

Evaluating Models Using Experience Studies:

SOA Studies Principles-Based Reserves Credibility

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Experience Studies are used to evaluate models

From SOA motto :

“The work of science is to substitute facts for appearances...”

Valuation assumptions should be somewhat close to actual experience

- Too high => Securitization
- Too low => Nondeductible extra reserves

MIB's Role as Compiler for SOA

MIB has been SOA Compiler since 1980's

- Gathers insurance experience data
- Cleanses and Validates insurance data
- Reports of actual experience for use in:
 - Individual Life Experience Study (ILES)
 - Annuity studies
 - LTC reports

Models are used by actuaries

- SOA studies
 - Expected basis is valuation basic table
- Principles-Based Reserves
 - Valuation Law and Manual
 - VM-50 and VM-51
 - VM-20 and Underwriting Criteria Score
- Credibility
 - Bayesian Approach

SOA studies: Model expected basis on valuation basic table

Individual Life Experience Study

Expected basis is 2001 Valuation Basic Table (2001 VBT)

Actual to Expected Ratio (A/E Ratio):

Less than 100% A/E Ratio is conservative

Payout Annuity Experience Study

First payout annuity experience study in 20 years

Contribute to next study!

Expected basis is Annuity 2000 Basic Table

Actual to Expected Ratio (A/E Ratio):

Less than 100% A/E Ratio is **NOT** conservative

ILES 2004-05

Nonsmoker Preferred Class Structure

Face Amt \geq 100,000, IA \geq 25

		Class_Rank_By_Smoker_Status			
Risk_Classes_By_Smoker_Status		1	2	3	4
2	2001 VBT A/E Ratio by Amt	53.5%	77.4%		
3	2001 VBT A/E Ratio by Amt	51.5%	78.8%	81.2%	
4	2001 VBT A/E Ratio by Amt	51.5%	56.6%	74.5%	82.1%

ILES Experience Studies

- Clearly, 100% of 2001 VBT is outdated
- Similarity of Class Rank of "1" among the three Preferred Class Structures
- Difference of Class Rank of "2" in the Nonsmoker Preferred Class Structure of 4
- Using lessons learned from the first preferred study, this 2004-05 study shows separate results for each Preferred Class Structure

Preliminary Payout Annuity Results

Refund Immediate Annuities 2000-2004					
A/E Ratio by Amount Annuity 2000 Basic Table					
	Contract Years				
Income Group	1-2	3-5	6-10	11 and over	Grand Total
Less Than \$2500	103.7%	109.0%	106.8%	117.0%	113.3%
\$2500-\$4999	101.9%	100.5%	106.3%	105.6%	104.8%
\$5000-\$7499	101.0%	98.4%	102.4%	99.1%	100.1%
\$7500-\$9999	96.5%	108.7%	97.1%	97.6%	99.2%
\$10000-\$14999	102.6%	97.2%	101.6%	91.5%	96.8%
\$15000-\$24999	97.2%	95.7%	88.0%	94.6%	93.4%
\$25000-\$49999	85.9%	91.3%	87.1%	90.5%	88.9%
\$50000 and over	80.1%	101.1%	136.3%	73.2%	98.1%
Grand Total	95.9%	99.1%	100.9%	100.9%	100.0%
ALL RESULTS SHOWN ARE PRELIMINARY AND SUBJECT TO CHANGE					

Preliminary Payout Annuity Results

Non-Refund Immediate Annuities 2000-2004					
A/E Ratio by Amount Annuity 2000 Basic Table					
	Contract Years				
Income Group	1-2	3-5	6-10	11 and over	Grand Total
Less Than \$2500	111.8%	114.7%	113.9%	120.8%	119.2%
\$2500-\$4999	74.8%	96.6%	91.8%	107.9%	101.0%
\$5000-\$7499	58.9%	78.9%	88.5%	102.9%	92.0%
\$7500-\$9999	51.1%	86.4%	88.7%	101.4%	89.9%
\$10000-\$14999	42.0%	70.2%	81.0%	98.2%	79.5%
\$15000-\$24999	49.7%	69.8%	73.1%	92.5%	74.6%
\$25000-\$49999	37.6%	67.2%	59.8%	77.2%	60.7%
\$50000 and over	45.3%	43.5%	24.9%	79.6%	44.8%
Grand Total	48.5%	65.7%	75.2%	103.8%	80.3%
ALL RESULTS SHOWN ARE PRELIMINARY AND SUBJECT TO CHANGE					

Payout Annuity Experience Study

Preliminary Results

- Lower mortality with higher annual annuity payout
- 100% of Annuity 2000 Basic Table
 - Corresponds to overall Refund business
 - Outdated for Nonrefund business
- New payout annuity valuation table being planned and may include mortality projection factors
- Additional payout annuity experience study will be helpful in valuation table and projection factors
- Please contribute to next payout annuity study

Principles-Based Reserves (PBR)

- Current system uses conservative mortality, low interest rates, no lapses and no expense assumptions
- Under PBR, a company uses realistic assumptions of mortality, interest rates, lapses and expense for reserves
- Regulators want both industry and individual company experience studies
 - VM-50, VM-51

Valuation Law and Valuation Manual

- Valuation Law is passed by legislatures to implement PBR
- Valuation Manual contains implementation details and is expected to change over time.
- PBR implemented beginning with individual life products
- Valuation Manual incorporates existing valuation rules for Annuity, LTC and Health

Statistical Agent and Statistical Plan VM-50 and VM-51

- Experience reporting is common in Property and Casualty (P&C)
- P&C statistical agents must collect statistical data in a form and detail as required by the NAIC Statistical Handbook
- VM-50 and VM-51 based on NAIC Statistical Handbook
- Mandatory experience studies with small company exemption

Purpose (PBR & Companies setting assumptions)

- Industry-wide experience study
- Regulators monitor companies' experience

Roles and Responsibilities

- Mandatory for many companies
- Statistical Plans and Statistical Agents
- NAIC Working Group as Oversight
- Professional Actuarial Associations

Data Quality

- Statistical Agent has standards on file, data and reasonability checking
- Statistical Agent asks data questions and points out critical indication of error
- Company responsibility for correct data and must respond to critical indication of error request

VM-50 Data Confidentiality: Category & Access

“Regulatory” means Ins dept & data verifiers (auditors, SOA staff)

- Category 1 – Individual Company Records
 - Company, Regulatory and Statistical Agent
- Category 2 – Aggregated records by company
 - Company, Regulatory and Compiling Statistical Agent
- Category 3 – Aggregated regulatory reports with company code breakdown
 - Regulatory, Compiling Statistical Agent, NAIC
- Category 4 – Aggregate industry research data
 - Regulatory, Compiling Statistical Agent, NAIC, Actuarial Associations
- Category 5 – Aggregate industry report data
 - General Public

VM-51 for Life Insurance

- Preferred Class Structure Questionnaire
- Additional Plan Code Form
- Statistical Plan for Mortality
 - Well-developed
 - $BOY + Issues - Deaths - Terminations = EOY$
 - Small Company Exemption
- Statistical Plan for Policyholder Behavior
 - Needs More Development
- Statistical Plan for Expenses - Does not exist

VM-20 Requirements for Principle-Based Reserves for Life Products

- Mortality assumptions
 - Simplified Method – Use underwriting criteria procedure to determine applicable VBT table
 - > 30 deaths use mortality experience and underwriting criteria procedure to determine applicable VBT table
 - Additional concerns of credibility and margins
- Policyholder behavior assumptions
 - Static
 - Dynamic model or other scenario-dependent formulation
- Expense assumptions
 - Fully allocated expenses
 - Direct costs, indirect costs, and overhead

Underwriting Criteria Procedure & Underwriting Criteria Score (UCS)

Underwriting criteria procedure undefined but dependent on Underwriting Criteria Score (UCS)

- UCS algorithm identifies mortality by extent of underwriting and assigns UCS Score
- UCS score is independent of mortality studies
 - VM-20 simplified method: limited or no experience
- Low UCS Score => lower mortality
- UCS Score increases => gradually higher mortality
- Development of UCS Score
 - Knockout criteria done
 - Debit/credit more work needed

Underwriting Criteria Score (UCS)

- Does not take into account extent to which underwriting criteria are followed
 - Business exceptions
- Market not taken into account
 - High income versus low income
- Independent of Experience Studies
 - How, by company, determine and map UCS Scores to each policy?

UCS and Experience Studies

Link is **Preferred Class Structure**

Preferred Class Structure

- Varies by Nonsmoker and Smoker
- All Classes Preferred through Residual Standard
- May be limited to issue Age, Plan, Face Amounts
- By Co: vary over time; multiple NS PCS at same time

Separate from Experience Studies

- Collect each company's underwriting criteria
- Develop UCS Scores
- Link UCS Scores to Preferred Class Structure of data

Underwriting Criteria Team of Preferred Mortality POG

- Company specific underwriting criteria collected
- Developed UCS scoring algorithm for knockout criteria – beta on SOA website
- Developed matches of UCS scores by company to preferred class structure
- Determined how to map UCS scores to policies for 2002-04 study done in 2006 (2006 Study)

UCS NS 2006 Study

UCS Score	A/E Ratio	Deaths
26	47.0%	6
41	63.1%	21
42	71.8%	78
95	65.3%	63
96	79.3%	174
119	65.9%	230
120	72.5%	9
141	95.8%	2,231
All	65.3%	5,444

UCS and Experience Studies

- Low to high UCS score (NS: 26 to 141) should mean gradual increasing mortality
- 2006 Study results indicates variation from expected gradual increase in mortality
- UCS does an excellent job in identifying Residual Standard (over 40% of deaths)
- Need new UCS Team to provide UCS scores and mapping them to each company's policy records for experience studies
- What is effect on VM-20's underwriting criteria procedure?

Credibility- Bayesian Approach

- Part of current research for SOA being done by Klugman, Rhodes, Purushotham
- Bayesian approach is to have Prior distribution combined with data to determine new estimate (Posterior distribution)
- Buhlmann empirical Bayes method uses data to estimate Prior distribution
 - Klugman provided formulas
 - One record for each policy
 - Q_x assigned to each policy is 2001 VBT
 - Calculations done on each policy

10 Company Sample from ILEC 2004-2005 Data

- For confidentiality, 90% to 95% of each company's records used
- Small, medium and large companies included
- Prior distribution is entire 10 company sample of 9.5 million records
- Buhlmann empirical Bayesian approach to determine new mortality estimate for each company
 - Combine Prior distribution with observed mortality for each company
 - Result is new mortality ratio for each company (Posterior distribution)

Buhlmann empirical Bayesian Approach Preliminary Results on 10 Company

Sample

Mortality Ratio by Amount				
<i>10 Cos Individual Company</i>				
Company Code	Prior Mortality	Deaths	Observed Mortality	Posterior Mortality
A	76.7%	1,318	106.4%	104.4%
B	76.7%	974	114.7%	102.1%
C	76.7%	609	63.5%	66.9%
D	76.7%	216	88.6%	84.0%
E	76.7%	12,624	61.4%	61.6%
F	76.7%	1,831	68.7%	71.2%
G	76.7%	3	40.6%	75.5%
H	76.7%	8,938	78.8%	78.5%
I	76.7%	3,422	86.4%	86.1%
J	76.7%	1,304	100.2%	97.0%



Credibility, Buhlmann Approach and Experience Studies

- Preliminary results on Buhlmann approach consistent with expectations in VM-20
 - Few deaths estimated mortality close to 10 company results (prior)
 - Increased deaths estimated mortality closer to company results (posterior)
- Works with small, medium and larger companies included in 10 company results
- Current research project on credibility formulas applied to mortality and lapse experience from 10 company sample from ILEC 2004-2005 Data

Evaluating Models Using Experience Studies

- SOA studies
 - Individual life preferred class structure
 - Annuity valuation table will need updating
- Principles-Based Reserves
 - VM-50, VM-51, VM-20
 - Companies select assumptions, mandatory data collection through statistical agent
 - Need UCS Scores and mapping to policies for study

Credibility

- Buhlmann empirical Bayesian Approach successful use of data from experience study

Experience Studies

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facts for appearances...”

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close to actual experience

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