

# Market Inter-Relationships

VALB Guarantees and Their Impacts

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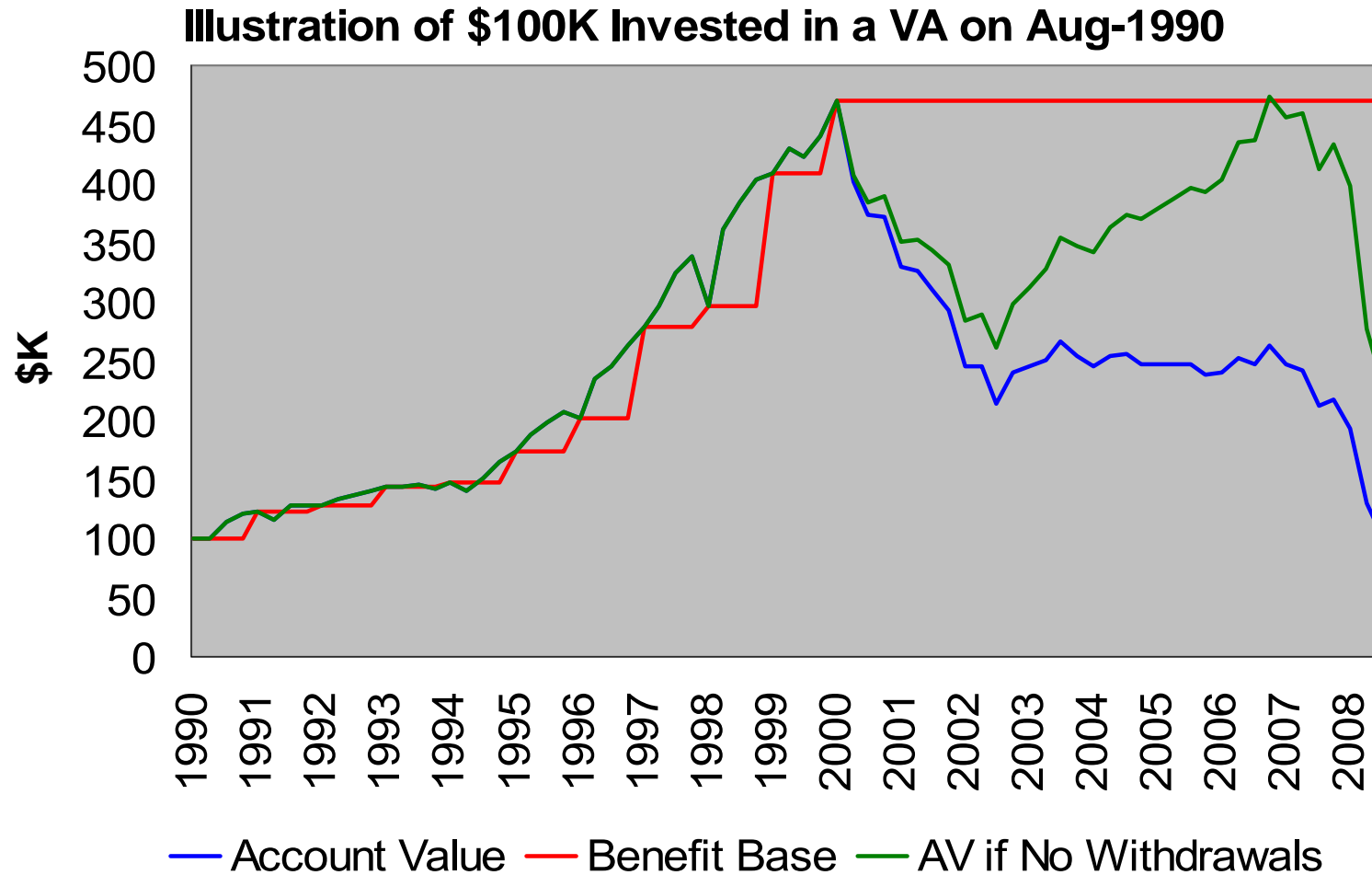
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# What is a VA GMLB?

- A Variable Annuity is a portfolio of mutual funds wrapped by an insurance company into a single security with certain insurance guarantees
- A recent innovation is Guaranteed Minimum Living Benefits that provide financial guarantees if the policy remains in-force
  - Most popular are GMWBs (W stands for Withdrawal)
  - The Withdrawals are usually for the life of the owner
- Withdrawals are funded from the Account Value first then claims are paid by the insurer in the form of an annuity if the AV is exhausted
- An annual fee is charged to the account for the guarantee

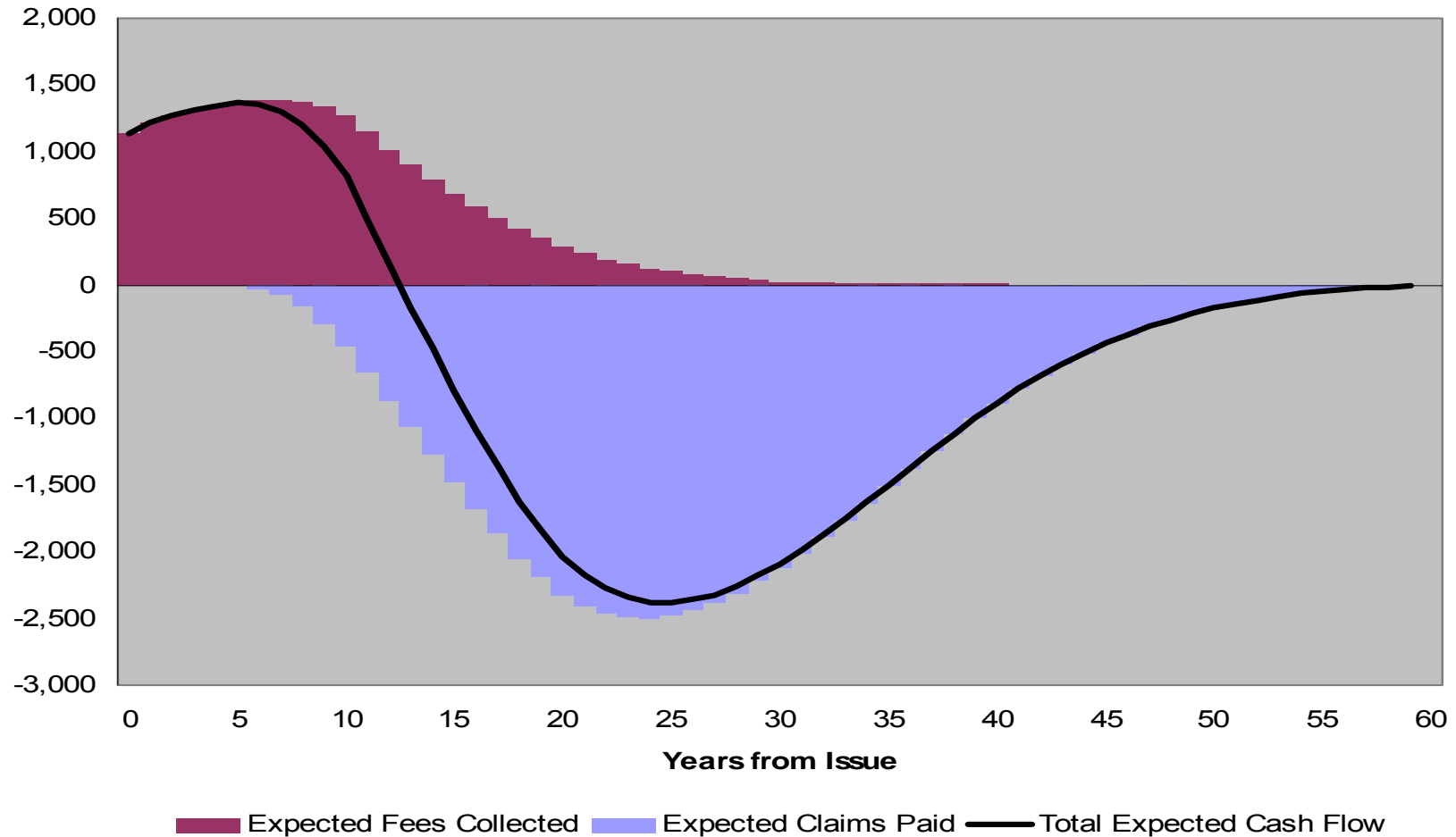
# Illustration of GMWB Mechanics



- Annual Withdrawal for Life of \$23.5K based on AV of \$471K in 2000
- Policy likely to incur its first claim in 4 to 5 years, about 25 years after policy issue

# Cash Flow Characteristics of GMWBs

Expected Cash Flows for \$100K of a GMWB Issued to a 55 year old



- GMWB Issued to a 55 year old, based on 10,000 Scenarios
- Long-Tailed contract due to Life Annuity Component

# Option Characteristics of GMWBs

- Asian Averaging
    - 5% withdrawal per year until account value exhausted
  - Basket Option
    - Multiple asset classes with one guarantee
  - Lookback on the Strike Put
    - Max Anniversary Value Benefit
  - Down-and-In and Up-and-Out Barrier Put
    - Driven by Policyholder Behavior
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- Greeks are similar to long dated index options
  - Gamma and convexity demonstrate that the first order greeks are less stable, resulting in more “dynamic” hedge ratios
  - Higher Order Greeks also demonstrate greater “dynamics” of hedge ratios

GMWB versus Long Dated SPX Put		
	GMWB	SPX Put
Type	65 Male	15-yr ATM
AV/Notional	100,000	89,910
PV(Claims)	-20,739	-20,739
Delta	11.6	11.7
Gamma	-0.032	-0.012
Vega	-665	-613
Rho	5,986	4,812
Convexity	-1,792	-983
Correlation	-1.9	-1.8

# Impact on Derivatives Markets: Vega

- Annual sales have about \$250MM of Vega
  - VA Sales are \$150 billion per year
  - About 40% of sales have GMLBs, or \$60 billion
  - Vega is about \$4.2 per \$1K of Account Value
- Vega hedging needs exceed supply
  - Even prior to the crisis implied vols in the long dated OTC options market were elevated several points
    - Only a fraction of the vega was being hedged
  - Crisis has resulted in lower supply
    - Less risk capital is available
    - Perceived attractiveness of short vega strategies has deteriorated
  - Market has become significantly less liquid as prices exceed those insurers are willing to pay

# Impact on Derivatives Markets: Gamma

- Annual sales have about 25,000 of Gamma
  - VA Sales are \$150 billion per year
  - About 40% of sales have GMLBs, or \$60 billion
  - Gamma is about .425 per \$1MM of Account Value
- Gamma hedging can be met with listed options (based on 2007 Cash Index Options Statistics from CBOE)
  - 1 year of sales volume would be ½% of annual dollar volume of Cash Index Options
  - Multiple years of sales could result in 5+% of dollar volume
  - 1 year of sales volume would be 1% of Open Interest of Cash Index Options
  - Multiple years of sales could result in 10+% of Open Interest of Cash Index Options

# Conclusion

- VA GMLB is an attractive product
  - Insurers increase sales of base product
  - Consumers get guaranteed income stream on top of equity investment
  - Will consumers be willing to pay the higher price that is needed?
- Potential hedge products
  - Longevity Risk
    - Bespoke trade well offered by Reinsurers
  - Correlation Risk
    - Interest Rate to Equities
    - Between Equity Indexes
    - Single Stock/Index Dispersion