Furthermore, interest rates may be lower at the same time equity returns are lower. There are various techniques to deal with negative cash flows or profits at later durations. For example, under one common approach, negative values are discounted backwards through future time intervals at a reasonable investment rate or at LIBOR until the backward discounting turns positive, at which point the 11.5% rate would be appropriate.

The paper develops a 99% correlation between Guaranteed Minimum Death Benefit (GMDB) and Guaranteed Minimum Income Benefit (GMIB). The model assumes an

annuitization rate of 3% annually. Realistically an insurer should expect some dynamic behavior where annuitization rates will be higher for adverse scenarios. Introducing a dynamic assumption will reduce this correlation significantly.

Table 12 shows that the CTE90 for "DI" slightly exceeds that for "DIA." This small difference could be due to modeling or statistical noise given that the CTE90 is based on only 100 scenarios.

While perhaps beyond the scope of this paper, an insurer may also want to consider the correlation of the results on the base product with the various guaranteed minimums or combinations thereof.

The paper states that the present value of future profits (e.g., present value of distributable earnings (PVDE)) will be reduced when including cost and benefits of hedging. This may be true if pricing is based on "real world" assumptions, but not if based on capital market assumptions. So this is not an absolute statement.

An utilization rate of 80% is assumed for the GMWB. An insurer might rather assume that some number of policyholders will utilize the benefit regardless, some will use it only to recoup their principal in a down market, and perhaps a small number will never use the benefit. Dynamic customer utilization may seem difficult to model, as it would involve dual tracks for any given scenario involving those utilizing and those not utilizing. The model could allow for both tracks and migration between the two, or another approach is to simply treat the dynamic customer utilization as another stochastic variable.

Both pricing and hedging have exposure to the uncertainty of the dynamic behavior assumptions.

Author Reply

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I am very thankful to Mr. Mark Evans and Mr. David Hopewell for their discussion on my paper. The discussion shows a number of fine, and interesting points; they added and enhanced the value of the paper. Modeling hedging and policyholder behavior have been vibrant and exciting areas of variable annuity (VA) pricing and risk/capital management, especially under principles-based reserve and capital framework. Deriving reasonable dynamic policyholder behavior assumptions and developing hedging mechanism in model office can be quite challenges for practitioners. As more advanced modeling capability and computing power become available, we would expect to see interesting pricing and risk/capital management analysis using different hedging strategies, in combination with various dynamic (or stochastic) policyholder behavior assumptions. Also, it is worth mentioning that refinements can be made, including using risk-neutral scenarios and doing the discounting accordingly, to make the paper more thorough. Finally, I would like to add a reference for interested readers.

Reference:

Jeffrey Leitz, Rebecca Scotchie. “Modeling C-3 Phase II Risk-Based Capital: Practically Impossible or Possibly Practical?” Towers Perrin – Tillinghast Update, August, 2005. On-Line at: *http://www.towersperrin.com/tp/getwebcachedoc?webc=TILL/USA/2005/200508/c3_impl_update.pdf*

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