



SOCIETY OF ACTUARIES

**Life 2009 Spring Meeting
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**Session 11 Panel Discussion
Variable Annuity Guaranteed Living Benefits -
Does Industry Pricing Still Make Sense?**

Moderator

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May 18, 2009

Does guaranteed living benefit pricing make sense?

Wendy Yu, FSA

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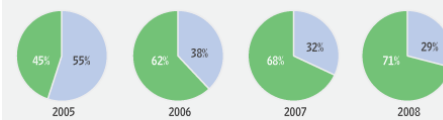
In a 2008 survey, a third of top variable annuity (VA) sellers said they doubted the insurers adequately understand the risk characteristics of VA's sold today

Annuity Anxiety

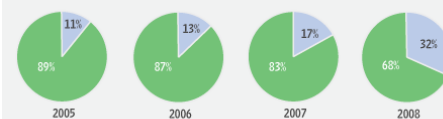
Two key questions from a February survey of the top sellers of variable annuities at Banc of America Securities-Merrill Lynch

■ Yes ■ No

■ Do you feel that insurers are taking on greater risk with the variable annuities sold today?



■ Do you feel that insurers adequately understand the risk characteristics of variable annuities sold today?



Source: Banc of America Securities-Merrill Lynch

Advisors, and investors, are concerned about companies whose earnings seem to be 100% correlated with S&P 500 and twice as volatile. Indeed, leveraged equity exposures, even if they are not captured by earnings, should be hedged. Not hedging the first dollar of claim is okay. Not hedging the last dollar is not.

Product design and pricing should consider risk characteristics associated with potential risk management strategies

Risk assessment

Realized volatility in tail scenarios	<ul style="list-style-type: none"> ▪ If dynamic hedging, best estimate price based on expected realized volatility ▪ Risk margin based on tail deviation
Implied volatility movement until issue	<ul style="list-style-type: none"> ▪ If static hedging, best estimate price based on today's implied volatility ▪ Risk margin based on potential deviation until re-pricing
Interest rate movement until issue	<ul style="list-style-type: none"> ▪ Best estimate price assuming today's interest rates ▪ Risk margin based on potential deviation until re-pricing
Fund basis risk in tail scenarios	<ul style="list-style-type: none"> ▪ Best estimate price assuming no basis risk ▪ Risk margin based on historical basis mismatch and fund strategy
Unexpected policyholder behaviour	<ul style="list-style-type: none"> ▪ Best estimate price based on expected behavior ▪ Risk margin using a more conservative assumption

Rapid re-pricing may not be desirable, even if feasible, so VA writers need to plan for changes in the capital market environment between pricing date and issue date, as well as build flexibility to manage policies post-issue

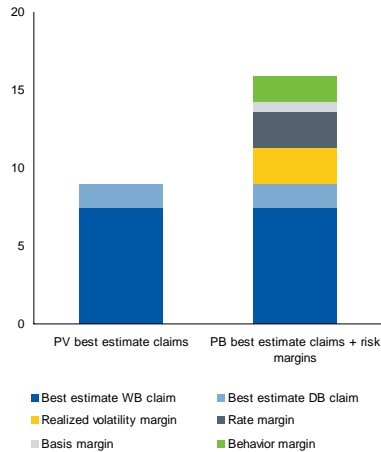
Risk management

Realized volatility in tail scenarios	<ul style="list-style-type: none"> ▪ Limit product features that contribute to convexity e.g. less frequent step-up ▪ Lower equity allocation when realized volatility is high e.g. aggressive portfolio equity allocation is managed between 50% and 70%
Implied volatility movement until issue	<ul style="list-style-type: none"> ▪ Negotiate long term agreement with structured solutions provider ▪ Lower equity allocation when implied volatility is high e.g. limited a la carte fund menu when VIX is higher than 40
Interest rate movement until issue	<ul style="list-style-type: none"> ▪ Link bonus to interest rate ▪ Link rider charge to interest rate
Fund basis risk in tail scenarios	<ul style="list-style-type: none"> ▪ Use index funds ▪ Monitor and manage investment options post-issue
Unexpected policyholder behaviour	<ul style="list-style-type: none"> ▪ Aim for consistent profitability across utilization patterns as much as possible for current and potential future capital market environment ▪ Consider temporary incentives for inforce block

For products that are currently in the market, risk margins are significant

Risk neutral economics – guarantee claims

Issue age 65, withdrawal delay 10 years
(% initial investment)



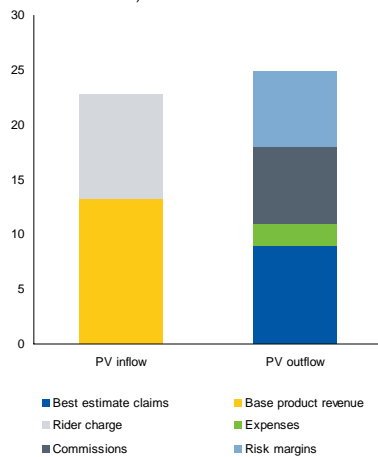
Assumptions

- B-share, 1% M&E, 7 year surrender charge period
- 7% upfront commission, 2% upfront expense
- 50% equity allocation, 95 bps investment expense, 50 bps revenue sharing
- Annual step-up, 7% rollup, 5% lifetime income starting age 60, 85 bps rider charge
- Realized volatility margin: 2 years of short term implied volatility is graded to long term equity volatility of 25%, instead of 20%
- Rate margin: interest rate is adjusted down by 50 bps; swaption implied volatility can be used to assess potential deviation
- Basis margin: fund tracked index well historically; potential for underperformance assumed to be small (2% over 10 years)
- Behavior margin: lapse is reduced by 10%; utilization and longevity margins are not considered in this example

For products that are currently in the market, risk margins are not covered by rider charge

Risk neutral economics – whole contract

Issue age 65, withdrawal delay 10 years
(% initial investment)



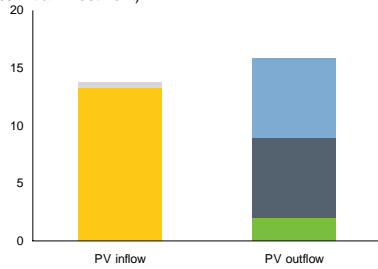
Comments

- On a risk neutral basis, base product revenue + rider charge can almost cover best estimate claims + commissions + expenses + risk margins
 - If hedge target is PV rider charge – PV claims, what are the economics on a real world basis?
- 1 Risk neutral PV claim and PV rider charge are locked in at issue
 - 2 Depending on future conditions, risk margins may or may not be needed to support hedging
 - 3 Since equity return may be higher or lower than the risk free rate, real world PV base product revenue may be higher or lower than the average risk neutral PV; higher equity return may also result in higher lapses

If base contract revenue can cover risk margins on a risk neutral basis, product is likely to be profitable

Real world economics – adverse scenario

Issue age 65, withdrawal delay 10 years
(% initial investment)

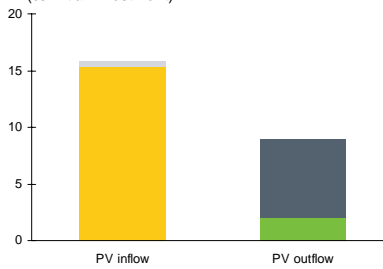


- Base product revenue
- Expenses
- Risk margins
- PV rider charge - PV claims
- Commissions

- Since future conditions are adverse, risk margins are needed to support hedging
- The 10th percentile of the S&P 500 10-year total return distribution is close to 30% (3% per year), so PV base product revenue for an adverse real world scenario is close to the average risk neutral PV

Real world economics – typical scenario

Issue age 65, withdrawal delay 10 years
(% initial investment)



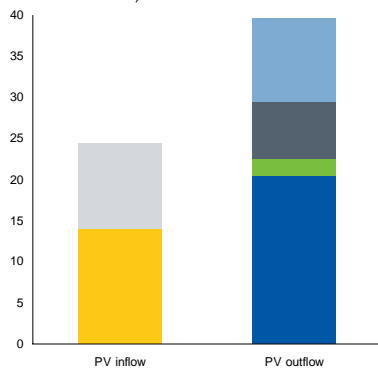
- Base product revenue
- Expenses
- Risk margins
- PV rider charge - PV claims
- Commissions

- Since future conditions are as expected, risk margins are not needed to support hedging
- Since equity return is significantly higher than risk free return, PV base product revenue is considerably higher, even if lapse rate is higher

Does guaranteed living benefit pricing make sense? It depends!

Risk neutral economics – whole contract

Issue age 50, withdrawal delay 10 years
(% initial investment)



- Best estimate claims
- Rider charge
- Commissions
- Base product revenue
- Expenses
- Risk margins

Comments

- For this policy, on a risk neutral basis, base product revenue + rider charge does not even cover best estimate claims + commissions + expense, let alone margins

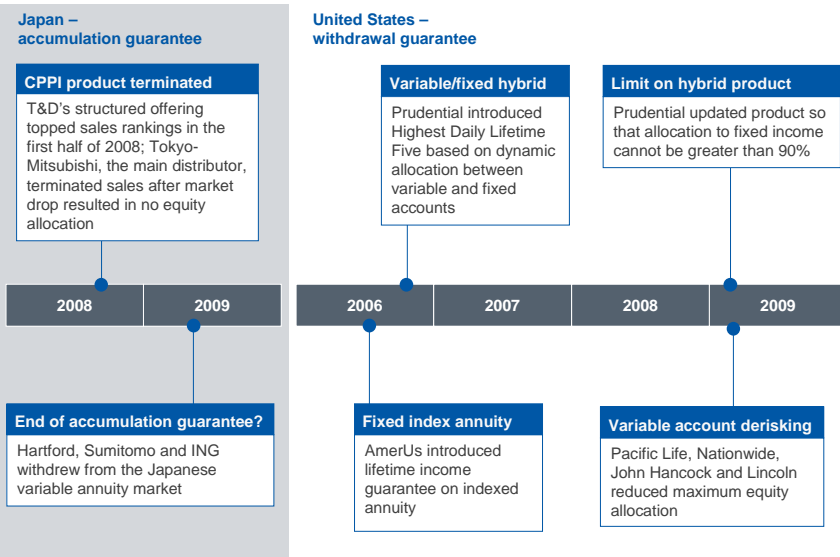
For products that are currently in the market, policy mix and investment options drive profitability

Risk neutral inflow - outflow		Issue age						
Fund model	Withdrawal behaviour	50	55	60	65	70	75	80
70% equity	Immediate			-16.3%	-11.8%	-8.0%	-5.5%	-4.9%
	Unconditional 5		-23.0%	-17.2%	-11.8%	-7.4%	-4.9%	-4.7%
	Unconditional 10	-22.6%	-17.4%	-11.7%	-6.8%	-3.6%	-2.8%	-4.6%
	Never	12.7%	10.5%	8.1%	5.3%	1.9%	-2.0%	-6.1%
50% equity	Immediate			-10.6%	-7.1%	-4.3%	-2.7%	-2.9%
	Unconditional 5		-15.5%	-10.7%	-5.4%	-3.1%	-1.6%	-2.2%
	Unconditional 10	-14.6%	-10.1%	-5.6%	-1.9%	0.3%	0.3%	-1.9%
	Never	13.9%	12.2%	10.3%	7.8%	4.7%	1.2%	-2.7%
20% equity	Immediate			-3.9%	-1.5%	0.2%	0.7%	-0.2%
	Unconditional 5		-6.8%	-3.2%	-0.1%	2.0%	2.5%	1.2%
	Unconditional 10	-5.2%	-1.9%	1.3%	3.8%	4.9%	4.2%	1.8%
	Never	14.7%	13.7%	12.4%	10.5%	8.1%	5.1%	1.7%

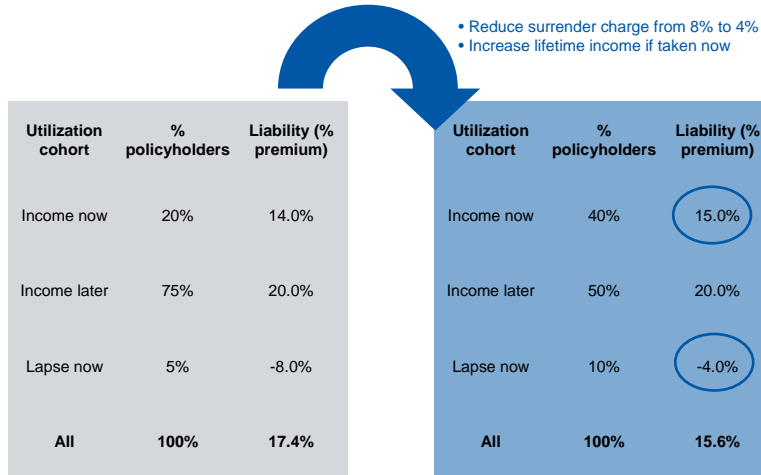
Very likely to be profitable (Green) Likely to be profitable (Yellow) Unprofitable (Red)

What about cost of capital? If whole contract revenue can support the cost of hedging in most scenarios, capital requirement should be manageable

Dynamic asset allocation can be as subtle as wider equity allocation bands or as intrusive as a pure Constant Proportion Portfolio Insurance (CPPI) strategy



For inforce blocks that are significantly in-the-money, there may be opportunities to improve economics by offering temporary incentives to policyholders that are in need of liquidity



Does guaranteed living benefit design and pricing make sense from the policyholder perspective?



- How valuable is the guarantee in an inflationary environment?
- Will dynamic asset allocation result in "buy high, sell low"?
- How much upside potential remain after 400 bps of fees?

Recent capital market conditions have interrupted the features war and given VA writers an opportunity to rethink the consumer value proposition

Variable Annuity Guaranteed Living Benefits – Does Industry Pricing Still Make Sense?

2009 SOA Life Spring Meeting, Denver, CO
May 18th, 2009

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Recent VA market trend

Financials

- ❑ Large VA losses announced by insurance companies
- ❑ Much larger realized and unrealized capital losses in general account for investment portfolios' severely depleted surplus and free capital
- ❑ Most companies have to increase GMxB reserves and required capital, accelerate DAC write-offs; while lower AUM depresses expected future fee revenues

Changes

- ❑ Most reinsurance companies exited the VA market, once again
- ❑ Some companies stopped writing VA guarantees in certain markets
- ❑ Most VA writers started to modify VA products by increasing fees, reducing guarantees, and requiring more restrictive asset allocations
 - Some move to much reduced guarantees and low fees
 - Some keep the relatively rich guarantees but charge higher fees
- ❑ However, some insurance companies recently announced entering the VA markets

Very challenging VA hedging and risk management environment

Unaffordable hedging/Full reinsurance costs

- ❑ Volatilities, interest rates, correlations
- ❑ Expected future equity returns for real world projections
- ❑ Hedge effectiveness (tracking errors, transaction costs, etc.)
- ❑ Capital Costs rise when easy financing is unavailable

Hedging under stress

- ❑ Surprising tracking error arose when hedges failed to replicate actively-managed mutual funds (compounded by large dollar delta positions)
- ❑ Companies reduced option purchases from prior standard 3-Greeks hedges
- ❑ Liquidity and cash flow problems when funding costs are high
- ❑ Certain regulatory requirements may have created unexpected consequences
- ❑ It's all about STAT and economics now, rather than GAAP earnings volatility

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Pricing of guarantees vs. base contract

- ❑ Different impact of policyholder behavior
- ❑ Different pricing assumption bases (real world vs. risk neutral)
- ❑ Some products are messed up by accounting

Base contract

- ❑ Base contract fees are typically not hedged
- ❑ Non-derivatives and no leverages with real world pricing
- ❑ Higher persistency good
- ❑ Critically-dependent on expected asset growth rate for future fee revenue
- ❑ Dependent on equity long term expected volatilities for reserve and capital charges

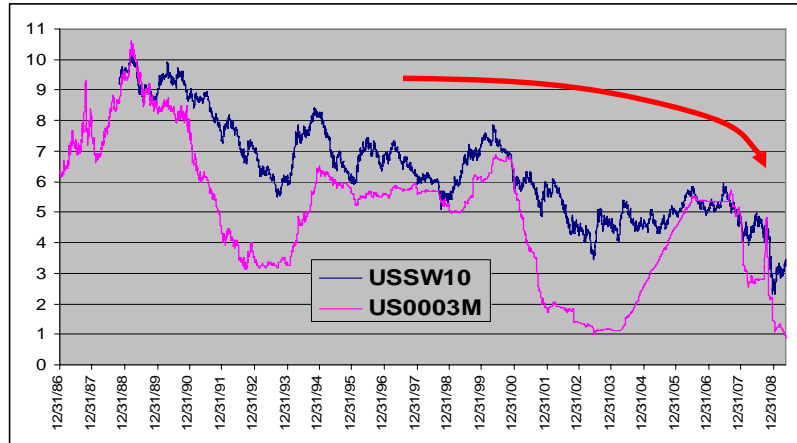
Guarantees

- ❑ GMxB Guarantees are generally (or should be) hedged
- ❑ Derivatives with risk neutral pricing and hedging
- ❑ Higher persistency bad
- ❑ Critically dependent on risk-free rates and equity implied volatilities for derivatives pricing
- ❑ All guarantees **should** be hedged (FAS 133/157 or SOP 03-1) – hedging the economics

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Historical interest rates

Long term trend of lower interest rates



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Impact of lower risk free rate and lower equity growth rate

Risk free rate for risk neutral pricing of derivatives

- ❑ Rho risk is very significant and, unfortunately, some consider it too late or too costly to hedge today
- ❑ Generally, the roll-up or bonus rate of guaranteed amount or base can not be hedged away
- ❑ Don't expect magic from the hedging team when risk free rate is 3% but the roll-up rate is 6%. The difference accrues, but a loss is a loss.
- ❑ If the roll-up or bonus rate is significantly higher than the risk free rate, it is not sustainable
- ❑ **Smart designs** should have floating roll-up rates linked to risk-free rates

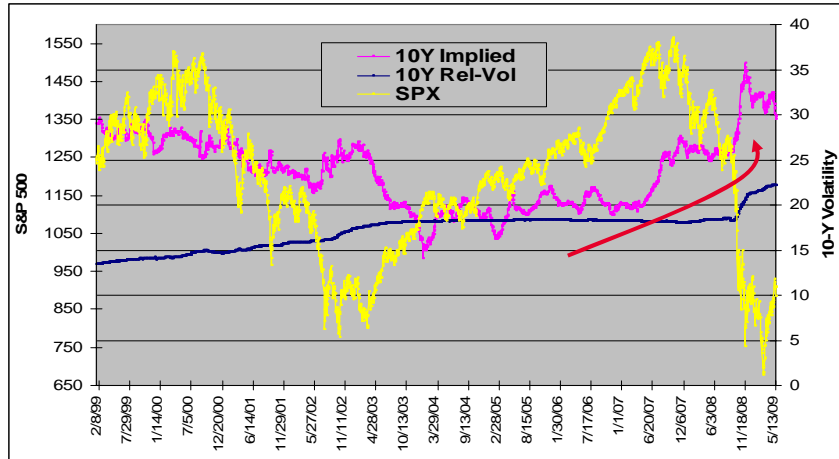
Long term expected equity growth rate for real world pricing

- ❑ For base contract pricing, companies typically don't hedge or can't afford to hedge all fees
- ❑ Lower expected equity (or all asset class) returns means lower allowable expenses, lower profits, higher reserves and more required capital
- ❑ Recent capital market events have demonstrated that, not only will drift be lower in the future, but also the uncertainty of the expected return is now much higher
- ❑ If equity mean return is 5% with higher volatility, it is almost impossible to price VA to achieve ROE at 15% in the next few years. So maybe we should price VA for 5% ROE?

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Historical implied and realized long term volatilities

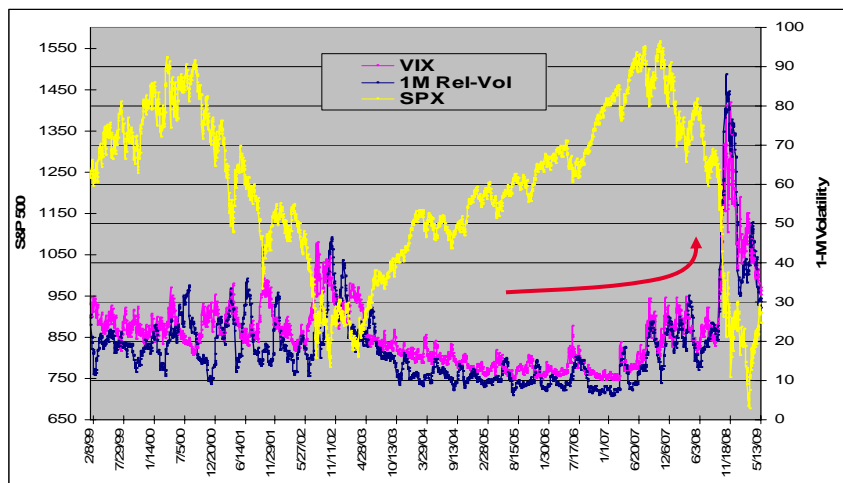
Significant pickup in long term implied and realized volatilities



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Historical implied and realized short term volatilities

Significant pickup in short term implied and realized volatilities



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Impact of higher implied volatility

Implied volatility for risk neutral pricing of derivatives

- Implied volatilities are high – we may be facing a new higher-volatility regime
- Long-dated implied volatilities are higher than the assumptions implied by most VA pricing:
 - Are they temporary and how soon will the things be normal?
 - What are the reasonable levels when capital markets recover?

Fair value and MTM accounting will drive more derivatives needs

- VA guarantees should be marked-to-market IF there is a market
 - There is scant liquidity for very long-dated volatility (e.g., > 10 years)
 - Even 10-year volatility is now less liquid than before the crisis
- MTM possibly not to be pushed by authorities before current capital market crisis recovers
- Once markets recover and if MTM rules are mandated, the natural trend will again be higher implied volatilities from strong demand
- Supply and demand for long-dated options are currently very unbalanced and may never return to the last ten year (before crisis) steady state

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Impact of higher realized volatility

Realized volatility for derivatives hedging

- Delta-hedging with realized volatility
 - The P/L is based on realized volatility (past experience), very uncertain and path dependent
 - There may be very large MTM pricing volatility (future expectation) which is STILL based on implied volatility
 - Significant gap risk (Gamma and jump risks)
- Hedging options CAN be designed to be paid on realized volatility
 - Companies don't have to pay implied volatilities when hedging
 - For example, timer options are priced such that the eventual cost is on realized volatility
- Very high realized volatilities today are catching up with the implied
 - Resulting much higher realized P&L losses (buy-high and sell low frequently)
 - Making delta-hedging cost similar to cost of options

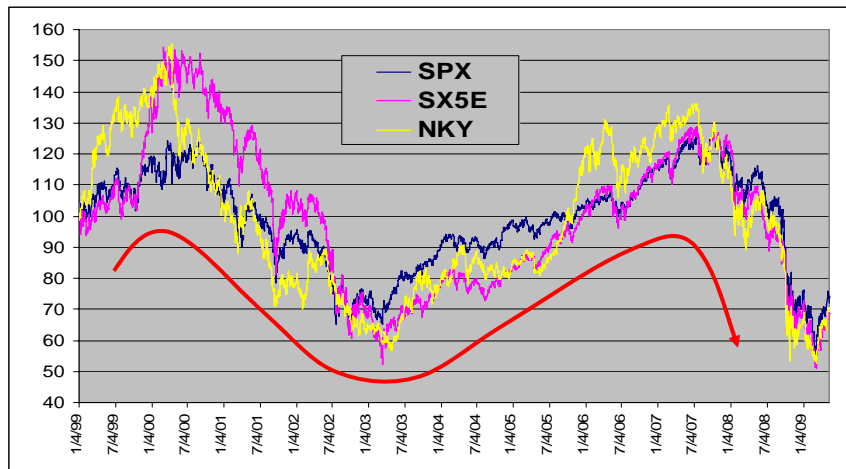
Long term expected realized volatilities for real world pricing

- VACARVM and C3P2 are directly impacted by the long term expected volatilities of the asset classes
- The recent capital market experience would probably push companies to choose higher and more prudent long term expected volatility assumptions than before

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Historical cross market equity performance

Over the long run, cross markets are highly correlated



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Impact of higher cross market and cross asset class correlations

New regime of correlations?

- In today's integrated global economy there seems to be a new regime of correlations, as well as new regime of volatilities
- During a crisis all asset classes and markets tend to crash similarly
 - Correlations among asset classes approach 100%
 - Correlations among different markets approach 100%

Implication of higher correlations in crisis

- Higher correlations of asset classes means higher volatility (both implied and expected)
- Making diversification and asset allocation much less effective
- Diversification is not there when you really need it
- The implication for product pricing – the correlation matrix in the assumption book probably under-estimated the cost of hedging and over-estimated the profitability
- Many hedging programs are under-hedged in crisis (and could be over hedged in boom markets)
- It is smart to purchase basket options when implied correlations are lower than crisis correlations

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Hedge effectiveness – Impact of higher basis risks

Basis risks (replication costs)

- In the long run, the mean basis risks are supposed to be around zero
 - Hedge ratios are typically set based on minimum variance methodology which is equivalent to betas from multiple regressions.
- The results should sometimes be positive and sometimes negative
 - But the trending "runs" could take a long time to break, i.e. we may still see long periods of continuous mostly "+s" or "-s"
- The regression-produced hedge ratios are only based on some statistics (mean results from the past history) and any day's results are random.
 - The period of history can not be too long for stale results and too short for too much sensitivity or market noise.
- Most hedgers (insurance companies and banks) lost from basis costs in 2008
 - The impact is magnified when the dollar delta sizes increased significantly (many multiples)
 - Many hedgers lost 300 bps or more
 - basis options are not readily available from dealers for large sizes
- Part of the reason may be the attribution of basis risks vs. gap (Gamma and jump) risks
 - When markets are very volatile, the differences between the active managed fund returns and the index returns may not have been properly identified for basis or gap components.
- Price-index based instruments to hedge against guarantees that are based on total returns
 - There may be difference in volatility surfaces (less significant today)
 - It may be better to use total return swaps and/or sell dividend swaps (when expected dividends were higher)

The pricing/volatility assumptions may have to be adjusted upwards

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Impact of higher hedging transaction cost

"Normal" financial engineering theory and corresponding hedging practices break down during the extreme capital market volatility and severe liquidity crisis

- Significant increase in counter-party credit risks and potentially corresponding cost of OTC transactions
 - Everyone is afraid of almost everyone else
 - Net Settlement for OTC derivatives an issue in many states
- Due to liquidity crisis, capital is very expensive and funding costs are higher
 - Some transactions that could easily be done just a year ago with easy access to short term funding (and easy roll over) are now too expensive due to lack of liquidity, funding and strong distaste for leverage
 - Everyone is holding onto their cash
- Costs of shorting assets are higher and thus all hedges for downside protections are more expensive
 - Higher cost to borrow stocks to short by dealers and hedge funds (from pension funds, mutual funds, etc.)
 - Sometimes certain assets cannot be shorted by government regulations at times
 - Difference between Fed fund rates and swap rates for banks who short
 - Higher futures roll costs and, therefore, delta hedging is less attractive
 - Fewer natural/speculative sellers of long dated options/volatilities today than a year ago would also result in higher cost of long dated options

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Accounting complexity

When in good time, companies were concerned about the (GAAP) earnings volatility

- ❑ Big reason for not hedging GMDB and GMIB by majority of the companies
- ❑ Only very few priced GMDB and GMIB as derivatives and implemented economic hedges
 - Most companies face large increases in reserves at 2008 year-end – with no or little corresponding gains from existing hedges or reinsurance on GMDB and GMIB

Now in crisis mode, companies are mostly concerned about (STAT) capital

- ❑ This is precisely the most expensive time to acquire new capital when you (and everyone else) need it
- ❑ Liquidity is very low and credit/counter-party risks are very high
- ❑ Yet, certain regulatory requirements, such as Standard Scenarios and state restrictions for reinsurance contracts may have inadvertently prevented companies taking prudent hedging or reinsurance positions before the crisis.

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Fund changes as fundamental solutions

Basis risk management

- ❑ Funds may be chosen with little or no basis risk
- ❑ Hedgeable (shortable) funds design
- ❑ ETFs, Index, and rules-based passive investment funds are efficient
 - Loss in revenue sharing may be more than offset by much smaller replication costs
- ❑ The key is track-ability

Volatility control

- ❑ Asset allocation requirement is essential – makes long term hedging predictable and lowers trading costs
- ❑ Volatility-target funds are the best
- ❑ CPPI based funds similar but with different goal – look out for lock out
- ❑ Automatic rebalancing of funds, according to asset class weights or volatility rules, should be applied to as many funds as possible

Fund solutions are the **best** approaches to bring down the guarantees cost

Smart designs would ask policyholders to pay for active investment choices and highly volatile asset classes

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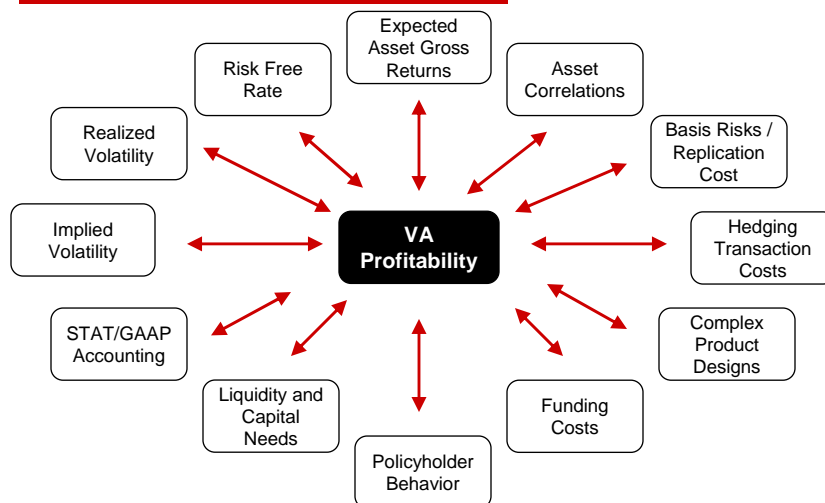
VA guarantees are derivatives

- VA guarantees are and should be treated as derivatives in pricing
 - All guarantees should be priced as hybrid derivatives
 - All derivatives should be hedged
- All assumptions (implied volatility, risk free rate, asset growth rates, asset expected volatility, policyholder behavior, and asset correlations) should be consistent between risk management and pricing design
- Leave enough room for unknown risks and price conservatively

If you can not get reinsurance or fully hedge, the guarantees are probably priced too low

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Many factors affecting VA guarantee pricing



Some of the most exotic, super-long dated, and hybrid derivatives ever created!

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Integration of risk management and VA pricing

Integrated Solutions

- Diversified solutions (short and long terms, actuarial and capital markets)
- Short term solutions managed by hedging team: dynamic hedging (doesn't just mean futures) and swaps (including semi-static and rebalancing hedges)
- Long term solution managed by actuaries: full reinsurance if possible
- Structured solution in between of dynamic hedging and reinsurance should be jointly managed by all

Integrated Teams for VA guarantee pricing and risk management

- Much closer working relationship between risk management and pricing actuaries
- Much better integration of financial engineering and actuarial science
- Much better enterprise risk management approaches that optimize the trade-offs among capital management, financial risk management, derivatives management, and product management
- Much better senior management understanding of the many bets their company is taking



Pricing Variable Annuity Guaranteed Living Benefits in An Extraordinary Time

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Milliman, Inc.
Financial Risk Management

SOA Life 2009 Spring Meeting, May 18, 2009, Denver, CO
Session 11, Panel Discussion



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- Challenges in Valuing GLB Guarantees
- Risk Management Considerations

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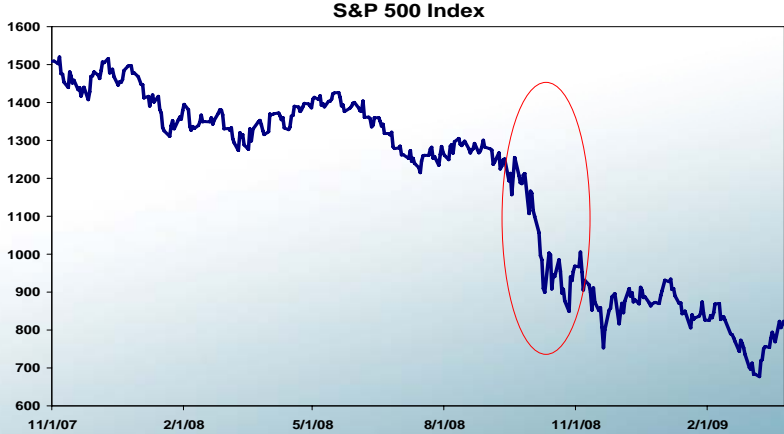


Latest Trends in VA GLB



Market Environments

- Equity Market Turbulence Worldwide
 - At the end of Mar 09, S&P is almost half of its Oct 07 high of 1,565



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Market Environments

- Rapid Reduction of Interest Rates

- Interest rate level is at historical low



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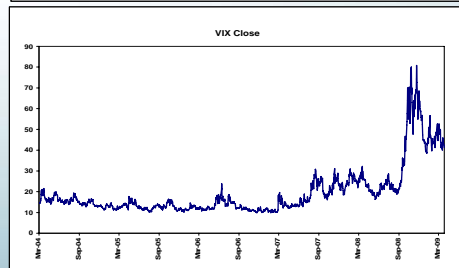
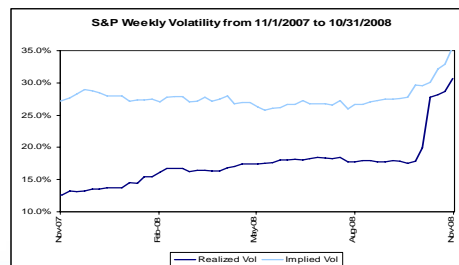
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Market Environments

- Significant increase in Volatility

- Both realized and implied volatility shot up
- Realized vol tripled
- Implied vol at 40% by October 2008
- Forced liquidation of hedge funds helped amplify the market volatilities



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Latest Trends in VA GLB – Pre-Meltdown

- VA GMWB
 - Battle in the “living benefits arms race” continues into early 2008
 - More generous benefit designs to gain market share
 - High rollup rates: as high as 10%
 - Frequent ratchet: quarterly/daily
 - Rollup on stepped-up balance
 - Higher withdrawal % upon older attained age for policyholder already withdrawing
 - Optional LTC features coupled with GLWB, etc.

- VA GMIB
 - Similar trends towards richer benefits
 - Increased rollup percentage
 - Rollup on a reset basis
 - Dollar-for dollar withdrawals of the rollup, etc.

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Latest Trends in VA GLB – Late 2008 To 2009

- Benefit Amendments and Re-pricing
 - Discontinuation of some existing riders
 - Increase in rider charge
 - Tuning-down in benefit features
 - Lower bonus percentage
 - Lower withdrawal rate
 - Less frequent ratchet, etc.

- Risk Tolerance Tightened
 - Changes in asset allocation requirements
 - More emphasis on effective hedging program

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Latest Trends in VA GLB – Late 2008 To 2009

- With effective date through mid May09, 33 VA writers filed changes on 125 existing products; 8 VA writers filed 12 new products.
- Summary of 2009 VA product changes:

A. Summary by nature of changes

Change Category	# of Products	# of Companies
Sales Discontinued or Restricted	42	18
Fee Increased	62	29
Product Features Scaled Back	44	19
Asset Allocation Changed/Restricted	16	10
Total	125	33

B. Summary by number of changes

# of Changes (from the above 4 categories)	# of Products	# of Companies
1	90	15
2	31	15
3	4	3
Total	125	33

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Challenges in Valuing GLB Guarantees



Challenges in Valuing GLB Guarantees

- VA living benefit guarantees are required to be marked to market
 - FASB Staff Position Paper 157-3:
 - “In determining fair value for a financial asset, the use of a reporting entity’s own assumptions about future cash flows and appropriately risk adjusted discount rates is acceptable where relevant observable inputs are not available....Regardless of the valuation technique used, an entity must include appropriate risk adjustments that market participants would make for nonperformance and liquidity risks.”

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Challenges in Valuing GLB Guarantees

- Valuation inputs/assumptions are critical in valuing GLB guarantees
 - Risk free rate and volatility
- Accurate estimates and inter-company comparisons are challenging
 - More transparencies required by rating agencies, regulators and investors
 - Standardized process and parameters are highly desirable in market transactions, e.g., M&A activity
- Potential effects of recent market movements and VA writers’ product redesign activities on policy holder behaviors
 - More awareness of value of VA guarantees
 - Volatilities in the market may invite more gaming activities
 - Or are we entering an era when participants are more risk averse?

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Milliman Guarantee Index

- Insurers' exposure to volatility is a key determinant of financial results
- Having a standardized volatility index will allow for transparency
 - Expected hedge costs can be quoted based on this Index
 - Expected hedge gains can be predicted by analysts & investors
- MG-Index will allow for comparisons of results across companies
 - Hedge costs & product charges can be easily compared by analysts & investors to:
 - Identify aggressive / conservative pricing practices
 - Estimate product margins

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Milliman Guarantee Index

- Developed from a stochastic volatility model
 - GARCH(1,1), reflects
 - Spikes in volatility
 - Fluctuations in volatility over time
 - Identifies & reflects high volatility environment associated with a financial crisis
- Semi-annual survey of actuarial & behavioral assumptions
- Market transactions based on MG-Index can be tracked accordingly
 - Reinsurance
 - M&A activity

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Illustrative Calculations: \$1 billion Lifetime GMWB Block

- 5% lifetime withdrawals after age 60
- Annual ratchet
- 5% simple interest rollup
- Average age = 62.5
- 50% / 50% Single / Joint
- 50% / 50% Male / Female
- 60% Equity / 40% Fixed Income

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\$1 Billion Lifetime GMWB Results Expected Hedge Cost for New Sales

Illustrative GMWB Results						
<i>Expected Hedge Costs (bps of Guaranteed Withdrawal Base)</i>						
Increase Due To	11/06	11/07	09/08	10/08	11/08	12/08
Swap Rates	NA	1	4	4	46	12
MG Index Volatility	NA	0	10	6	-2	-7
Total Increase in Expected Hedge Cost from Prior Date	NA	1	14	11	44	6
Expected Hedge Cost	28	29	42	53	97	103
<i>Sensitivity Test - Optimal Customer Behavior</i>						
	11/06	11/07	09/08	10/08	11/08	12/08
With Asset Allocation Restrictions (Equity=60%)	37	39	56	69	120	126
Without Asset Allocation Restriction (Equity=100%)	70	71	103	126	185	185

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\$1 Billion Lifetime GMWB Results Increase in Reserve for Existing Business

Illustrative GMWB Results

\$1 Billion block issued on 11/30/06

Note: Reserve changes consider market factors only & ignore the passage of time

Increase in Reserve Delta	11/06	11/07	09/08	10/08	11/08	12/08	Total
Index Leads	NA	-31	126	171	43	-76	233
Swap Rates	NA	09	55	69	758	234	1125
MG Index Volatility	NA	-09	126	81	-22	-76	99
Total Increase in Reserve from Prior Date	NA	-31	307	320	779	82	1457
Reserve Level (\$Millions)	0	-31	276	596	1375	1457	1457
Reserve Level, % of Account Value	00%	-03%	28%	60%	138%	146%	146%

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Risk Management Considerations



What Has The Market Done

- Value proposition of VA living benefit guarantees is validated
- Need for effective risk managements throughout the product cycle is strengthened
- Effectiveness of hedging programs is also well tested
 - Overall effectiveness for VA hedging programs is around 93%
- Questions are asked:

VA GLB Design and Pricing	General Economy
<ul style="list-style-type: none"> ▪ Do the consumers really need those expensive benefit feature? ▪ Does product differentiation only take the form of richer benefits? ▪ Have we priced for and hedged the risks adequately? ▪ 	<ul style="list-style-type: none"> ▪ Did everyone has a business in buying a house? ▪ Should a mortgage lender loosen credit criteria in loan application just because others were doing so? ▪ Did all constituents understand the complex nature and hidden risks in CDS, MBS etc.?

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Lessons Learned

- Lessons learned from other parts of the financial industry
 - Simple is smart
 - Transparency is the key
 - Extreme scenario(s) can actually happen
- Applied in both product design and risk management
- Sound risk management principles
 - VA dynamic hedging programs utilize simple instruments
 - Futures and swaps performed well in market stresses
 - Plain vanilla options
 - Highly liquid and well collateralized instruments
 - Transparent approach
 - Widely discussed/reviewed among multiple parties
 - Perform sufficient stress tests and hedge major exposures
 - Stress tests/mock hedging are often performed in designing the program

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Looking Ahead

- Changes in variable annuity business and life insurance industry as a whole is inevitable
- Hedging program and risk management techniques are also facing their fair share of evolution
 - Basis risk
 - Gap and volatility risk
 - Policy holder risk
 - Rebalancing strategy refinement etc.
- Effectiveness risk management will be a differentiator among companies
- More hedging and wider coverage are expected

Reference:

Milliman Report "Performance of Insurance Company Hedging programs During the Recent Capital Market Crisis", by Peter Sun and Ken Mungan

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