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REINSURERS AND DIRECT WRITERS: COMPARATIVE RESULTS FROM THE RECENT SOA MORTALITY TABLE STRUCTURE SURVEY

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In July 2007 the SOA published the Report of the Society of Actuaries Mortality Table Construction Survey Subcommittee (henceforth, the Report). I was a coauthor of this Report. The survey had 64 respondents: 53 direct writers and 11 reinsurers.[1] This provided a rich dataset that we could not exhaust in our published report and still produce it in a timely fashion. In particular, we did not do separate analysis for direct writers and reinsurers, which could be of particular interest to readers of Reinsurance News.[2] The goal of this article is to provide additional analysis based on this distinction among survey respondents.

Before we begin, let me point out that unlike the Report (available at soa.org/research), this article is an individual effort, a summary of my own observations related to the survey data.

Underlying Table

The survey asked what the predominant product (directly issued or reinsured as the case may be) was for new sales in 2006 (Table 1).

Table 1: Predominant Product

Product	% of Reinsurers	% of Direct
Level Premium Term	55%	56%
Universal Life / Variable Universal Life	18%	20%
Universal life with secondary guarantees	18%	6%
Whole life	0%	10%
Other	9%	8%
Respondents	**11**	**50**

Table 2: Underlying Mortality Table

Mortality Table	% of Reinsurers	% of Direct
Society of Actuaries 1975-80 Basic Table	55%	42%
2001 Valuation Basic Table	36%	32%
Own company's experience	18%	14%
Society of Actuaries 1990-95 Basic Table	0%	8%
Society of Actuaries 1985-90 Basic Table	0%	4%
2001 CSO	0%	2%
Other	18%	2%
Respondents	**11**	**50**

The only significant difference between reinsurers and direct writers was that whole life was not predominant for any of the reinsurers.

Table 3: Reasons For Selecting Underlying Table

Reason	% of Reinsurers	% of Direct
Best reflects our business	73%	38%
Relationship of select to ultimate mortality best reflects anticipated future experience	36%	24%
Maintains continuity with prior pricing assumptions	18%	50%
Consistent with reinsurers/retrocessionaires' experience	18%	40%
Consistent with ceding companies' experience	18%	0%
Consistent with what other companies are doing	9%	8%
Recommended by consultant	9%	2%
Most up to date industry table	0%	4%
Other	27%	8%
Respondents	**11**	**50**

Respondents were directed to answer the remaining questions in the survey based on this predominant product.

The survey asked which mortality table was used as the underlying basis for the company's pricing assumption, and why that table was chosen. Some respondents gave more than one answer (Table 2).

There is broad agreement between the two groups—the '75-'80 Table is most popular, followed by the 2001 VBT. However, 14 percent of direct writers reported using one of the '85-'90, '90-'95 Basic Tables or the 2001 CSO, none of which were used by the reinsurers. The "other" responses

included the Tillinghast Older Age Mortality Study and the Bragg tables.

Direct writers seemed to place more emphasis on continuity with prior assumptions and consistency with their reinsurers, while reinsurers were in strong agreement that the selected table best reflected their business. The "other" reasons offered had to do with specific advantages of the table selected (Table 3).

Modifications to Underlying Table

The survey asked which modifications to the underlying table the company uses in determining the final pricing mortality table (Table 4).

Table 4: Modifications Made to Underlying Table

Modification	% of Reinsurers	% of Direct
Risk class	91%	96%
Update experience to current pricing period	91%	46%
Smoking status	82%	82%
Policy size	82%	58%
Sex	64%	68%
Policy duration	55%	72%
Age	55%	70%
Target market	45%	10%
Distribution channel	36%	6%
Conversions from term to permanent	18%	14%
Differences during and after the contestable period	9%	6%
Reclassification of smokers to nonsmokers	9%	0%
Other	45%	16%
Respondents	**11**	**50**

Risk class was the most common answer given by both reinsurers and direct companies. Smoking status and sex also ranked relatively high for both groups. The most significant differences were that

reinsurers favored modifying the table based on four factors that were less favored by direct companies. Those were:

- Policy size,
- Updating experience to current era,
- Target market, and
- Distribution channel.

"Other" items listed by the reinsurers related mainly to varying the table for individual characteristics of the ceding company.

Table 5: Sources of Information For Modifications to Table

Source	% of Reinsurers	% of Direct
Our own mortality experience	91%	78%
Industry studies	91%	52%
Consultants	36%	32%
Ceding company experience	36%	0%
Reinsurers	18%	68%
Respondents	**11**	**50**

Respondents were asked to select any of the given sources of information that they used to make these modifications (Table 5).

Note the significant difference in reliance on industry studies, as well as the difference in reliance on reinsurers/retrocessionaires. Reinsurers' comparatively low reliance on their own retrocessionaires makes sense: retrocessionaires' business is almost exclusively excess of reinsurers' already relatively high retention limits and that means that retros' portfolios can be expected to be quite different in nature than reinsurers' portfolios.

With the exception of the reinsurer/retrocessionaires item, the reinsurers as a group were more likely to use every source of information listed in the survey, perhaps a sign of the thoroughness one might expect from their industry.

Table 6: Frequency of Review of Modifications

Frequency	% of Reinsurers	% of Direct
More frequently than annually	18%	6%
Annually	55%	43%
Every 2 to 3 years	18%	20%
When new products are developed	9%	27%
Other	0%	4%
Respondents	**11**	**49**

The survey asked how frequently these modifications to the underlying table were reviewed (Table 6).

The results showed that 73% of reinsurers reviewed their modifications annually or more frequently versus 49% of direct writers.

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Select Period

Respondents were asked to provide the length of the select period of their company's pricing mortality table for issue ages 25, 50 and 75 (Table 7).

The direct writers as a group reported using slightly longer select periods than reinsurers. This is somewhat surprising, since reinsurers might be expected to take the more aggressive stance on how long selection might last.

Mortality Ratios[3]

The survey requested mortality rates for issue ages 25, 50 and 75 at various durations, as well as for various attained ages from 25 to 105. The goal was to calculate:

Table 7: Length of Select Period

Select Period	% of Reinsurers			% of Direct		
	Issue Age 25	Issue Age 50	Issue Age 75	Issue Age 25	Issue Age 50	Issue Age 75
< 15 years	0%	0%	9%	4%	4%	9%
15 years	36%	27%	36%	34%	32%	27%
20 years	18%	9%	18%	4%	2%	18%
25 years	45%	55%	27%	40%	44%	39%
30 years	0%	0%	0%	6%	6%	5%
50 years	0%	0%	0%	4%	10%	0%
70 years	0%	0%	0%	6%	0%	0%
> 70 years	0%	0%	0%	2%	0%	0%
Other	0%	9%	9%	2%	2%	2%
Median	20	25	18	25	25	20
Respondents	**11**	**11**	**11**	**50**	**50**	**44**

- *Select to Ultimate Ratios:* The relative power of selection on mortality and how quickly selection wears off by policy year, ($q_{[x]+t}$ / q_{x+t}, where $q_{[x]+t}$ = mortality rate for issue age x at duration t and q_{x+t} = ultimate mortality rate at attained age $x + t$).
- *Best Preferred Class to Residual Class Ratios:* The relative mortality of preferred risks and the extent to which the state of being a preferred risk persists by policy year ($q^{P}_{[x]+t}$ / $q^{R}_{[x]+t}$, where P = preferred, R = residual standard).

In the tables that follow, I have chosen the median response as the single most valuable summary statistic of the responses as a whole.[4]

Select to Ultimate Ratios

Certain respondents provided only partial responses to the request for mortality rates. As a result, the number of responses varied from cell to cell. The number of responses contributing to the medians below ranged from seven to nine reinsurers, and from 28 to 40 direct writers (Tables 8-13).

The Select to Ultimate ratios for age 50, best preferred are very consistent between the reinsurers and the direct writers. However, the reinsurers take a more aggressive view of the power of selection at age 25, especially between durations six and 11, while the direct writers take a more aggressive view of the power of selection for 75-year-olds, at least for the first 11 durations. It's also interesting that reinsurers and direct writers tend to agree that selection is gone after 20 years for age 25 and age 75 issues, while for issue age 50 some selection persists beyond 20 years.

For the residual standard class, the same general pattern applies, with reinsurers more confident in the power of selection for age 25 and the direct writers more confident for age 75. For age 50, the reinsurers seem to take a slightly dimmer view of the power of selection than the direct writers.

Table 8: Median Select to Ultimate Ratio: Issue Age 25 Best Preferred

	Duration					
	1	6	11	16	21	26
Reinsurers	45%	58%	71%	95%	100%	100%
Direct	46%	66%	80%	100%	100%	100%

Table 9: Median Select to Ultimate Ratio: Issue Age 50 Best Preferred

	Duration					
	1	6	11	16	21	26
Reinsurers	33%	60%	72%	88%	94%	100%
Direct	33%	59%	72%	88%	90%	100%

Table 10: Median Select to Ultimate Ratio: Issue Age 75 Best Preferred

	Duration					
	1	6	11	16	21	26
Reinsurers	32%	61%	73%	91%	100%	100%
Direct	25%	49%	65%	92%	100%	100%

Table 11: Median Select to Ultimate Ratio Issue Age 25 Residual Standard						
	Duration					
	1	6	11	16	21	26
Reinsurers	48%	63%	81%	99%	100%	100%
Direct	53%	67%	82%	100%	100%	100%

Table 12: Median Select to Ultimate Ratio Issue Age 50 Residual Standard						
	Duration					
	1	6	11	16	21	26
Reinsurers	37%	67%	78%	98%	100%	100%
Direct	38%	63%	78%	92%	97%	100%

Table 13: Median Select to Ultimate Ratio: Issue Age 75 Residual Standard						
	Duration					
	1	6	11	16	21	26
Reinsurers	33%	69%	86%	93%	100%	100%
Direct	30%	53%	72%	97%	100%	100%

Best Preferred to Residual Standard Ratio

There are two things being measured with this ratio. First, the magnitude of the ratio indicates the assumed amount of mortality savings due to the more restrictive selection process for preferred risks. Secondly, the upward drift of this ratio as duration increases measures the "wearing off" of the preferred nature of the risk. To focus on this wearing off, I've computed the mortality discount implied by the median, which is simply 100 percent minus the median preferred to standard ratio, and the relative change in this implied discount as the duration increases (Tables 14-16).

Table 14: Preferred to Standard Ratio: Issue Age 25						
	Duration					
	1	6	11	16	21	26
Reinsurers						
Median	57%	57%	57%	57%	58%	59%
Implied discount	43%	43%	43%	43%	42%	41%
Relative change	100%	100%	100%	100%	98%	95%
Respondents	11					
Direct						
Median	55%	56%	58%	60%	61%	65%
Implied discount	45%	44%	42%	40%	39%	35%
Relative change	100%	98%	93%	89%	87%	78%
Respondents	43					

For issue age 25, reinsurers clearly expect little preferred to wear off over the first 26 years (drift from 57 percent to 59 percent) while direct writers as a group see a stronger upward trend (from 55 percent to 65 percent), a wearing off of about 22 percent in relative terms.

For issue age 50, the same relationship holds, with reinsurers assuming more persistence of preferred than direct writers, though the difference is not as dramatic as at age 25.

For issue age 75, the reinsurers saw preferred persisting for the first 11 durations and wearing off fairly quickly thereafter. While the direct companies saw about the same or a little more aggregate wearing off over 26 years, they saw it wearing off more consistently over the 26 year time frame.

Table 15: Preferred to Standard Ratio: Issue Age 50						
	Duration					
	1	6	11	16	21	26
Reinsurers						
Median	55%	56%	57%	58%	60%	62%
Implied discount	45%	44%	43%	42%	40%	38%
Relative change	100%	98%	96%	93%	89%	84%
Respondents	11					
Direct						
Median	53%	55%	56%	60%	61%	67%
Implied discount	47%	45%	44%	40%	39%	33%
Relative change	100%	96%	94%	85%	83%	70%
Respondents	43					

In September 2007, the Futurism Section, the Committee on Knowledge Extension Research and the Committee on Life Insurance Research published a report titled "Persistence of Individual Mortality Risk Differentials Utilizing A Modified Online Predictive Market." This project used innovative techniques to study the persistency of preferred as measured using quantities similar to the "implied discount" and "relative change" above. I encourage the reader interested in further investigation to find this report at soa.org/research.

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Table 16: Preferred to Standard Ratio: Issue Age 75						
	Duration					
	1	6	11	16	21	26
Reinsurers						
Median	58%	59%	59%	62%	71%	80%
Implied discount	42%	41%	41%	38%	29%	20%
Relative change	100%	98%	98%	90%	69%	48%
Respondents	11					
Direct						
Median	54%	58%	61%	65%	73%	80%
Implied discount	46%	42%	39%	35%	27%	20%
Relative change	100%	91%	85%	76%	59%	43%
Respondents	37					

Mortality Improvement

The survey asked whether respondents modified their pricing mortality tables to make explicit adjustments for future mortality improvements. The survey went on to ask those who responded positively to state how many policy years of improvement are assumed for issue ages 25, 50 and 75, male nonsmoker best class (Table 18).

Table 17: Adjust for Future Mortality Improvement		
	% of Reinsurers	% of Direct
Yes	100%	28%
No	0%	72%
Respondents	**11**	**50**

There is a difference of opinion with respect to using future mortality improvements in pricing. Assuming future mortality improvements is much less common among direct writers than among reinsurers—in fact, every reinsurer reported that they assume future mortality improvements in pricing. However, among those direct writers who do assume future mortality improvements, a somewhat more aggressive stand is taken, with improvements assumed to persist for a longer time at every age.

After asking how long improvements were assumed to persist, the survey asked for the specific annual improvement factor for male nonsmoker best class, issue age 50 (Table 19).

Table 19: Median Annual Improvement Factor							
	Duration						
	1	5	6	10	11	20	21
Reinsurers	0.8%	1.0%	1.0%	1.0%	1.0%	0.0%	0.0%
Respondents	11						
Direct	1.0%	1.0%	1.0%	1.0%	1.0%	0.6%	0.0%
Respondents	13						

There is only slight evidence that those direct writers who assume future mortality improvements take a somewhat more aggressive position on the magnitude of the annual improvement.

Finally, the survey asked how often the company's assumption as to future mortality improvement assumption is reviewed for possible adjustment.

Table 20: Frequency Of Review Of Mortality Improvement Assumption		
Frequency	**% of Reinsurers**	**% of Direct**
More frequently than annually	0%	0%
Annually	45%	20%
Every 2 to 3 years	45%	40%
Less frequently than every 3 years	0%	7%
When new products are developed	0%	27%
Other	9%	7%
Respondents	**11**	**15**

Reinsurers appear to review their mortality improvement assumption somewhat more frequently.

Table 18: Years of Future Mortality Improvement Assumed						
	Reinsurers			Direct		
Years	Issue Age 25	Issue Age 50	Issue Age 75	Issue Age 25	Issue Age 50	Issue Age 75
0	18%	0%	9%	0%	0%	0%
5	0%	0%	9%	0%	0%	0%
10	18%	18%	18%	21%	21%	33%
15	18%	36%	18%	14%	14%	25%
20	27%	27%	27%	36%	36%	17%
25	0%	0%	9%	7%	7%	25%
30	18%	18%	9%	7%	7%	0%
50	0%	0%	0%	0%	7%	0%
75/Lifetime	0%	0%	0%	14%	7%	0%
Median	15	15	15	20	20	15
Respondents	**11**	**11**	**11**	**14**	**14**	**12**

Conclusions

Please keep in mind that any conclusions are limited by the sample size. This is especially the case with respect to the direct writers. For the reinsurers, while the total number of survey respondents is small, they represent a substantial portion of their industry. Of course, any conclusions are also limited by the accuracy of the answers to the survey questions and of the interpretations of survey questions made

by respondents. Keeping these limitations in mind, some conclusions worth noting include:

- Reinsurers and direct writers both use the SOA '75-'80 Table and 2001 VBT most commonly.
- Direct writers made somewhat fewer modifications to their underlying table and the modifications they made were more likely to be based on consistency with past assumptions and consistency with their reinsurers. Reinsurers seemed to customize their tables more to the specific ceding company, and tended to use industry studies and their own experience to make these modifications.
- Direct writers used slightly longer select periods in their pricing mortality tables than reinsurers.
- Reinsurers assumed more power of selection than direct writers at age 25, while the direct writers assumed more power of selection than reinsurers at age 75.
- When it came to the persistence of the mortality advantage of preferred risks, reinsurers believed that preferred would wear off more slowly than the direct writers tended to believe.
- Every reinsurer reported assuming future mortality improvements in pricing, while a clear minority of direct company respondents reported doing so.

Some of these conclusions might be considered surprising, especially if one assumes that reinsurers are more aggressive than direct writers. On the whole, this might be true, but the survey data have revealed a more ambiguous picture than one might have expected. ✹

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[1] The Report stated that 10 of the 64 respondents were reinsurers. Eleven is the correct number.

[2] The differences between the published Report and this article are as follows.

a) For analysis of Select to Ultimate ratios, Select Grading ratios and Preferred to Residual ratios, the Committee used only responses from those respondents reporting either a 15-year select period or a 25-year select period. There were between 14 and 18 respondents for the 15-year case (depending on age) and between 17 and 23 respondents for the 25-year case. Responses from those reporting some other select period were not analyzed. In the present article, all respondents are included regardless of select period. This increases the effective number of respondents by about 10, depending on cell.

b) The ratio analysis was done separately for the 15-year and 25-year cases. Direct writers and reinsurers were not analyzed separately. In the present article, the analysis was done by reinsurer vs. direct, instead of by reported select period.

c) There was comparatively little editing of responses in the Report, even when responses seemed not to correctly interpret the question in the survey. By contrast, such responses in the present article have been carefully edited. When select rates reported were higher than ultimate rates for the same attained age, the resulting ratio was capped at 100 percent. Furthermore, if a company priced on a pure ultimate basis for a given cell, their responses were not included in the analysis of Select to Ultimate Ratios for that cell. Finally, the respondent's indicated select period was overridden if the mortality rates provided indicated another select period. The de facto select period was assumed to be true.

[3] The Report also contains an analysis of the Select Grading Ratio, which is the ratio of a given select mortality rate to the mortality rate at the end of that row of the mortality table. In this article, I have skipped an analysis of these ratios, preferring instead to concentrate on Select to Ultimate Ratios and Preferred to Residual ratios.

[4] If one is trying to measure an underlying random process, mean may be more useful because it is the expected value's unbiased estimator. However, in this case we are not trying to estimate some underlying "true" value; rather, we are trying to gauge a consensus of opinions, and the median is preferable because of its lesser sensitivity to outliers, especially considering the relatively small sample sizes we have in this survey.