LONGEVITY RISK TASK FORCE UPDATE

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Presentation to the NAIC's Longevity Risk Subgroup

Agenda

- ☐ Current Approach

- ☐ Proposed Methodology

- ☐ Field Study

- ☐ Next Steps

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Current Approach

- Focused on a longevity risk charge for payout annuities (including deferred payout)

- Statutory reserves are generally intended to be at the 85th percentile level
  - Formulaic plus any additional reserves from asset adequacy testing (AAT)

- RBC factors generally cover risks in excess of reserves up to a 95th percentile event
  - Capital requirements are established under the assumption that statutory reserves are adequate; RBC is not a balance sheet item and is not intended to make up for shortfalls in reserves. Stresses up to the 85th percentile are assumed to be covered in reserves
  - The longevity risk stress event will include both basis risk (risk that actual company mortality varies from the table) and trend risk (risk that actual mortality improvement varies from assumed)
  - Based on its nature, trend risk stress event looks at a relatively long time horizon

- RBC longevity risk charge will be based on difference between "current" statutory reserve and statutory reserve calculated under a longevity stress, converted to a factor

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Risks To Be Included

- LRTF previously determined that focus should be on trend risk only (mortality improvement), and used historical data to develop a stress event for mortality improvement based on the 95th less the 85th percentile result (0.25% up to age 85; 0.50% age 85-104)

- Current reserve basis (2012 IAM) appears to only include a margin for basis risk

- Therefore, LRTF determined that charge should consider both basis risk and trend risk

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Components of Basis Risk

Valuation Table vs. Company Mortality

☐ Prescribed statutory valuation mortality may not be conservative enough for all business

☐ AAT Testing already covers this risk

Company Mortality Experience Assumption vs. True Company Mortality Basis

I. **Credibility Risk**—difference between the true underlying mortality basis and company experience due to the limited amount of experience data. Size of this risk declines as the quantity of experience increases

II. **Volatility of True Mortality**—true underlying mortality rates have volatility and change from year to year even with fully credible data

III. **Mortality Trend Adjustment**—mortality experience over a multi-year period must be translated to a base table year using a mortality improvement assumption. Basis risk will result to the extent this assumed improvement differs from actual underlying improvement.

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I. Credibility Risk

□ Full credibility is often defined as 95% confidence that an assumption is within 5% of the true value

□ Some error margin always exists even with long experience from a fully credible block of business

□ Figures below use Longley-Cook credibility formula to estimate this error margin

□ Adjusted for credibility by amount of insurance in force using data underlying the 2012 IAM table development

# of Deaths	One-sided confidence interval for μ				95th - 85th
	85%	95%	99%		
250	14.0%	22.2%	31.4%		8.2%
500	9.9%	15.7%	22.2%		5.8%
1,082	6.7%	10.7%	15.1%		4.0%
3,000	4.0%	6.4%	9.1%		2.4%
10,000	2.2%	3.5%	5.0%		1.3%
100,000	0.7%	1.1%	1.6%		0.4%
200,000	0.5%	0.8%	1.1%		0.3%

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II. Volatility of True Mortality

☐ This results from year-to-year volatility in true population mortality rates in the experience study period

☐ Using data and analysis from the LRTF's prior work on trend risk, the annual volatility of population mortality in the U.S. is 2.9% at 1 standard deviation

☐ This result is scaled to multi-year experience periods using the assumption that each years' volatility is independent

☐ Longer experience periods will reduce this risk component as the impact of volatility in any single year is diminished

Volatility of Underlying Population Mortalitiy Rate μ						
Annual volatility of mortality rate (improvement rate) from trend risk work:					2.9%	
# of Exp Yrs	85%	95%	99%	95th - 85th		
1	3.0%	4.8%	6.7%	1.8%		
3	1.7%	2.8%	3.9%	1.0%		
5	1.3%	2.1%	3.0%	0.8%		
10	1.0%	1.5%	2.1%	0.6%		

III. Trend Adjustment

- ☐ Risk results from differences between actual and assumed mortality improvement during the experience period that is used to adjust mortality experience to the base table effective date

- ☐ Quantification uses mortality trend stress work previously completed by group (aggregate M/F results across all ages based on the normal model at 85th and 95th percentile relative to mean improvement)

- ☐ Trend stress is applied for ½ of the experience period—trending from the mid-point of the experience period to the end point

- ☐ Longer experience periods will increase this component as the possibility for error in trending older experience to the valuation date increases

Mortality Trend Adjustment					
Trend Stress:	0.38%	0.60%	(from Trend Stress work, normal model)		
# of Exp Yrs	85%	95%		95th - 85th	
1	0.2%	0.3%		0.1%	
3	0.6%	0.9%		0.3%	
5	1.0%	1.5%		0.6%	
10	1.9%	3.0%		1.1%	

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Aggregate Basis Risk

- ☐ The three components are independent, so aggregate basis risk measured as (A2 + B2 + C2) ½

- ☐ Overall risk is not that sensitive to the length of experience period given the trade-off between Annual Volatility and Trend Adjustment as the experience period lengthens.

- ☐ Credibility adjustment declines with experience, but aggregate basis risk quickly becomes dominated by components B and C for large blocks of business.

- ☐ Aggregate basis risk is independent of mortality trend risk

# of Exp Yrs:	3	3	3	5	5	5	10	10	10
# of Deaths	500	3,000	100,000	500	3,000	100,000	500	3,000	100,000
I. Credibility	5.8%	2.4%	0.4%	5.8%	2.4%	0.4%	5.8%	2.4%	0.4%
II. Volatility	1.0%	1.0%	1.0%	0.8%	0.8%	0.8%	0.6%	0.6%	0.6%
III. Trend Adjustment	0.3%	0.3%	0.3%	0.6%	0.6%	0.6%	1.1%	1.1%	1.1%
Total Basis	**5.9%**	**2.6%**	**1.1%**	**5.9%**	**2.6%**	**1.0%**	**5.9%**	**2.7%**	**1.3%**

Result is a qx aggregate basis risk stress event ranging from approximately 1% to 6% depending on block size

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Field Study

- While we have performed simple testing in Excel, the LRTF suggests that the NAIC Longevity Risk Subgroup (LRSG) conduct a study to evaluate results of applying the agreed upon approach to actual company blocks of business

- LRTF has developed instructions and a template to be completed to enable LRSG to conduct a field study on individual and group annuities

- Request Dec. 31, 2016 statutory CARVM reserve amounts calculated on the 3 assumption bases, under a range of valuation interest rate, issue age, duration since issue, and gender combinations

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Field Study Details (Initial Draft)

Run A – 2016 CARVM Valuation Basis (assumed to be 85th percentile)

- 2012 IAM Table (1994 GAR for Group business)
- Projection Scale G2 (Projection Scale AA for Group business)

Run B – 95th Percentile Stress – basis risk

- 2012 IAM Table (1994 GAR for Group business), all rates adjusted for our defined basis risk stress event (99%, 97%, or 94%, depending on block size)
- Projection Scale G2 (Projection Scale AA for Group business)

Run C – 95th Percentile Stress – trend risk

- 2012 IAM Table (1994 GAR for Group business)
- Projection Scale G2 (Projection Scale AA for Group business), all improvement factors adjusted for our defined trend stress event (0.25%/0.50% stress)

Capital = [(Run B - Run A)^2 + (Run C – Run A$)^2$]$^{1/2}$

Next Steps

- Questions for LRSG
  - Does approach for basis risk make sense?
  - Should the charge vary by block size?

- Conduct field study and evaluate results

- Determine approach to correlation with other risks (most significantly, C2)

- Continue to evaluate approach for a potential RBC charge for lifetime income benefits

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Appendix

Prior Update provided to Life Risk Based Capital Committee (NAIC Summer Meeting)

Determining Trend Risk Tail Event

- LRTF analyzed historical population data over the period 1900-2013 using Social Security population data

- Calculated 1-, 5-, 10-, 20-, and 40-year rates of improvement by age bucket and gender

- Fit historical improvement data to a normal distribution to evaluate use of a normal model

- Developed a 95th percentile improvement event, focused on the 20-year historical period (which is conservative vs. current RBC's typical 5-10 year horizon)

- Evaluated difference between 95th percentile and 85th percentile for use in RBC

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Distribution of Mortality Improvement Data

Below is the distribution of annual and 20-year mortality improvement data from 1940-2013 used to develop the shock event
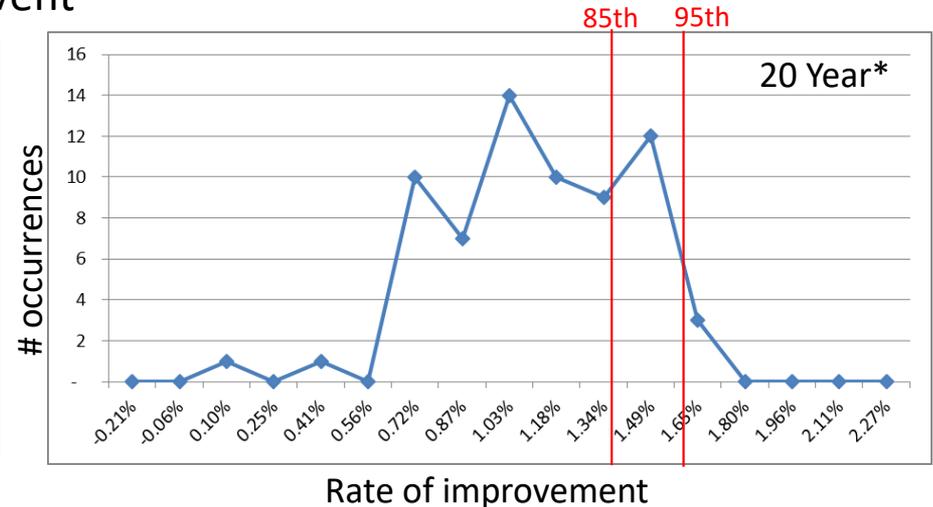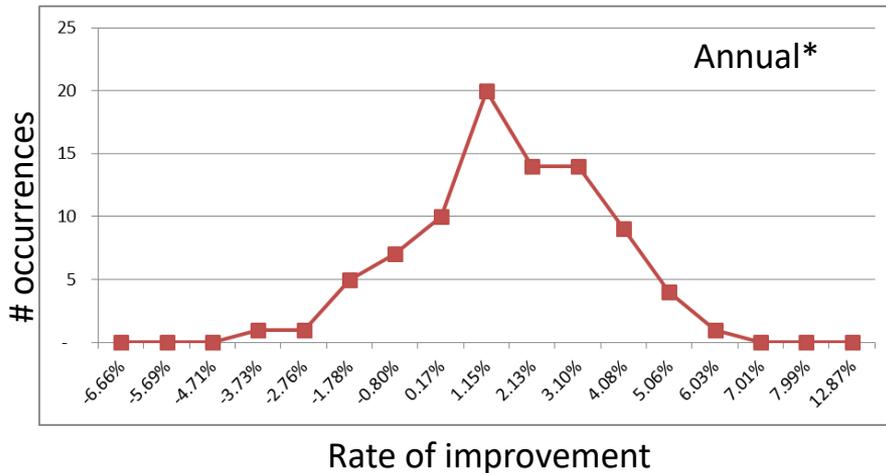
*Annual is improvement over historical one-year periods
*20 year is improvement over historical 20-year periods, converted to an annual rate

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For more information

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