SOCIETY OF ACTUARIES

9th Annual Product Development Actuary Symposium
June 2009

1E/2B: Are You Making a Classic Or a Penny Dreadful? Setting Long-Term Assumptions In a Short Term World

Cathy Bierschbach, Greg Roemelt

Product Development Actuary Symposium

2009

Session 1E/2B: Are You Making A Classic Or A Penny Dreadful? Setting Long-Term Assumptions in a Short Term World

a.k.a. Share the Fear

Cathy Bierschbach
Vice President, Life Pricing
June 29, 2009

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Audience Response Keypad

- **Enter you response when you see the answer now button**
- **A light on the keypad will indicate your response was recorded**
- **You may change your response while polling is open**
- **No need to hit the go button**
- **Please leave your keypad at end of session**

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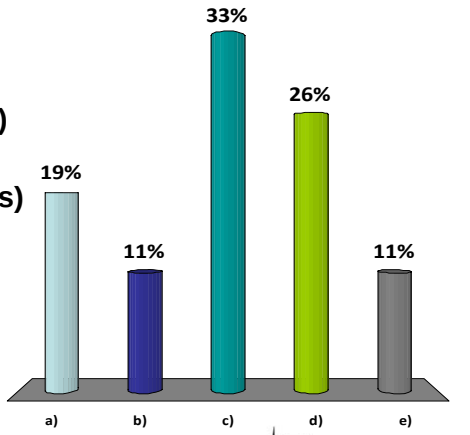
Warm Up Question
When did you start working full time as an actuary?

a) 2004 or later (5 years or less)
b) 1999 to 2003 (between 5 and 10 years)
c) 1989 to 1998 (between 10 and 20 years)
d) 1988 or earlier (too long to count)
e) None of your business



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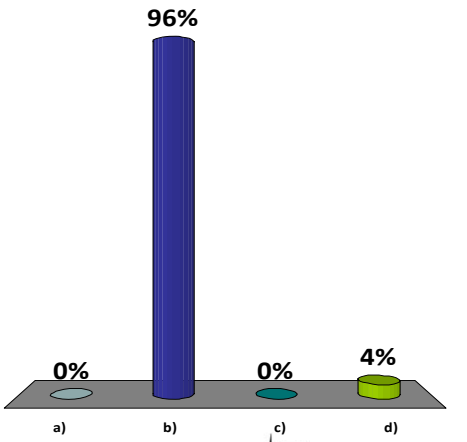
Question #1 – Setting Lapse Assumptions
How are your lapse assumptions set?

a) Historical data
b) Historical data adjusted for "actuarial judgment"
c) "Actuarial judgment"
d) Don't ask me – I just use what I'm told to use



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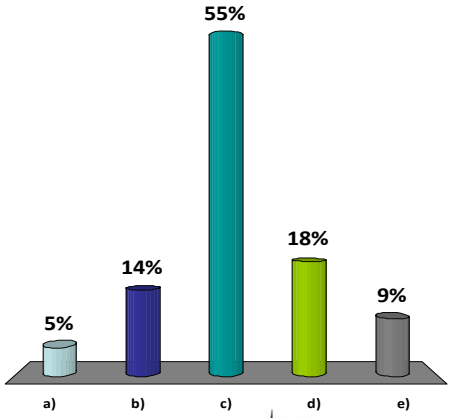
Question #2 – Ultimate UL Lapse
What is your ultimate UL lapse assumption?

a) **Same as initial**
b) **>5%**
c) **>2% to 5%**
d) **>1% to 2%**
e) **<=1%**



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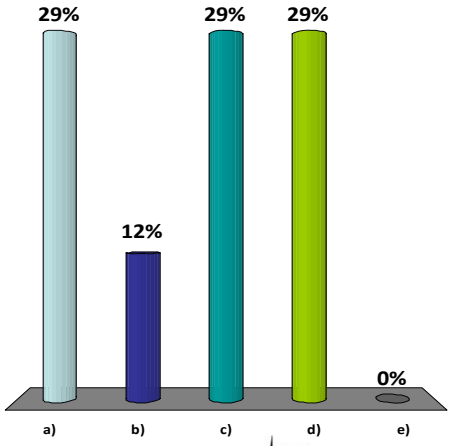
Question #3 – Fine Tuning ULSG Lapses
Do you vary your ULSG lapse assumption by:

a) **Attained age and/or duration**
b) **Relationship between current and shadow account**
c) **a & b**
d) **We don't vary**
e) **c & d**



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Flaws of Historical Data

- **Changes in the competitive landscape**
  - Term replacement wars
- **Changes in competitive positioning**
- **Ability to get clean, credible data**
  - Especially true when you segment to needed level of detail
- **Appropriate experience may not be there yet**
  - Shock lapses on term
  - Conversion utilization at end of level period
  - Ultimate UL lapse assumption

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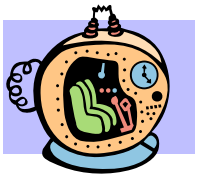
Power of Historical Data

- **If the past is understood, trends may be able to be extrapolated**
- **RGA's "The Term Insurance Market"**
  - Lisa Renetzky presenting tomorrow
- **Canada's "Term to 100" emerging experience**



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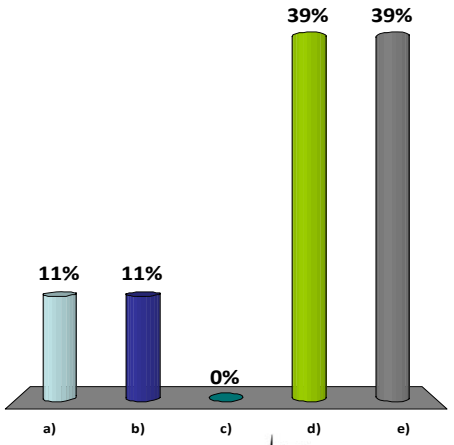
Question #4 – UL Premium Patterns
What do you do to protect from variations?

a) **Slope of charges**
b) **Product features**
c) **Adjusted shadow account interest rates**
d) **Combination of the above**
e) **Huh?**



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UL Premium Patterns

- **Assuming everyone is testing: level, single and short pays**
- **Recent articles**
  - Dialing down guarantees
  - Step pay and grade pay
    - Included strategy of paying target in year one and then dropping down the premium
  - IRR on ROP death benefits
  - Shadow account arbitrage
    - Strategic withdrawals of cash values
  - Catch-up provisions
- **Would you notice the oddities in premium patterns?**
- **What premium should you reflect in your models?**
- **Premium suspension vs. lapsing**

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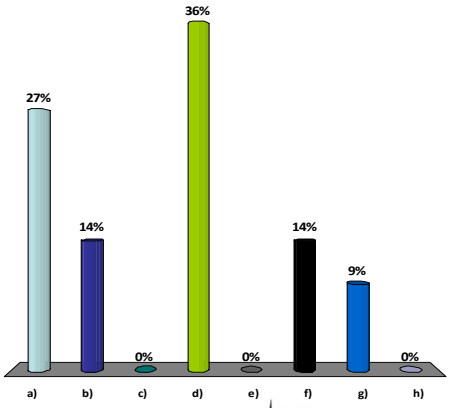
Question #5 – Mortality Table
What is your base mortality table based on?

a) **7580 Table**
b) **01 VBT**
c) **08 VBT**
d) **Company derived based off 01 VBT**
e) **Company derived based off 08 VBT**
f) **Company derived**
g) **Other**
h) **Do not know and/or care**



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Female Older Age Mortality

Female Preferred Nonsmoker

	Age 45		Age 55		Age 65		Age 75		Age 80	
Company	**Prem**	**Target**	**Prem**	**Target**	**Prem**	**Target**	**Prem**	**Target**	**Prem**	**Target**
A	6,170	7,130	9,830	11,020	16,526	19,100	30,502	28,260	47,771	39,980
B	5,895	7,500	9,656	11,900	16,403	19,000	29,804	35,000	50,640	53,000
C	6,036	8,210	9,751	11,220	16,791	18,600	30,506	30,370	45,986	46,880
D	6,026	6,297	9,497	10,080	15,929	17,291	29,794	31,176	45,860	51,558
E	6,774	7,196	10,214	11,696	16,617	18,596	30,363	31,296	48,683	47,556
F	6,399	8,440	10,287	13,250	15,939	19,060	30,121	32,090	45,868	44,120
G	6,525	6,525	10,892	10,892	20,448	20,448	39,757	39,757	53,041	53,041
H	6,467	6,840	9,815	10,760	16,558	17,580	31,065	29,950	50,383	40,580
I	6,417	7,143	10,132	11,818	16,693	19,830	31,577	32,584	55,643	57,841
Transamerica	**6,212**	**7,620**	**9,840**	**11,720**	**16,924**	**19,500**	**31,920**	**30,580**	**47,811**	**45,280**
% from lowest premium/highest target	**5.38%**	**-9.72%**	**3.61%**	**-11.55%**	**6.25%**	**-4.64%**	**7.14%**	**-23.08%**	**4.25%**	**-21.72%**
Rank of TransACE	**5 of 10**	**3 of 10**	**6 of 10**	**4 of 10**	**9 of 10**	**3 of 10**	**9 of 10**	**7 of 10**	**5 of 10**	**7 of 10**

YRT Reinsurance Rates/Pricing Mortality

	Avg 1-5	Avg 6-15	Avg 16-25	Avg 26-35
41-50	**112%**	**126%**	**185%**	**171%**
51-60	**111%**	**122%**	**170%**	**122%**
61-70	**125%**	**125%**	**152%**	**109%**
71-75	**138%**	**124%**	**132%**	**103%**
76-80	**141%**	**107%**	**113%**	93%
81+	**141%**	96%	83%	82%

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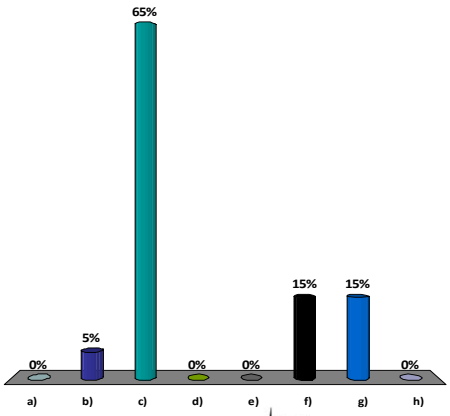
Question #6 – Expenses
What are your expense assumptions based on?

a) Fully allocated (or close to) as % of premium
b) Fully allocated (or close to) on per policy basis
c) Fully allocated (or close to) on a combination of % of premium and per policy
d) Marginally (or close to) as % of premium
e) Marginally (or close to) on per policy basis
f) Marginally (or close to) on a combination of % of premium and per policy
g) Other
h) Do not know and/or care



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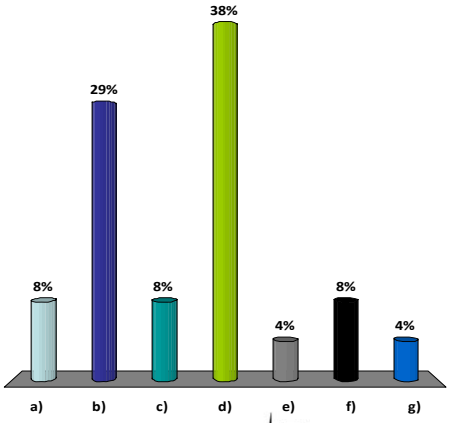
Question #7 – Biggest Fear
What industry issue worries you the most?

a) Post Level Term Profits
b) Reserves & Associated Solutions Or Lack Thereof
c) Premium Patterns
d) Older Age Mortality
e) Pandemic
f) Other
g) Nothing Worries Me



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So how do we set assumptions?

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So how do we set assumptions?

- **Carefully after:**
  - Talking to sales and marketing
  - Looking at historical data
  - Looking at new illustrations
  - Lots of scenario testing
  - Looking at impact on various cells

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Setting Long Term Assumptions in a Short Term World

Greg Roemelt

June 29, 2009

Importance of Economic Assumptions for Pricing

- Impact on Cash Flows
- Different than liability assumptions
  - Liability assumptions apply to large number of policyholders
  - Economic assumptions can be simulated over a large number of scenarios, but only one scenario will actual occur

Developing Economic Assumptions for Pricing

- Default rates and costs
- Credit spreads
- Call and prepayment behavior

Default Costs

- Traditional Default Cost Development
  - Probability / Severity Approach
  - Both factors varied by quality of Assets
  - Probability may vary over time
  - Severity developed based on recovery rates

Comparison to Reality

- Before defaulting, bonds usually are downgraded
- Historical default rates developed based on initial ratings
- Severity based on long term recovery rates

Deficiencies in the Simplified Approach

- Does not measure increased cost of capital associated with downgrades
- May not measure increased likelihood of default after downgrade
- Does not include a cost of capital for time period between default and ultimate recovery
- Lacks flexibility and is less friendly for stochastic methods

More Robust Methodology for Developing Default Costs

- Develop a matrix of bond upgrades and downgrades
- Use a lattice approach to develop the probabilities of a bond being in the various rating classes at all times
- Probability of default in any period is weighted average of the annual class default rates applied to the amounts in each class.
- Capital associated with asset is based on weighted average capital cost

Example
Moody's One Year Letter Migration Rates

From \ To	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	Default
Aaa	91.4%	7.9%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.00%
Aa	1.1%	91.1%	7.4%	0.3%	0.0%	0.0%	0.0%	0.0%	0.02%
A	0.1%	3.0%	91.2%	5.2%	0.5%	0.1%	0.0%	0.0%	0.03%
Baa	0.0%	0.2%	5.1%	89.1%	4.4%	0.8%	0.2%	0.0%	0.17%
Ba	0.0%	0.1%	0.4%	6.2%	83.6%	7.8%	0.6%	0.1%	1.19%
B	0.0%	0.0%	0.1%	0.4%	5.6%	82.7%	5.7%	0.7%	4.66%
Caa	0.0%	0.0%	0.0%	0.3%	0.6%	10.2%	69.7%	4.1%	15.05%
Ca-C	0.0%	0.0%	0.0%	0.0%	0.4%	3.4%	11.5%	48.1%	36.59%

Example
Impact of Migration Over Time

	Year										
Rating	0	1	2	3	4	5	6	7	8	9	10
Aaa	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Aa	0%	3%	5%	7%	9%	10%	12%	12%	13%	14%	14%
A	100%	91%	84%	77%	71%	67%	62%	59%	56%	53%	50%
Baa	0%	5%	9%	13%	16%	18%	19%	21%	22%	23%	23%
Ba	0%	1%	1%	2%	2%	3%	4%	4%	5%	6%	6%
B	0%	0%	0%	0%	1%	1%	1%	2%	2%	2%	3%
Caa	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Ca-C	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Historical Default Rates, 1970-2008

Rating	Annual Probability of Default
Aaa	0.000
Aa	0.017
A	0.025
Baa	0.172
Ba	1.192
B	4.660
Caa	15.050
Ca-C	36.590

Weighted Average Defaults and C-1 Factors

Year	1	2	3	4	5	6	7	8	9	10
Annual Rate	0.025%	0.048%	0.075%	0.106%	0.140%	0.176%	0.214%	0.253%	0.291%	0.330%
C-1 Factor	0.245%	0.309%	0.376%	0.444%	0.513%	0.581%	0.649%	0.715%	0.779%	0.840%

Impact of Recover Assumption

- Recover assumption translates the probability of default into a cost of default
- Example:
  - Probability of default = 1%
  - Recovery after default = 40%
  - Cost of default = 60bp
- Recovery amounts can be determined from:
  - Market prices immediately after default
  - Ultimate recoveries
- If ultimate recoveries are used, should factor in cost of capital associated with holding securities in default

The Credit Spread Puzzle

- Credit spreads are the difference between yields on corporate debt subject to default risk and risk free Treasury securities
- Credit spreads are generally understood as compensation for credit risk
- But explaining the precise relationship has been difficult
- For example, from 1997 to 2003, average spread on BBB-rated bonds was 170 basis points, by average yearly loss from default was 20 basis points

Decomposing Credit Spreads

- Expected losses
  - Small fraction of overall spread
- Taxes
  - Treasury bonds only subject to Federal tax
  - Corporate bonds taxed by Federal and states
- Risk premium
- Liquidity premium
  - Thin market
  - Risk of market becoming illiquid

Decomposing Credit Spreads

- Difficulty in fully diversifying credit risk
  - — Without full diversification, unexpected losses will be priced in the spread
  - — Skewed returns

Difficulty in Diversity - CDO Example

- Structure of an Arbitrage CDO
  - Long position in low quality debt paying high spreads
  - Short position in high quality debt paying low spreads
- Hypothetical CDO
  - Collateral pool of Baa bonds with expected loss of 25 bp
  - 175 bp credit spread on Baa
  - Issue Aaa bonds at 50 bp

Difficulty in Diversity - CDO Example

- Typical CDO
  - 100 names in collateral pool, diversity score of 40
  - Can take months to assemble collateral
  - Marginal costs of adding more bonds are high
- Full diversification is not achieved by investors with the most to gain

Implications for Setting Credit Spread Assumptions

- Credit spreads are related to default cost, but also include other factors
- Undiversified risk is another large component of spreads
- The level of spreads associated with undiversified risk is related to default costs

Callable Bonds

- Finance theory shown optimum time to call bond is when it is first in the money
- As usually, reality does not follow theory
  - Firms make irrational decisions
    - — Delaying in-the-money calls
    - — Calling an out-of-the-money bond
- Implications for asset projection models

Empirical Research

- King an Mauer (2000) examined factors affecting the timing of calls on non-convertible bonds
- Three groups:
  - Called immediately when bond went into the money
  - Called when bond was out of the money
  - Delayed call after bond went into the money
- Significant cost to delaying call

Factors Impacting In The Money Calls

- Opportunity cost of leaving bond outstanding (+)
- Amount of time bond has been in the money (+)
- Slope of the yield curve (+)

Implications For Setting Call Assumptions

- The more calls in are the money, the more likely the bond is to get called
- The longer a bond is in the money, the more likely it is to get called
- Out of the money bonds do get called
- Slope of the treasury curve impacts call behavior

Factors Impacting Mortgage Prepayments

- Refinancing incentive
- Age
- Seasonality
- Burn out

Ross – Roll Model

- Refinancing Incentive
  - Based on minimum and maximum prepayment rates, slope parameter and expected parameter

RI = a + b * acrtan [c + d * (WAC – 10T)]

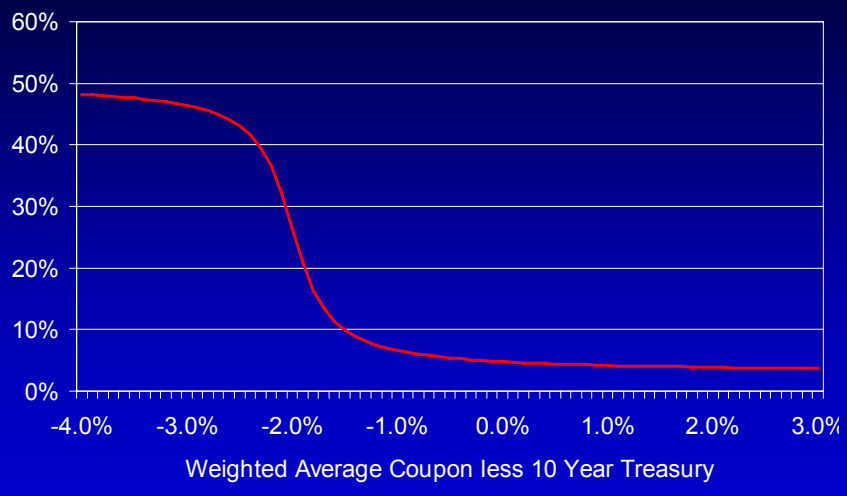
a = Average (MaxCPR,MinCPR)

b = (MaxCPR – a) / (π/2)

c = 1000 * slope / b

d = - d / expected

Refinancing Incentive



Other factors

- Age = min (month/30, 1)
- Seasonality – factors varying by month
- Burnout
  - =0.3 + 0.7 * outstanding principal / initial principal

Ross – Roll Model

- Monthly prepayments =
  RI * Age factor * Seasonality Factor * Burnout Factor

Burnout

- Not path dependent in Ross/Roll model
- Possible enhancement is to bifurcate pool into two cohorts based on propensity/ability to pre pay

Importance of Asset Assumptions to Pricing

- Impact profitability
- Not always easy to develop
  - Good candidate for sensitivity testing and results distribution analysis
- Testing can be performed over multiple scenarios, but only one will occur

Sources

- Corporate Default and Recovery Rates, 1920 – 2008, *Moody's Global Credit Policy*
- Amato, Jeffery D. and Eli M Remolona, 2003, The Credit Spread Puzzle. *BIS Quarterly Review, 51-62*
- Lipton Amy F., and Nandu Nayar, 2007, Timing of Corporate Callable Bonds: An Empirical Examination Using Survival Analysis

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