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# SUMMARY OF PRESENTATION DELIVERED AT THE SOA 2009 ANNUAL MEETING "HEDGING FOR LIFE INSURERS – WHAT'S NEXT FOR VARIABLE ANNUITIES?"

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**H**edging programs have become a mainstay in the risk management arsenal of life insurers seeking to mitigate the capital markets risk associated with their products, especially variable annuities. The recent financial crisis has placed significant stresses on variable annuity (VA) hedging programs and the lessons learned in responding to these stresses will likely play an important role in shaping future developments. This talk focuses on four key topics in this regard: a) management of severe adverse movements in underlying asset values; b) treatment of volatility risk; c) management of fund mapping related basis risk; and d) credit risk as an emerging area of concern.

A brief review of VA hedging model basics is a good place to begin in developing an understanding of the problems encountered by hedging programs in the financial crisis. VA hedging models are generally simulation based and work by first generating a set of risk neutral economic scenarios using parameters appropriate to current market conditions. The paths are then used in conjunction with a detailed model of the structural features of the guarantee and policyholder information to value the guarantee as the expected value of the present value of its future cash flows.

Successful dynamic hedging of VA market risks relies upon the ability to acquire effective risk off-setting positions in a timely manner. In order to do this, it is necessary to compute sensitivities, or greeks, which measure the response of the economic value of the guarantee to changes in market parameters. Key greeks that are usually considered for hedging are delta and gamma—first and second order derivatives measuring equity price level sensitivity respectively, rho and convexity—first and second order derivatives measuring interest rate sensitivity, and vega—a first order derivative measuring sensitivity to (equity) volatility.

## MANAGEMENT OF SEVERE MOVEMENTS IN UNDERLYING ASSET VALUE

The recent financial crisis is notable for the magnitude of



severe market movements occurring over short periods of time. Such movements can be problematic for dynamic hedging programs both mathematically and operationally. The mathematical issue turns on the use of greeks to create market risk neutralizing positions based on a Taylor series like approximation which becomes less accurate for larger market movements. This problem can be somewhat mitigated by using higher order greeks, e.g., gamma. The operational issue concerns the fact that execution of required hedging transactions may not be feasible in the presence of sufficiently large and rapid market movements. This issue can be addressed by prepositioning hedging instruments, e.g., out of the money options, to neutralize greeks in prescribed market stress scenarios. This type of catastrophe or macro hedging has been widely used in banking and is now being more actively considered by insurers.

Life insurers' near term responses to the hedging challenges posed by large adverse market movements may constitute a prolog to the future. These responses include programmatic reviews of risk limits, escalation protocols, system/operational responsiveness, utilization of wider set of greeks, including second order greeks (gamma, possibly convexity), and choice of hedging instruments. Cost/benefit considerations include a greater appreciation of the value of protective strategies coupled with a more acute sensitivity to implementation costs and the transactional difficulties associated with the use of highly specialized instruments in turbulent markets.

## TREATMENT OF VOLATILITY RISK

To achieve market consistency, many hedging platforms parameterize their hedging models using implied volatility. The high levels of market implied volatility characterizing the recent financial crisis have motivated greater scrutiny of the treatment of volatility in VA hedging programs. The volatility dependence of VA guarantees is significant and unhedged volatility can be an important source of hedge slippage. However, the complete treatment of implied volatility is complex as this quantity depends on both tenor and moneyness. The relative paucity of traded data at distant tenors and moneyness is an issue.

# // COUNTERPARTY CREDIT RISK IS AN AREA OF HEIGHTENED FOCUS FOR VA HEDGING OPERATIONS. ... //

In light of recent market experience, a number of writers who initially chose to hedge only delta, or delta and rho, are revisiting their decision to not hedge vega. In doing this, the elevated cost of hedging instruments, given recent levels of implied volatility, and the increased operational complexity associated with vega hedging, must be weighed against the added risk management benefits. Hedging instruments tend to be vanilla options, but variance swaps are also receiving attention. Volatility modeling is becoming more sophisticated to capture the full volatility surface. Modeling paradigms span the gamut from ad hoc strike dependent volatility adjustments to the use of more complex stochastic processes, e.g., local volatility or stochastic volatility.

## MANAGEMENT OF FUND MAPPING RELATED BASIS RISK

The funds underlying a variable annuity contract are typically not themselves directly hedgable. In practice, they are usually linked to hedgable market indices via linear relationships called fund mappings, which are essentially multifactor linear regressions expressing the returns of a given fund in terms of the returns of a prescribed set of hedgable indices. The effectiveness of a hedging strategy making use of these mappings depends critically on their explanatory power. This explanatory power can become attenuated over time, especially as a result of market turbulence or changes in fund strategic objectives, thereby giving rise to fund mapping related basis risk and potentially significant hedge slippages.

Product design is the first line of defense that VA writers have against the basis risk engendered by ineffective fund mappings. Hedge friendly designs utilize underlying funds with risk/return characteristics that are well described by hedgable market indices with broad and deep associated derivatives markets. The importance of ongoing fund mapping management is becoming more widely recognized among VA writers. This is evidenced, for example, by increased allocation of dedicated staffing resources to monitor and improve fund mapping performance and establishment of more formal risk management protocols requiring regular fund mapping assessment and recalibration if needed.

## CREDIT RISK—AN EMERGING AREA OF CONCERN

Recent well publicized defaults, or near defaults, particularly within the banking and broker/dealer communities, have motivated a renewed awareness of the importance of credit risk management in general. Counterparty credit risk is an area of heightened focus for VA hedging operations, somewhat in contrast to the situation prior to the recent financial crisis. Effective management of credit risk is an emerging area of practice among life insurers, and VA writers in particular. Possible avenues of approach include: strengthened, more formalized, monitoring of obligor credit quality and exposure concentration; imposition of more rigorous credit risk limits; and utilization of modern market-based credit quality metrics in addition to traditional ratings. **■**



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