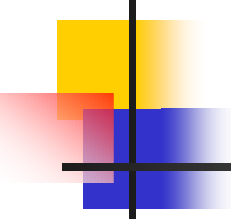


CASE STUDY Principles- based Approach for Life Product Reserves



– 3rd Qtr 2011





Calculation of PBA Life Reserves: Company Example

- Assumes the company is in the 3rd year after the effective date of PBA
- PBA approach to reserves only applies to a small portion of inforce





Calculation of PBA Life Reserves: Product Portfolio

Products currently being issued:

1. Accumulation UL, no secondary guarantees
2. UL with Shadow Account
3. 20-year level term
4. Variable Life





Calculation of PBA Life Reserves: Product Portfolio

Products no longer issued but on the books:

1. Traditional whole life (numerous policy forms)
2. Level term (numerous policy forms)
3. ART Term (numerous policy forms)
4. UL with SG (numerous policy forms)
5. UL with no SG (numerous policy forms)





Calculation of PBA Life Reserves: Reserve Valuation Process

1. Select Cash Flow model
2. Finalize Prudent Estimate valuation assumptions
3. Test blocks for stochastic modeling exclusion
4. Define scenarios for Stochastic Reserve
5. Define Model Segments; allocate assets
6. Build liability populations for Stochastic and Deterministic Reserve calculations





Calculation of PBA Life Reserves: Reserve Valuation Process

7. Review assumptions, methodologies, and conclusions with PBA Reviewer (pre-release basis)
8. Calculate Net Asset Earned Rates
9. Complete 9/30 reserve calculations
10. Adjust 9/30 reserve results to 12/31
11. Complete aggregate Asset Adequacy Analysis
12. Complete documentation requirements and submit final PBR Actuarial Report to PBA reviewer (post-release basis)





Step 1: Select Cash Flow Model

- Will need projection of cash flows for each future year. Need to project:
 - future liability cash flows (benefits, expenses, premiums and other revenue)
 - asset cash flows from starting assets and future modeled reinvestment assets (investment earnings, maturities, prepayments, etc).
- Valuation Manual allows cash flows to be determined using methods and techniques used for cash flow testing under existing Guidelines and ASOPs.





Select Cash Flow Model, cont.

Question: Use same Cash Flow Model used for cash flow testing, or develop new one?

Answer: Use same model as cash flow testing

- Expect most companies will use existing cash flow testing models
- Need to determine what modifications (if any) need to be made to cash flow model.



Step 2: Finalize Prudent Estimate Valuation Assumptions

For assumptions not stochastically modeled:

Anticipated Experience:

The set of estimates of future experience for each Risk Factor that, in the opinion of the actuary, is most likely to give an unbiased estimate of the related cash flows

Prudent Estimate:

Anticipated Experience adjusted for a margin that reflects a provision for estimation error and adverse deviation

Margin:

Determined by the actuary using actuarial judgment. Note: some margins may be subject to limits and/or ranges determined by regulators.





More coordination with Pricing Process

- Assessing, measuring and determining the risks associated with the product will be the major change in product development and pricing.
- Substantially more discussion between the Pricing Actuary and the Valuation Actuary





Valuation Assumptions

Assumptions not stochastically modeled:

- Mortality
- Policyholder Behavior*
- Expenses*
- Asset Defaults
- Non-guaranteed elements*

* dynamically modeled (i.e., will vary by scenario)

Assumptions stochastically modeled:

- Interest rate movements
- Stock market performance





Determining Mortality Assumptions

Overview:

1. Reflect company experience if credible
2. Blend company experience with industry table to the extent not fully credible.
3. Method to determine credibility will be selected by the actuary
4. Margin must be added for uncertainty
5. Select NAIC approved Valuation Table that best “matches” credibility adjusted experience table
6. Cannot assume mortality improvement beyond the projection start date.





Mortality Assumptions – Specific Steps

1. Define Mortality Segments
2. Develop mortality curves based on the company's actual experience studies for each Mortality Segment.
 - a. Can use experience from other segments if appropriate
 - b. If no experience exists, use industry experience





Mortality Assumptions – Specific Steps

3. Weight experience curves from step 2 with prescribed industry table (without margins), based on degree of credibility
 - a. Credibility method is selected by the actuary, but must meet prescribed standards
 - b. Presumes a multiple set of industry tables have been approved by the NAIC reflecting different underwriting classes
 - c. Method to identify the prescribed industry table for blending will be based on an “underwriting score” based on the company’s underwriting criteria.
 - d. Grade experience curves to industry table over period of time, with the period of time determined by the actuary.





Mortality Assumptions – Specific Steps

4. Reflect mortality improvement from date of the experience study to the projection start date.
5. Add a margin for uncertainty, using actuary's judgment
 - a. Sensitivity tests must be performed to establish the margin
 - b. The margin must be expressed as a constant divided by the curtate expectation of life
6. Select the final valuation table (with margins) used for the reserve calculation
 - a. Presumes a multiple set of valuation tables have been approved by the NAIC reflecting different underwriting classes
 - b. Actuary selects the valuation table that produces a final reserve amount that is closest to, but not less than, the reserve amount if the mortality table from step 5 was used.





Step 3: Stochastic Modeling Exclusion

- Review portfolio for blocks without Material Tail Risk.
- Two candidates for stochastic modeling exclusion:
 - 20-year level term product with 90% coinsurance arrangement
 - UL block with no secondary guarantees
- It must be demonstrated that the Deterministic Reserve adequately provides for the risks of the block in order to elect the Stochastic Reserve exclusion.
- If stochastic modeling exclusion is elected, then an Aggregate GPVAD reserve must be calculated





Stochastic Modeling Exclusion, cont.

Method chosen for stochastic exclusion test:

- Project cash flows using actual asset & liability records for the block to be tested as of 6/30.
- Calculate the Deterministic Reserve (DR) on the block being tested.
- Calculate several deterministic reserve amounts using a set of adverse deterministic interest rate scenarios (e.g., interest rates increase dramatically, and fall suddenly).
- If impact of adverse scenarios on the reserve is immaterial, then stochastic modeling is not necessary.





Stochastic Modeling Exclusion, cont.

Result of testing 20-year term:

- Immaterial differences between the various deterministic reserve levels (less than 1%).
- Conclusion: will not perform stochastic modeling for this block. Will add an “additional reserve” of 2% of the DR (based on judgment) to assure continued eligibility for exclusion.

Results of testing UL with no secondary guarantees:

- Result: Material differences between the DR and the various deterministic reserve levels (up to 5%).
- Conclusion: Need to perform stochastic modeling for this block.



Step 4: Define Stochastic Scenarios

Four Options:

1. Prescribed stochastic generators and model parameters
2. Pre-packaged scenarios generated from prescribed generators and model parameters
3. Proprietary scenario sets developed by the company*
4. Stochastic models developed by the company if mandated calibration criteria established by the NAIC are met.

* A small number of prescribed paths that are not necessarily a representative sample of a larger set of stochastic paths, but a conservative sample created explicitly for PBA reserves. A set of scenario weights would also be constructed, with the goal to approximate the prescribed CTE amount.





Define Stochastic Scenarios, cont.

Conclusion: option #2: Prepackaged scenarios

- A representative sample of 1,000 scenarios was selected using the prescribed scenario picking tool.
- Representative scenarios were selected for:
 - U.S. Treasury rates
 - S&P 500 returns for General Account (GA) assets
- Integration of interest returns and equity returns was done using prescribed method developed by the NAIC





Step 5: Define Model Segments and Allocate Assets

Definition of “Model Segment”:

A group of policies and assets associated with those policies that are modeled together to determine the path of Net Asset Earned Rates. This grouping will generally follow the company’s asset segmentation plan, investment strategies, or approach used to allocate investment income.

Conclusion:

Use the same asset segments used in company’s asset segmentation





Model Segments, cont.

Current Asset segments

Segment 1: All traditional whole life products

Segment 2: All term products

Segment 3: All UL products

Segment 4: All variable products





Asset Segments, cont.

Determine the starting asset amount

- Total assets equal estimated PBA reserve
- Estimated PBA reserve is based on pricing model. May eventually use prior years actual PBA reserve to estimate the current year PBA reserve.
- Estimated PBA reserve is:
 - Segment 2: Term: 50% of premium
 - Segment 3: UL: 102% of account value
 - Segment 4: VUL: 90% of total account value





Asset Segments, cont.

Starting Assets by Model Segment

(based on estimated PBA Reserve)

Model Segment 1: None

Model Segment 2: 10% of total assets

Model Segment 3: 15% of total assets

Model Segment 4: Negative balance





Asset Segments, cont.

Starting GA assets for segment 4 are negative:

Account value:	SA	98,000
	GA	2,000
	Total	100,000
Estimated PBA reserve:		90,000 (90%)
= Total Starting Assets:		90,000
less SA Assets:		98,000
= GA Assets:		(8,000)





Asset Segments, cont.

Allocation of assets

For segments 2 and 3, the actuary decided to select starting assets for the cash flow model to equal a pro-rata slice of each asset in the respective asset segment.

Segment 2: 10% of each asset

Segment 3: 15% of each asset

For segment 4, assets will be based on a negative cash balance (borrowing position) with an appropriate borrowing rate.





Modeling SA Funds for Variable Products

- Similar to approach used for C3 P2
- Determine number of fund categories (i.e. large cap stocks, international stocks, etc.)
- Allocate each fund to a category
- Total investment return for each fund category will be determined by weighting the returns from selected fund categories.
 - For Deterministic Reserve, path of returns is prescribed for each fund.
 - For Stochastic Reserve, paths of returns are stochastically generated for each fund via one of four accepted approaches





Step 6: Build Liability Populations

- Similar to cash flow testing procedures -- will build populations as of 9/30.
- For Deterministic Reserve (DR): use actual 9/30 liability records at the contract level.
- For Stochastic Reserve (SR): use same policy groupings (i.e., modeling cells) used for cash flow testing based on 9/30 data. Sensitivity testing had shown that a more granular model would not have a material impact on the reserve.
- The Stochastic Reserve will be determined in the aggregate for all policies.
- Will need to adjust results from 9/30 to 12/31 using an appropriate method (see example later).





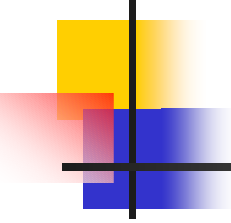
Step 7: Review Assumptions & Methods with PBA Reviewer

Once assumptions and methods are finalized, a meeting is scheduled to review conclusions with an independent peer reviewer (PBA Reviewer) on a “pre-release” basis.

Meeting is scheduled for early November.

An actuarial report is prepared that documents the assumptions, methods and conclusions, and is sent to the PBA reviewer in advance of the meeting.





Step 8: Calculate Net Asset Earned Rates

For each Model Segment:

- Determine a path of projected portfolio Net Asset Earned Rates for each year (or month, etc)
- This path of projected portfolio Net Asset Earned Rate will differ by each model segment
- Only returns on GA assets are used (not SA returns)
- The Net Asset Earned Rate for each year (or month, etc.) will equal:

Net Investment Income / Invested Assets





Asset Returns - Starting Assets

Fixed income GA assets (bonds, commercial mortgages)

- Project gross investment earnings based on the contractual provisions for each asset.
- Default costs and investment expenses determined using prudent estimate assumptions
- Asset optionality (i.e., call provisions, prepayments) will be modeled dynamically over the scenarios using prudent estimate assumptions.
- Realized capital gains and losses due to asset sales will be projected (if any, e.g., to raise cash or rebalance portfolio)





Asset Returns - Starting Assets

Equity investments in GA (stocks, real estate, etc)

- Determine number of equity categories (i.e. large cap stocks, international stocks); allocate assets to categories.
- Total investment return for each category will be projected based on a path of S&P 500 returns, with total return on each category reflecting differences from S&P 500 return.
 - For Deterministic Reserve, path of S&P 500 returns is prescribed.
 - For Stochastic Reserve, paths of S&P 500 returns are stochastically generated.
- Investment expenses based on prudent estimate assumption.





Asset Returns - Starting Assets

All other GA investments

- Policy loans
- Hybrid investments (e.g., convertibles, mezzanine)
- All hedge instruments supporting the Asset Segment but not associated with specific fixed income or equity assets, e.g., liability or ALM hedges (specific asset hedges are included with the associated assets)





Reinvestment Assets

- Net cash flows will be reinvested in a manner consistent with the company's investment policy for each model segment.
- Disinvestment will be consistent with the company's investment policy and reflect reasonable short-term borrowing assumptions
- Net investment earnings on reinvested assets are based on:
 - Prescribed new money rates for fixed income assets
 - Prescribed S&P 500 returns for equity investments





Reinvestment Assets, New money rates

For the Deterministic Reserve:

- An ultimate new money Treasury yield curve will be prescribed, based on a 65 CTE analysis of historical Treasury curves (averaging the lowest returns).
- New money Treasury curves for each future period will be based on a linear interpolation from current Treasury curve at valuation date to the ultimate Treasury curve.

For the Stochastic Reserve:

- New money Treasury curves will be stochastically generated for each year for each scenario.





Reinvestment Assets, Spreads over Treasuries

For both the Deterministic Reserve and Stochastic Reserve:

- Spread over Treasuries (net of defaults and investment expenses) will be prescribed.
- Prescribed spreads will vary by such things as:
 - Asset type
 - Asset quality
 - Remaining life of asset
- Study is underway by SOA to research historical patterns of net spreads as input to set these prescribed spreads.





Equity Return Assumptions

- Will apply to both Starting assets and Reinvested assets
- S&P 500 equity returns:
 - Deterministic Reserve: prescribed
 - Stochastic Reserve: stochastically generated for each year for each scenario.





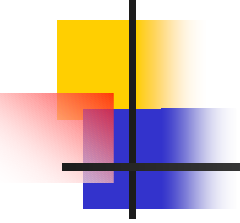
Net Investment Earnings

Net Investment Earnings in each period equals:

- Gross investment income (including change in due and accrued) plus capital gains and losses minus default costs and investment expenses.
- Policy loan interest (net of investment expense) will be included
- Shall also include income from hedge instruments and amortization of the IMR.

Invested assets shall be determined in a manner that is consistent with the timing of cash flows and length of each future period (e.g., month, quarter, year, etc)





Discount Rates = Net Asset Earned Rates

The Discount Rates for each Model Segment are set equal to the associated path of Net Asset Earned Rates

- From the deterministic scenario for the purpose of calculating the Seriatim Reserves for each policy within the Model Segment (GPV method)
- From each stochastic scenario for the purpose of calculating the Stochastic Reserve (GPVAD method)

The path of Net Asset Earned Rates is also used to determine:

- Interest crediting rates, which impact surrender and death benefits
- Other cash flow items impacted by earnings rates (such as, the inflation assumption on expense growth)



Step 9: Perform 9/30 reserve calculations

1. The Deterministic Reserve is a seriatim, policy by policy calculation.
2. The Stochastic Reserve is determined in the aggregate across all policies (except those subject to the SR exclusion)
3. A CTE level of 65 is assumed for the Stochastic Reserve (will be determined by regulators)
4. Reserve calculations are based on the 9/30 data, and then the results are adjusted to 12/31 (as described in step 10)





Deterministic Reserve calculation

1. Calculate the Seriatim Reserve for each policy, which equals

$A + B - C$, where:

A = PV of future benefits

B = PV of future expenses (excluding FIT)

C = PV of gross premiums and other revenue

The PV amounts are calculated using the path of discount rates for each asset segment

2. For each policy, take the greater of the cash surrender value and the Seriatim Reserve
3. The Deterministic Reserve equals the sum of the results from step 2 for all policies.





Deterministic Reserve calculation

4. For variable life policies, two additional terms are needed to calculate the Seriatim Reserve for each policy, $D - E$, where:

D = Account value invested in the Separate Account

E = PV of future net cash flows to/from the General Account from/to the Separate Account *

The PV amounts are calculated using the path of discount rates for each asset segment

* Future policyholder allocations of net premiums to the Separate Account are added to the reserve while future transfers of Separate Account values to pay death or withdrawal benefits, as well as amounts charged to the Separate Account for cost of insurance, M&E, etc. are subtracted from the reserve





Stochastic Reserve calculation

1. Calculate the Scenario Reserve for each Scenario, which equals $A + B$:

A = Starting Assets

B = Greatest PV of accumulated deficiency

Where the accumulated deficiency in each year equals the negative of the accumulated assets, and the PV amount is calculated using the path of discount rates for each model segment.

2. Rank the Scenario Reserves from lowest to highest
3. Take the average of the highest 35% (the highest 350 of the 1,000) Scenario Reserves
4. For policies subject to the Stochastic Reserve exclusion, recalculate the DR using a aggregate GPVAD method



Step 10: Adjust 9/30 reserve results to 12/31

1. Need to adjust the reserve calculations as of 9/30 to 12/31.
2. Need to reflect changes from 9/30 to 12/31 that impact the reserve amount, such as new sales, and changes in economic conditions.
3. In this example, the company concluded that since economic conditions did not change much over the period, and since new sales would not have much impact on the 12/31 reserve, a simple ratio approach would be used.





Final Reported Reserve Calculation

1. Take the DR plus the excess of the SR over the DR as of 9/30.
2. Adjust the result of step 1 to reflect changes from 9/30 to 12/31 using the ratio of the DR as of 12/31 and 9/30.

Results:

Deterministic Reserve, 9/30:	425,000
Stochastic Reserve, 9/30:	450,000
Reported Reserve, 9/30:	450,000
Deterministic Reserve, 12/31:	437,000

Reported Reserve, 12/31: 462,705 = 450,000 * (437/425)





Step 11: Complete Aggregate Asset Adequacy Analysis

Principles-based versus Asset Adequacy Analysis

- Both involve more actuarial judgment than current “rules-based” valuation approach
- Asset adequacy analysis has few limits and controls; actuary has a high degree of discretion in setting scenarios, assumptions
- In contrast, the Principles-based approach will contain some prescribed elements within the framework and limits





Asset Adequacy Analysis, cont.

- Still need to perform asset adequacy analysis on all policies in the aggregate for the purpose of the Actuarial Opinion as required by the AOMR
- Two possible options regarding PBA reserves:
 1. PBA reserves are added to formulaic reserves and cash flow testing is performed on a combined basis.
 2. ASOP #22 allows consideration of the PBA approach as an acceptable asset adequacy analysis method, and thus, if applicable, could exclude PBA reserves from cash flow testing.
- Conclusion: use option #1.





Step 12: Complete Documentation Requirements

Valuation Manual requires the actuary to prepare a PBR Actuarial Report.

