SOCIETY OF ACTUARIES

# Equity-based Insurance Guarantees Conference
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## Pricing EAI Guarantees

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# Equity Indexed Annuity Pricing

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# Equity Indexed Annuities

- Overview of market, products, and history
- Pricing of EIAs
- Pricing of GLWBs on EIAs

## Market Size

- $24.8 billion of sales in 2007
- $12.8 billion in first half of 2008 (up 3%)
- 29% of Fixed Annuity Sales in first quarter 2008 are Indexed
- $125 billion assets under managment

## Market Overview

- Snowflake design –No two products are alike
- Variety of crediting methodologies
- Surrender Charge Periods 5 –16 years; also two-tier
- Guarantees vary – 87.5% @ x% to 100% @ x% less surrender charges.
- Indices are a single equity index or a combination of multiple indices, sometimes a retrospective combination. Also some bond indices.
- Bonuses

## How are EIAs priced?

- Most EIA characteristics are similar to those of other fixed annuities
  - Expenses
  - Reserves
  - Major portion of investments
  - Available interest translated into affordable index-based interest crediting

➔Price like a traditional fixed annuity

## What are the major pricing steps?

- Use a stochastic model
- Recognize cash flows of a traditional fixed annuity
- Include recognition of index-based crediting
- Recognize costs and benefits of hedging, including expected interest credits

## What are the key issues?

- Specialized
  - Correlated index and interest scenarios
  - Dynamic benefit determination
  - Hedge modeling
  - Dynamic policyowner behavior
  - Reserves
  - Crediting methodology
- Standard
  - Guarantees
  - Mortality
  - Expenses
  - Target surplus and profit goals
- Other
  - Free looks, rate locks, and transfers

## Scenario Development

- Correlated interest and index scenarios
- "Historic" index movements
  - Just for crediting
- Actual, not implied, volatility

## Dynamic Benefit Determination

- Based on “Hedge Budget”
- Current option pricing assumptions
  - Risk-free rate
  - Index implied volatility
    - Constant or derived?
  - Index dividend
    - Constant?
  - Recognize skew where appropriate
- Best with closed-form option pricing

## Hedging

- Companies typically model perfectly matched hedging.
- Reduce options bought for surrenders and/or deaths?

## Hedging Variations

- Annual ratchets, multi-year point-to-point, high water, etc.
- Should (low) renewal guarantees be hedged in advance?
- Hedge for the account value or for the surrender value?
- Should the cumulative minimum guarantee put-risk be hedged?

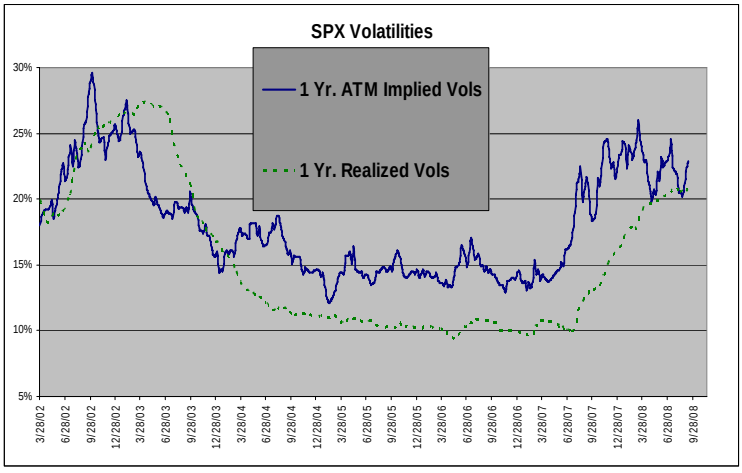
## Dynamic Hedging

- Companies are using dynamic hedging to hedge their book of business
- Provides more flexibility
  - Aggregation of hedging
  - Complex index benefit designs
- Difficult to model
  - Pricing does not incorporate this.

# Should dynamic hedging be recognized in pricing?

- Dynamic hedging provides trade-offs
  - Reduced average hedging cost
    - Results from trade of implied volatility for actual volatility
    - Savings depend upon constraints chosen
  - Economic capital required
    - Unhedged risk traded for dynamic uncertainty
- "Gain" should be retained as part of risk/reward

# Dynamic Hedging



## Financial Impact of Dynamic Hedging

- Would need ability to monitor hedge effectiveness –
- Gain or Loss due to changes in:
  - Index Level (Delta and Gamma)
  - Volatility (Vega)
  - Interest Rate (Rho)
  - Time Decay (Theta)
- Need tools to report results to management

## Policy Owner Behavior

- EIAs still relatively new product. Have been around for only 13 years.
- Need to factor in dynamic lapses.
- Possible factors – surrender charges, average indexed crediting rate, last interest credit, fixed-rate competition
- Consumer expectation on index returns

## Reserves - Statutory

- Similar to fixed-rate reserving
  - CARVM
  - Actuarial Guideline 35
  - Actuarial Guideline 33

## Reserves - GAAP

- FAS 133.
  - Generally a mismatch between a long duration liability and short duration hedge
  - Can cause results that don't make economic sense over short periods.
  - Results can be volatile
    - "Budget Method" limits volatility to interest discount factor

## Option Pricing for Crediting Methodologies

- Participation rates, caps, and spread fees have Black-Scholes solutions
- Averaging can be approximated
- Path-dependent designs present difficulties
- May need to assume that “all methods are created equal” and use proxies for complex designs

## Guarantees

- Need to incorporate the cumulative guarantees.
- Stochastic modeling needed to determine the cost of the guarantees.
- Modeling will incorporate the guarantees into benefit payments and reserves.

## Mortality

- Identical to non-indexed annuities
- Need to model various ages versus just average age.
- Cost increases by age.
- Hedging percentage varies by age if hedging haircut for mortality.

## Expenses

- Typical commission, new business, and maintenance expenses
- Need to factor in extra expenses versus traditional annuities:
  - Must pay for use of index
  - Extra cost for transfers
  - System modifications
  - Suitability / Compliance Costs

## Target Surplus & Profit Goals

- RBC and target surplus issues similar to those for fixed-rate annuities
  - Recognize counterparty risk level on hedge value
- Profit goals similar to those for fixed-rate annuities

## Free Looks, Rate Locks, & Transfers

- Generally outside the basic model
- Free looks and post-anniversary transfers present opportunity for anti-selection
- Transfers can be costly whether into or out of the indexed options.
  - Transfers between indexed options are low cost
- Rate lock cost depends upon liberality of provision

## Other Risks

- Ability to buy hedges when needed
- Hedge management
- Default of counterparty (Lehman)
- Market conduct at point of sale
- Additional cost if EIAs become securities

## Description of GLWBs on EIAs

"Guaranteed Lifetime Withdrawal Benefit"

- Guarantees a lifetime annual withdrawal of a specified percentage of a "Benefit Base" even after the account value hits zero
- Benefit Base
  - Shadow account, not real money
  - Might increase to account value or as roll-up
- Longevity insurance if interest credits are low

## Pricing of GLWBs on EIAs

- Model the underlying EIA
- Model EIA + GLWB
- Determine GLWB cost that achieves profit goal
  - Maintain EIA profitability?
  - Separate profit goal for GLWB?

## GLWB Pricing Considerations

- Time horizon
- How to recognize risk management (hedging)
- Dynamic policyholder behavior
- Withdrawal use patterns
- Mortality
- Reserves
- Cost after zero account value

## GLWB Time Horizon

- Base annuity pricing seldom runs beyond 20 years, often less
- GLWB cost is in the out-years
  - Need to project to age 100 and beyond

## What is the GLWB risk cost?

- Risk varies inversely with index-based crediting
- Will hedging be strongly suggested by rating agencies, GAAP reporting, insurance regulations, the insurer's chief risk officer?
- Can be quantified on a risk-neutral basis and brought into pricing as a hedge cost

## GLWB Policyholder Behavior

- Does the presence of a GLWB improve persistency?
  - Annually, including initially
  - At time of “spike” lapses
- Improvement when GLWB is in-the-money (ITM)
  - What is ITM?
  - How ITM-sensitive is the improvement?

## GLWB Withdrawal Patterns

- Will a GLWB induce new withdrawal patterns among policyowners?
  - Will greater withdrawals erode underlying annuity profitability?
  - How does this affect the profitability benchmark?
- What is the expected distribution of withdrawal deferral among users of the GLWB?
  - Also, will some never use the benefit?

## GLWB Mortality

- Does a GLWB attract healthier lives?
- Conservatism is redefined
  - For the base annuity, high mortality is conservative
  - For the GLWB, low mortality is conservative
- How much mortality improvement should be assumed for the long time horizon?

## GLWB Reserves

- Does a GLWB on EIA fall within VA CARVM?
  - Independent reserve but based on historic indices
- Or is it accommodated under AG 33?
  - Integrated reserve but without lapses

## Cost After Zero Account Value

- Model continuing flows
- Treat as life-contingent annuitization
  - Discount rate

## Conclusions

- Pricing of EIA's requires a carefull understanding of both risks & returns
  - Goal is to avoid taking unacceptable risk and to be paid for taking acceptable risk
- GLWBs take the risks and the solutions to a new level