

A MILLIMAN GLOBAL FIRM



Milliman USA

Consultants and Actuaries

**Guaranteed Living Benefits
Asset Adequacy Testing**

Valuation Actuary Symposium – Orlando, FL
Thursday, September 19, 2002

Agenda

- MMMM
- Retrospective Accumulation
- Asset Adequacy Testing
 - Guidance
 - Assumptions
 - Sample results

Guideline MMMM

- Interim requirement for year end 2002(?)
- Applies to all GLBs subject to CARVM
 - GMIB, GMAB, GMWB, GPAF
 - Excludes group annuity not subject to CARVM
- Aggregate reserve equals sum of:
 1. Aggregate reserve for VA without GLB
 - Including cash surrender value floor
 - Include AG 34
 2. Retrospective accumulation of charges
 - Subject to asset adequacy

Guideline MMMM

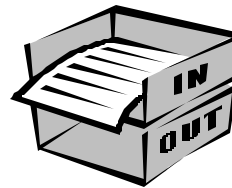
- Reinsurance issues
- Ceding
 - If proportional, reserve credit for portion of reserve calculated without reinsurance
 - Adjustment necessary for non-proportional
 - Included in asset adequacy model
- Assumed
 - Retro Accumulation = Sum of gross reinsurance premiums
 - Subject to asset adequacy

Retrospective Accumulation

- Retrospective accumulation of charges
 - Accumulation of full charge
 - Policies still in force and eligible
- Charge imputed if not specified
 - Reasonable to base on 80th to 90th percentile
- What is the accumulation rate
 - “sum of aggregate VAGLB charges”
- Release reserve
 - Not specified
 - Interim requirement

Asset Adequacy Analysis

- “Standalone” testing
- Income items include
 - Charges
 - Investment income on reserve
 - Reinsurance payments
- Expense items include
 - Benefits paid
 - Reinsurance premiums
 - Taxes
- Assets should reflect hedge strategy



Asset Adequacy Analysis

- Actuarial Standards of Practice 7
 - 3.4: Identification of assets
 - 3.4.2: Investment strategy
 - Asset segmentation
 - Investment strategy
 - Use of derivatives
 - 3.5: Projection of liability cash flows
 - Historical experience if credible
 - Effects of external factors
 - Ability of policyholder to exercise options
 - Expenses

Asset Adequacy Analysis

- Actuarial Standards of Practice 7
 - 3.8: Reinsurance
 - Possibility of non-performance
 - 3.9: Separate account
 - General account guarantees
 - Non-recovery of expense allowance
 - Allowable transfers
 - 3.10: Modeling and Data
 - Choice of scenarios reasonable for testing purpose
 - Number of scenarios to capture variability
 - Sensitivity testing

Asset Adequacy Analysis

- Actuarial Standards of Practice 22
 - 3.3.1: Asset Adequacy Analysis
 - BV of Liability = BV of Assets at kick-off
 - 3.4.2: Adequacy of Reserves and Other Liabilities
 - Adequate under moderately adverse conditions
 - Reserve to withstand any circumstance usually implies excessive reserves
 - 3.4.7: Management Action
 - Should be considered and documented
 - 4.1: Required Communications
 - Documentation

Assumptions

- GMIB
 - Various Benefit Base
 - Guaranteed annuitization
 - 3% interest
 - Annuity 2000 with G improvement mortality
 - Annuitization factor
 - PV of guaranteed payments at current 5-year Treasury
 - Annuity 2000 mortality
 - No reinsurance or hedging assumed
 - Investment strategy
 - 1-year Treasuries
 - Charges:
 - 10, 30, 30, 45 for ROP, 5% RU, MAV, Max(5% RU, MAV)

Assumptions

- Scenario Generation

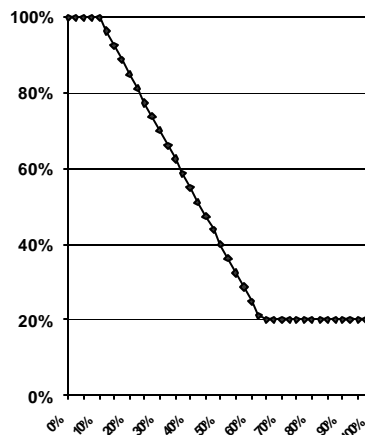
- Phase I generator used for yield curves
- Regime switching model
 - S&P 500 have -30% correlation with 10-year Treasury
 - Subaccount are S&P 500, Small Cap, Bond
- 500 Scenarios
- Calibrated to C-3 Phase II requirement
- Model assumes 100% S&P except where specified



Assumptions

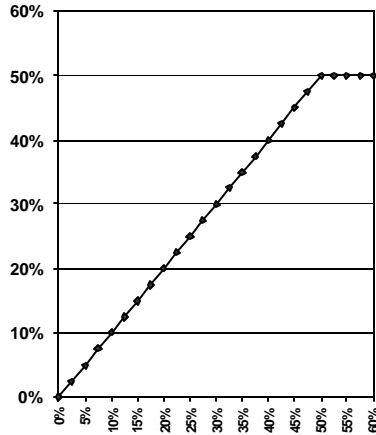
- Dynamic Lapse

- Regulators like less lapse when ITM
- GMDB:
 - $\text{Max}(50\%, 1-1.5 * (\text{ITM} - 1.1))$
 - $\text{ITM} = \text{GMDB} / \text{AV}$
- GMIB:
 - $\text{Max}(20\%, 1-1.5 * (\text{ITM} - 1.1))$
 - $\text{ITM} = \text{GMIB} * \text{Ann Factor} / \text{AV}$
- Minimum multiplied by base lapse



Assumptions

- GMIB Utilization
 - Regulators like more utilization when ITM
 - Typical functions
 - ITM% ^2
 - 50% ITM%
 - 100% ITM%
 - May want to vary by age



Asset Adequacy Analysis

● Results – GMIB

	ROP GMDB/GMIB	5% Roll-up GMDB/GMIB	Max Anni GMDB/GMIB	Greater of 5% Roll-up/MAV
90 CTE	-0.35%	-4.66%	-3.10%	-6.17%
65 CTE	-0.10%	-1.33%	-0.89%	-1.78%
60 CTE	-0.09%	-1.16%	-0.78%	-1.56%
Percentiles				
99.0%	0.68%	-9.51%	-10.01%	11.57%
97.5%	0.42%	-6.32%	-4.43%	9.07%
95.0%	0.47%	-3.41%	-1.13%	5.04%
90.0%	0.51%	0.12%	0.72%	-0.60%
83.3%	0.55%	1.59%	1.41%	1.76%
50.0%	0.73%	2.15%	2.08%	3.08%

Asset Adequacy Analysis

● Results – GMIB

Greater of 5% Roll-up and MAV	100% Equity 0% Bond	75% Equity 25% Bond	50% Equity 50% Bond	25% Equity 75% Bond	0% Equity 100% Bond
90 CTE	-6.17%	-1.82%	-0.51%	-0.13%	-1.66%
65 CTE	-1.78%	-1.49%	-0.14%	-0.04%	-0.49%
60 CTE	-1.56%	-0.51%	-0.13%	-0.03%	-0.43%
Percentiles					
99.0%	-11.57%	-4.88%	-1.83%	-0.24%	-3.21%
97.5%	-9.07%	-2.55%	0.34%	1.16%	-2.28%
95.0%	-5.04%	-0.32%	1.65%	1.70%	-1.45%
90.0%	-0.60%	1.44%	2.29%	2.24%	-0.31%
83.3%	1.76%	2.37%	2.40%	2.32%	0.52%
50.0%	3.08%	2.92%	2.70%	2.48%	2.24%

Asset Adequacy Analysis

● Results – GMIB

Greater of 5% Roll-up/MAV	10% ITM	20% ITM	30% ITM	40% ITM
90 CTE	8.84%	12.21%	16.21%	20.64%
65 CTE	2.70%	4.13%	6.20%	8.95%
60 CTE	2.36%	3.61%	5.43%	7.83%
Percentiles				
99.0%	15.51%	19.54%	24.20%	28.81%
97.5%	11.48%	15.37%	20.13%	25.01%
95.0%	7.41%	10.19%	13.90%	18.30%
90.0%	2.83%	6.05%	8.94%	13.09%
83.3%	0.74%	1.09%	3.91%	7.27%
50.0%	3.10%	3.12%	3.17%	3.23%

Sensitivity Testing

- Dynamic Lapse

Greater of 5% Roll-up/MAV	Base Case	None	50% Floor	3 Times rather than 1.5
90 CTE	-8.84%	-12.21%	-16.21%	-20.64%
65 CTE	-2.70%	-4.13%	-6.20%	-8.95%
60 CTE	-2.36%	-3.61%	-5.43%	-7.83%
Percentiles				
99.0%	-15.51%	-19.54%	-24.20%	-28.81%
97.5%	-11.48%	-15.37%	-20.13%	-25.01%
95.0%	-7.41%	-10.19%	-13.90%	-18.30%
90.0%	-2.83%	-6.05%	-8.94%	-13.09%
83.3%	0.74%	-1.09%	-3.91%	-7.27%
50.0%	3.10%	3.12%	3.17%	3.23%

Sensitivity Testing

- Utilization function

Greater of 5% Roll-up/MAV	Base Case	50% ITM	ITM^2	100% ITM No Cap
90 CTE	-8.84%	-12.21%	-16.21%	-20.64%
65 CTE	-2.70%	-4.13%	-6.20%	-8.95%
60 CTE	-2.36%	-3.61%	-5.43%	-7.83%
Percentiles				
99.0%	-15.51%	-19.54%	-24.20%	-28.81%
97.5%	-11.48%	-15.37%	-20.13%	-25.01%
95.0%	-7.41%	-10.19%	-13.90%	-18.30%
90.0%	-2.83%	-6.05%	-8.94%	-13.09%
83.3%	0.74%	-1.09%	-3.91%	-7.27%
50.0%	3.10%	3.12%	3.17%	3.23%

Other Issues

- Inforce “cell” construction
 - Typical issue year, decennial age won’t work
 - Consider
 - Subaccount allocation
 - ITM-ness
- GMDB
 - Should be included in company Asset Adequacy Analysis
 - Regulators wary of “glossing over”
 - “7% subaccount growth assumed so no additional GMDB”
 - “immaterial”
 - Consider modeling