

ACTUARIAL RESEARCH CLEARING HOUSE
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Memorandum

To Assistant Group Actuary, Group Finance

From J.W. Spencer, Actuarial Assistant, Disability Products
JWS

Re LTD Reserve Basis Project

As part of our LTD Reserve Basis project we need to develop an "expected" termination rate table based on our experience and the 1987 CGDT Basic termination rates. I spent some time recently testing our own experience and have come up with recommended tables. First I will describe the procedures of my study followed by my final recommendations.

My goal of the study is to create tables which are based on Sun Life experience in the first 5 years of disability duration, then equal to 100% of the 1987 Basic rates after 5 years. The 1987 CGDT has tables for male and female and also for 3 and 6 month elim periods. To perform the study I created one table from the 1987 tables which was unisex and for one elim. For durations under six month I used the mean of the male and female 3 month rates and durations 6 and over I first created unisex tables for each elim then took the mean of each elim to arrive at one table. Our LTD claim file has an approximate $50/50^{1/2}$ split of male, female claims and 3, 6 month elim claims; thus, the reason I meaned the 1987 rates to get one table.

The first step of the study is to develop Sun Life experience termination rates for durations up to 5 years. To increase the credibility of the rates for each age/duration combination, I grouped the data for several durations and ages which I will call the "test durations". The age groupings I used were the quinn-

quennial age groups used in pricing and also the 1987 tables. The test durations are as follows:

- a. [3,6) months
- b. [6,12) "
- c. [12,18) "
- d. [18,24) "
- e. [24,36) " (3rd year)
- f. [36,48) " (4th year), and
- g. [48,60) " (5th year).

The Sun Life termination rates determined for the test durations are to be compared with the one 1987 table I created as described above. Since the 1987 table has monthly rates up to 24 months then shift to annual rates for years 3 and on, I had to determine rates for the test durations under 24 months.

Now on to the testing...

The procedures and assumptions of my study are as follows:

1. I performed a seriatim morbidity study from our July 1991 LTD reserve file. Claims approved for benefits and incurred after 1979 were used for the observation period. Programs were written in APL to develop the results.
2. Age at disability determined as nearest quinquennial age.
3. I excluded ASO policies and St. Vincents' and Mattel (both partial ASO/insured policies).
4. Male and female claims were combined for all test durations.
5. For durations under 6 months I exclusively used experience from 3 month elim claims. Durations 6 and over included claims from all different elims.

6. "Exposure" for each claim was credited from the end of elimination period to..

- a. If closed claim (terminated) exposure credited to end of test duration in which claim was terminated (i.e. claim exposed to risk for whole duration in test cell).
- b. If open claim (active) exposure credited only to current duration at 7/31/91 - treated as an "ender".
- c. If claim closed due to reaching expiration date for benefits treated as a "withdrawal" from study, not a terminated claim. Exposure credited only to expiration date.

7. Each terminated claim was credited with a +1 in numerator for test duration in which termination occurred. As stated in 6c claims reaching expiration date are not counted as a termination.

The termination rate for each test duration equals total terminations over total exposure. The results of the study are shown in Table 1.

Next, the raw experience termination rates were graduated (smoothed) for each test duration. Using the Normal Distribution assumption I was able to establish a credibility factor for each test cell assuming a 95% confidence interval. According to Mortality Table Constructions by R.W. Batten the standard deviation for an experience mortality rate is the estimated mortality rate over the square root of the number of observed deaths. For this study the standard deviation would be the experience termination rate over the square root of the number of observed terminations. A 95% confidence interval is thus the experience termination rate +/- two standard deviations. I determined the credibility would be $1 - (2 \text{ Std Dev}) / (\text{Experience Term Rate})$ for each cell. For cells with less than 15 terminations the normal distribution does not hold. A cell with 15 terminations has approximately 48% credibility, thus I decided

to grade the credibility linearly from 0 to 48% for test cells with 0 to 15 terminations.

The first set of graduated rates are a weighting of the experience termination rate and the 1987 Basic Q as defined below:

$$(\text{Credibility of cell}) \times (\text{S.L. Exp Rate}) + (1 - \text{Cred}) \times (\text{1987 Basic Q})$$

These new graduated rates were then "smoothed" by performing a least squares regression onto a quadratic or cubic equation depending on the general shape of the curve.

The results of the graduations are shown in Table 2. Also, graphs of the raw experience termination rates, the weighted graduated rates, and the final "smoothed" rates are portrayed in Graphs 1 and 2.

Table 3 shows ratios of the following different termination rates:

1. Final graduated Sun Life experience to current pricing rates.
2. Final graduated Sun Life experience to 1987 CGDT Basic rates, and
3. Pricing rates to 1987 CGDT Basic rates.

Graphs of the three different termination rates (Grad S.L., 1987 CGDT, and pricing) are shown in Graphs 3 and 4. The following general conclusions can be drawn by looking at Table 3 and the graphs:

1. The under 24 month graduated Sun Life experience rates are generally slightly larger than 1987 CGDT rates ranging from 100% to 138% of the 1987 q's. The rates generally are larger for the younger ages and close to 1987 q's for older ages

2. The post 24 month graduated rates are much larger than both the 1987 CGDT and pricing q's for all durations and ages. The rates range from 115% to 190% of 1987 q's.

The result in item 2 indicates why we are currently realizing much better terminations than the current pricing rates. A rationale for the increase in post 24 month rates is the transition from "own occ" to "any occ" at 24 months for almost all of our business.

Based on the above results I recommend that we implement the final graduated Sun Life experience rates for durations up to 5 years and the 1987 CGDT Basic termination rates for durations over 5 years. I also recommend that we implement two tables - one for 3 month elims and the other for 6 month elims. The tables would be developed by multiplying the current 1987 Basic tables by the ratios of the graduated rates and the 1987 rates (see boxed ratios from Table 3). These tables would represent our "expected" termination rates. For valuation we need to determine interest rates and margin (80% term rates CAS?, 90% term rates Stat?, 100% or 90% term rates internal?). I will be awaiting your response before beginning the next step in this project.

attachments

Table 1

Group LTD Study of Sun Life Experience Termination Rates (Incurred 1980 to Present)

I. Actual Terminations from Sun Life's LTD1900 Claim file

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	71	152	134	95	80	88	91	98	101
6-12	87	150	171	126	135	135	142	184	189
12-18	19	41	56	39	62	62	71	83	80
18-24	7	18	29	31	28	22	43	53	44
24-36	15	31	57	59	76	67	63	86	74
36-48	3	8	16	13	10	24	30	38	30
48-60	1	8	8	9	12	17	15	31	15
60-72	0	2	4	4	2	2	12	23	3
72-84	0	0	4	2	1	4	8	11	1
84-96	1	1	2	3	2	6	8	13	0
96-108	0	0	0	0	3	1	7	5	0
108-120	0	0	2	1	0	6	4	5	0

II. Actual Exposures from Sun Life's LTD1900 Claim file

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	150	315	348	321	363	399	462	619	602
6-12	160	317	459	451	554	628	803	1,165	1,127
12-18	71	168	286	312	410	475	645	979	923
18-24	52	118	212	254	329	390	551	853	781
24-36	42	93	166	198	276	332	476	747	616
36-48	24	52	97	123	169	225	366	578	340
48-60	21	39	68	92	134	162	295	467	141
60-72	18	26	51	68	97	125	236	370	18
72-84	15	18	40	49	78	101	190	237	5
84-96	13	12	30	34	64	84	155	139	1
96-108	11	6	21	22	49	63	109	69	0
108-120	9	3	15	18	31	40	68	25	0

III. Sun Life Experience Termination Rates

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	0.4735	0.4831	0.3854	0.2964	0.2205	0.2203	0.1969	0.1583	0.1676
6-12	0.5439	0.4734	0.3722	0.2792	0.2435	0.2149	0.1768	0.1579	0.1678
12-18	0.2662	0.2447	0.1955	0.1249	0.1510	0.1306	0.1100	0.0848	0.0867
18-24	0.1352	0.1523	0.1371	0.1221	0.0852	0.0564	0.0780	0.0621	0.0563
24-36	0.3585	0.3332	0.3437	0.2973	0.2750	0.2019	0.1324	0.1152	0.1202
36-48	0.1243	0.1528	0.1649	0.1055	0.0591	0.1069	0.0819	0.0657	0.0883
48-60	0.0481	0.2067	0.1168	0.0973	0.0895	0.1048	0.0509	0.0664	0.1064

Table 2

Group LTD Study of Sun Life Termination Experience

III. Sun Life Experience Termination Rates

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	0.4735	0.4831	0.3854	0.2964	0.2205	0.2203	0.1969	0.1583	0.1676
6-12	0.5439	0.4734	0.3722	0.2792	0.2435	0.2149	0.1768	0.1579	0.1678
12-18	0.2662	0.2447	0.1955	0.1249	0.1510	0.1306	0.1100	0.0848	0.0867
18-24	0.1352	0.1523	0.1371	0.1221	0.0852	0.0564	0.0780	0.0621	0.0563
24-36	0.3585	0.3332	0.3437	0.2973	0.2750	0.2019	0.1324	0.1152	0.1202
36-48	0.1243	0.1528	0.1649	0.1055	0.0591	0.1069	0.0819	0.0657	0.0883
48-60	0.0481	0.2067	0.1168	0.0973	0.0895	0.1048	0.0509	0.0664	0.1064

IV. Credibility of Experience Term Rates

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	0.763	0.838	0.827	0.795	0.776	0.787	0.790	0.798	0.801
6-12	0.786	0.837	0.847	0.822	0.828	0.828	0.832	0.853	0.855
12-18	0.541	0.688	0.733	0.680	0.746	0.746	0.763	0.780	0.776
18-24	0.224	0.529	0.629	0.641	0.622	0.574	0.695	0.725	0.698
24-36	0.484	0.641	0.735	0.740	0.771	0.756	0.748	0.784	0.768
36-48	0.096	0.256	0.500	0.416	0.320	0.592	0.635	0.676	0.635
48-60	0.032	0.256	0.256	0.288	0.384	0.515	0.484	0.641	0.484

V. Graduated Sun Life Experience Term Rates = $cred \times S.L. + [(1 - cred) \times 1987 (3)]$

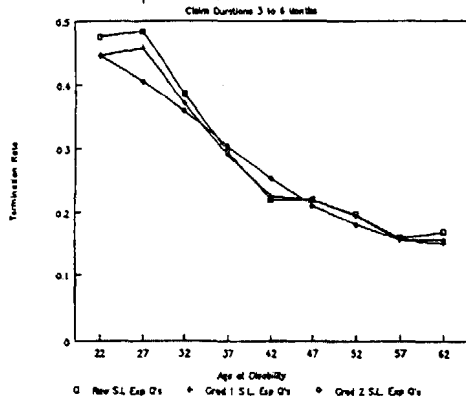
Dur/Age	22	27	32	37	42	47	52	57	62
3-6	0.4450	0.4570	0.3705	0.2913	0.2260	0.2195	0.1941	0.1545	0.1502
6-12	0.5052	0.4497	0.3596	0.2752	0.2407	0.2118	0.1743	0.1530	0.1550
12-18	0.2444	0.2288	0.1895	0.1337	0.1456	0.1260	0.1063	0.0817	0.0757
18-24	0.1352	0.1380	0.1272	0.1152	0.0871	0.0648	0.0739	0.0586	0.0479
24-36	0.2670	0.2738	0.2925	0.2541	0.2377	0.1757	0.1190	0.1044	0.1041
36-48	0.1213	0.1175	0.1266	0.0860	0.0593	0.0842	0.0693	0.0594	0.0724
48-60	0.0881	0.1119	0.0792	0.0663	0.0619	0.0737	0.0458	0.0579	0.0727

VI. "Smoothed" Graduated S.L. Experience Term Rates

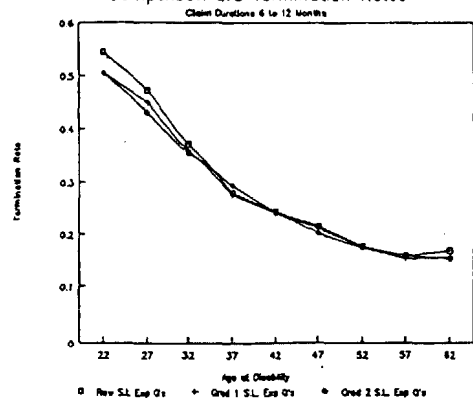
Dur/Age	22	27	32	37	42	47	52	57	62
3-6	0.4450	0.4050	0.3590	0.3052	0.2540	0.2100	0.1800	0.1562	0.1552
6-12	0.5050	0.4302	0.3558	0.2930	0.2418	0.2021	0.1739	0.1573	0.1523
12-18	0.2475	0.2203	0.1938	0.1684	0.1446	0.1228	0.1034	0.0835	0.0775
18-24	0.1375	0.1300	0.1200	0.1082	0.0951	0.0824	0.0701	0.0583	0.0468
24-36	0.2950	0.2862	0.2776	0.2523	0.2169	0.1779	0.1275	0.1100	0.1100
36-48	0.1350	0.1225	0.1100	0.0946	0.0844	0.0757	0.0694	0.0625	0.0692
48-60	0.1072	0.0938	0.0818	0.0718	0.0640	0.0587	0.0564	0.0573	0.0618

Graph 1

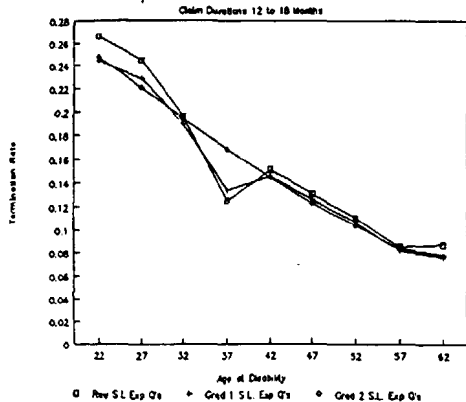
Comparison LTD Termination Rates



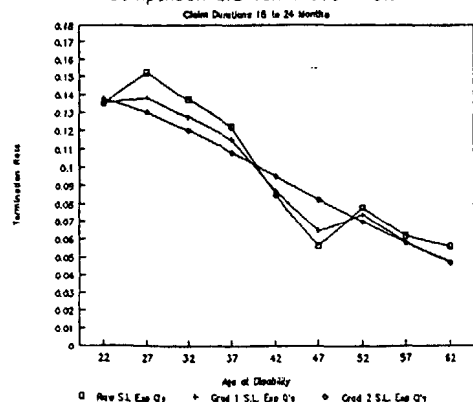
Comparison LTD Termination Rates



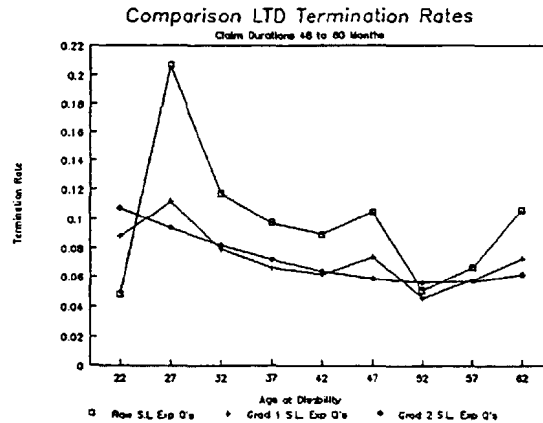
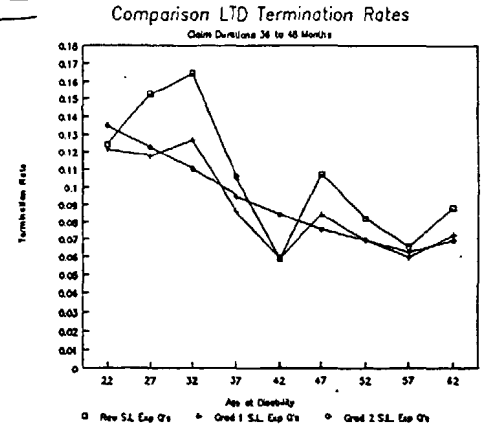
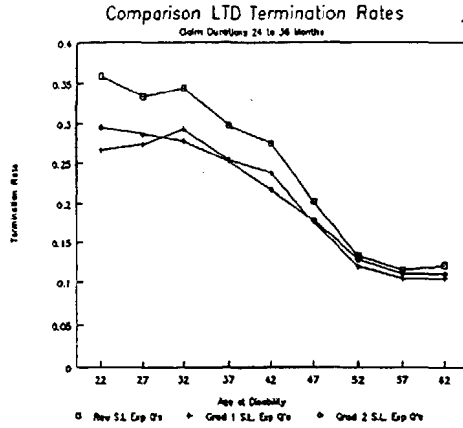
Comparison LTD Termination Rates



Comparison LTD Termination Rates

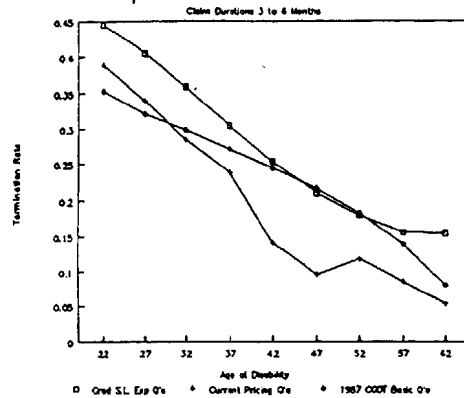


Graph 2

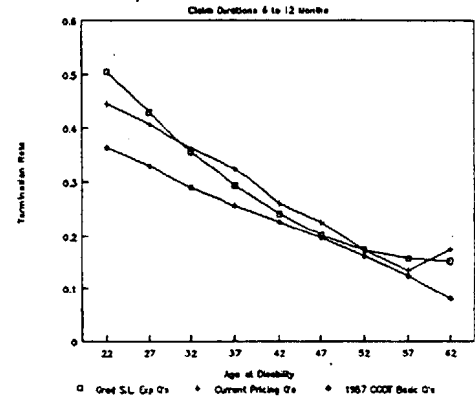


Graph 3

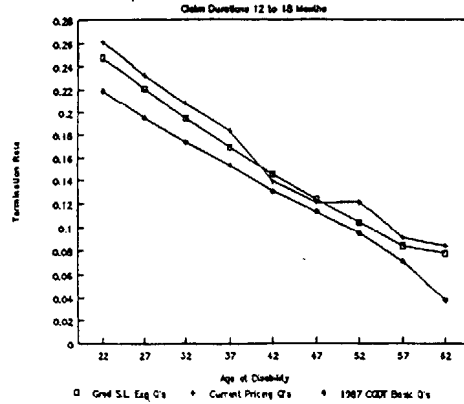
Comparison of LTD Termination Rates



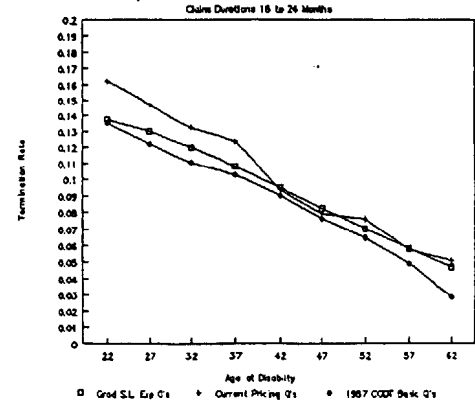
Comparison of LTD Termination Rates



Comparison of LTD Termination Rates



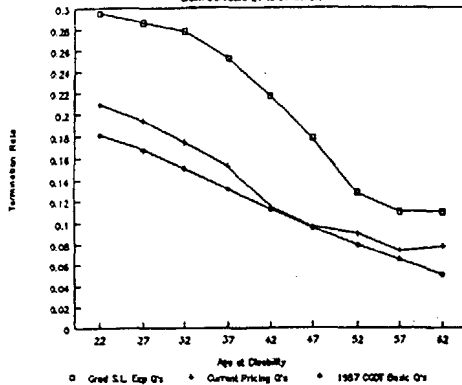
Comparison of LTD Termination Rates



Graph 4

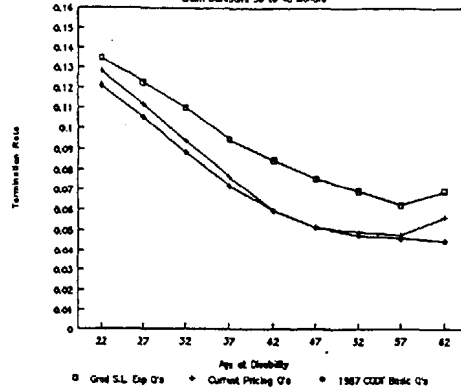
Comparison of LTD Termination Rates

Claim Durations 24 to 36 Months



Comparison of LTD Termination Rates

Claim Durations 36 to 48 Months



Comparison of LTD Termination Rates

Claim Durations 48 to 60 Months

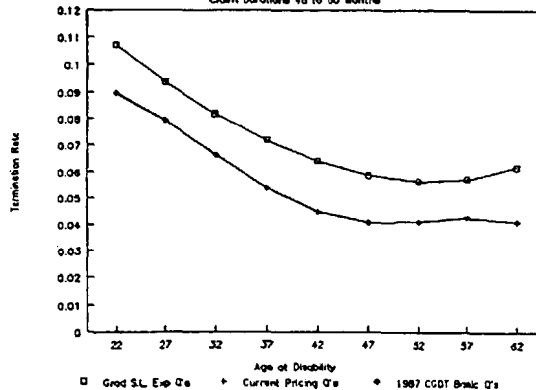


Table 3

***** Ratios of LTD Termination Rates (Q's) *****

** UniElim/UniSex Ratio Grad S.L. Experience to Pricing Q's (Test Durations)

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	1.145	1.190	1.261	1.280	1.801	2.203	1.518	1.834	2.924
6-12	1.129	1.056	0.983	0.908	0.928	0.893	1.003	1.173	0.872
12-18	0.948	0.949	0.935	0.921	1.046	1.022	0.858	0.923	0.927
18-24	0.848	0.887	0.906	0.873	1.013	1.042	0.925	1.013	0.923
3	1.409	1.475	1.592	1.655	1.898	1.844	1.426	1.487	1.409
4	1.052	1.096	1.175	1.238	1.416	1.469	1.412	1.305	1.227
5	1.194	1.178	1.231	1.332	1.425	1.435	1.368	1.338	1.505

* Recommended adjustments

to

1987

(GDT

Basic

Q's.

** UniElim/UniSex Ratio Grad S.L. Experience to 1987 CGDT Basic Q's (Test Durations)

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	1.260	1.257	1.201	1.123	1.037	0.969	0.982	1.120	1.942
6-12	1.389	1.310	1.227	1.141	1.063	1.025	1.074	1.264	1.904
12-18	1.131	1.136	1.121	1.106	1.115	1.092	1.097	1.181	2.065
18-24	1.017	1.065	1.087	1.050	1.052	1.081	1.083	1.185	1.650
3	1.628	1.706	1.845	1.923	1.934	1.879	1.610	1.684	2.156
4	1.116	1.162	1.247	1.313	1.420	1.474	1.464	1.352	1.551
5	1.198	1.183	1.235	1.337	1.432	1.441	1.374	1.342	1.498

** UniElim/UniSex Ratio Pricing to 1987 CGDT Basic Q's (Test Durations)

Dur/Age	22	27	32	37	42	47	52	57	62
3-6	1.100	1.056	0.953	0.877	0.576	0.440	0.647	0.610	0.664
6-12	1.230	1.240	1.249	1.257	1.145	1.148	1.070	1.078	2.183
12-18	1.193	1.196	1.198	1.201	1.066	1.068	1.279	1.280	2.227
18-24	1.198	1.201	1.200	1.202	1.038	1.037	1.170	1.170	1.787
3	1.155	1.157	1.158	1.162	1.019	1.019	1.129	1.132	1.530
4	1.061	1.061	1.061	1.061	1.002	1.004	1.037	1.036	1.264
5	1.004	1.004	1.004	1.004	1.005	1.004	1.004	1.003	0.995

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