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First Principles LTC–Restoration of Benefits

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Author's Note: *This article compares differences in long-term care insurance policies based on whether or not the restoration of benefits feature is included. A first-principles model was used for the mathematical determinations.*

Certain abbreviations are used: LTCI (long-term care insurance), NH (nursing home), ALF (assisted living facility), HC (home care), MDB (maximum daily benefit), MLB (maximum lifetime benefit), BP (benefit period), EP (elimination period), IP (inflation protection), ROB (restoration of benefits), and ALR (active life reserve, or contract reserve). The term 'care settings' refers to the three principle settings for those receiving benefits: NH, ALF and HC.

MODEL TYPES

The advantages of a first-principles model are becoming increasingly apparent and desired by LTCI carriers. Too often, people utilize the term "first principles" when they are simply referring to the derivation of claim costs by using claim-incidence (incidence) rates and claim-termination (termination) rates. A true first-principles model derives all values from calculations that use first principles. These basic principles are then used to develop pricing, valuation, and/or projection analyses for active lives and disabled lives.

For a first-principles model, incidence, utilization and termination assumptions are generated using measurements of company or industry experience. Monthly claims paid, claims incurred and claim reserves are calculated from the assumed incidence and termination rates. At the end of each month, the present value of future claim payments is calculated to tabulate the claim reserve. The reserve at the incurral date represents the incurred claim.

For a claim-cost model, incurred claims are calculated in advance of the analysis and entered as an assumption. An overall claim runoff pattern is also input, and all claim payments are assumed to runoff based on this schedule. Therefore, claim payments and claim reserves are a function of the input claim runoff. For the claim-cost model, all policies (active lives and disabled lives) incur claims which put the onus on the claim cost assumption to reach the appropriate claim levels.

Clearly, claim payments and reserves will generally be more precise using a first-principles model rather than a faster but less precise claim-cost model.

ROB: REMAINING BENEFITS

In general, the ROB feature will restore a policy's MLB, as if no claim occurred, under certain circumstances. The circumstances often include: benefits were not exhausted under the prior claim, and the insured proved that he could perform his benefit triggers for a specified period of time (commonly six months) following the conclusion of their most recent period of care.

For some policies, the maximum benefit cannot be defined. Examples include those policies with an unlimited BP and those with the ROB feature. Policies with a "fixed" BP and without ROB have a finite maximum benefit. If this latter policy includes some form of IP, the maximum benefit may be increased each year by the inflation protection amount, but the maximum benefit continues to be a fixed, although changing, amount.

When considering anti-selection, policyholders who are close to exhausting their benefits may end their period of care and return to an active status. To address this possibility, the following assumes that 50 percent of those about to exhaust their benefits return to an active status (the remaining 50 percent exhaust their benefits).

When a policy with ROB is priced, the incurred claim for each attained age is based on the entire benefit period. For a policy without ROB, prior paid claims must be considered because the policy will not pay more than the MLB. If pricing looks at each attained age, the paid claims for prior ages should be subtracted from the MLB, to obtain the MLB available for the current age. If pricing looks at cen-

tral ages, the paid claims for the central ages may be interpolated to obtain paid claims for all ages. Then the paid claims for prior attained ages may be added, and this total subtracted from the initial MLB to obtain the remaining MLB for current age.

NH-ONLY, ONE-YEAR BENEFIT PERIOD

As an example, consider a policy with a simple benefit structure: female, issue age 62, NH-only, MLB of $3,650, one unit with $10 of MDB, 0-day EP, no IP, and claims are paid at 100 percent utilization.

If a policy has ROB, each attained age is priced with an MLB of $3,650 ($10 per day for one year). The incidence and termination rates are used to calculate the paid claims for each month, at each attained age. Due to the ROB, the benefits are restored to their initial MLB after each claim and the insured has the availability of the full MLB at each attained age. Therefore, for each attained age, the full benefit period is used with the attained-age continuance rates to derive paid claims.

Calculating the (undiscounted) paid claims for each of the quinquennial ages, leads to a summary found in Figure 1 (see the 'With-ROB' column).

Figure 1. Paid claims by age at disablement: one-year NH-only benefits.

	ROB	
Age	With	Without
62	2.389	2.389
67	3.145	3.137
72	6.780	6.737
77	22.448	22.091
82	52.196	49.740
87	129.126	113.704
92	219.508	156.201
97	258.737	125.197
102	258.737	84.773
107	258.737	58.857
112	258.737	39.174
117	258.737	25.719

(Note: With the data set used, ages above 95 were combined to derive incidence and termination rates.)

We can linearly interpolate between central ages to determine the gross amount spent at interim ages. Using ages 62 and 67, the paid claims for age 66 are: $2.994. Paid claims for ages 62-66 are equal to: (2.389 + 2.994) ÷ 2 × 5 = 13.457. Paid claims for ages 118-120 are approximated using the paid claims for age 117. For ages 118 and 119, the incidence and continuance rates are the same as for age 117. Therefore, for a one-year benefit period, the paid claims for ages 118 and 119 are the same as for 117. For age 120, everyone has expired by the end of the year. We will approximate the paid claims as 50 percent of the paid claims for age 117.

Total paid claims are estimated as $8,770.98.

(2.389 + 2.389 + (3.145 – 2.389) * 4 ÷ 5) ÷ 2 × 5 + (3.145 + 3.145 + (6.780 – 3.145) * 4 ÷ 5) ÷ 2 × 5 + … + 258.737 × 5 + 258.737 × 3.5 = $8,770.984.

If a policy **does not have** the ROB feature, we must keep track of the paid claims at all attained ages to ascertain that total benefits do not exceed $3,650. At age 62, the issue age, we have the full MLB of $3,650 available. We calculate, again, paid claims equal to $2.389.

To calculate the paid claims at the next central age, 67, the remaining MLB must first be determined. With ROB, the remaining amount is always $3,650; however, without ROB, the amount decreases because the total gross paid claim amount will not exceed $3,650. Using the paid claims at age 62, we can derive the paid claims at each of attained ages 63, 64, 65 and 66. We could go through a fair amount of work to determine the amount spent at ages 63-66, or, we can conservatively estimate the paid claims as: 2.389 × 5 = $11.944. The MLB available at age 67 is: 3650.00 – 11.944 = $3,638.056. To determine paid claims, use continuance rates until the remaining maximum of $3,638.056 has been spent. For age 67, we find the amount of paid claims is $3.137 (approximately one cent less than the version with ROB).

To determine the remaining MLB amount available at central age 72, we utilize the paid claims at age 62 of 2.389, and 3.137 at age 67. By interpolation, the paid claims at age 66 is $2.988. The cumulative amount paid out at all ages prior to age 72 is: (2.389 + 2.988) ÷ 2 × 5 (for ages 62-66) + 3.137 × 5 (for ages 67-71) = 13.441 + 15.687 = $29.129. To calculate the claims paid at age 72, run the continuance rates until the maximum remaining benefit, 3,650 – 29.129 = $3,620.871, is reached. From this we determine that the amount of paid claims at age 72 = $6.737.

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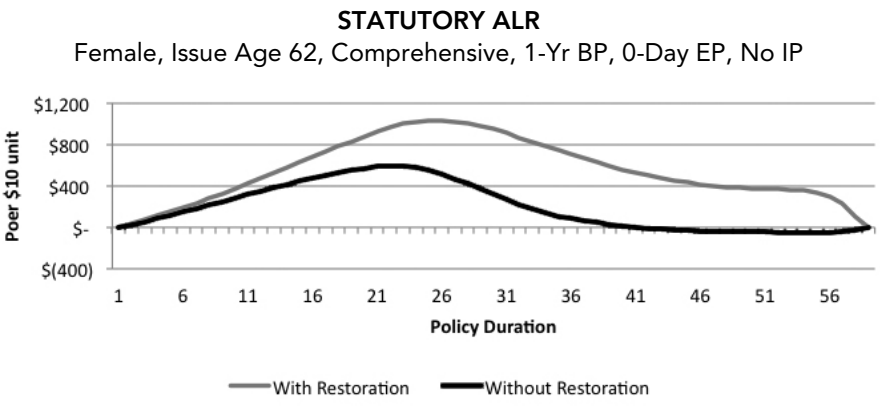
In a similar manner, for the remaining central ages, we can calculate the available MLB and use the continuance rates to calculate the paid claims. Paid claims for the central ages are shown in the 'Without-ROB' column of Figure 1 on page 27.

As illustrated, we can approximate the cumulative paid claims: $3,446.67.

Figure 2. Paid claims by age at disablement, one-year comprehensive benefits.

	ROB					
	With			Without		
Age	NH	ALF	HC	NH	ALF	HC
62	2.10	1.21	3.58	2.10	1.21	3.58
67	2.77	1.60	5.95	2.75	1.58	5.92
72	5.96	3.46	11.95	5.84	3.39	11.78
77	19.68	11.52	20.00	18.70	11.00	19.37
82	45.74	26.66	32.83	40.35	23.82	30.29
87	112.93	66.19	56.24	83.73	50.67	46.10
92	192.08	112.62	70.36	88.81	55.36	40.18
97	226.58	133.24	71.67	44.27	28.13	20.11
102	226.58	133.24	71.67	23.85	15.34	11.94
107	226.58	133.24	71.67	9.30	6.17	5.23
112	226.58	133.24	71.67	5.71	3.79	3.21
117	226.58	133.24	71.67	1.71	1.13	0.96
Total	**$7,679.92**	**$4,511.36**	**$2,825.00**	**$1,632.83**	**$1,005.17**	**$986.70**

Figure 3. Statutory ALR, one-year comprehensive benefits.



With the policy assumptions used here, the policyholder does not use all of his/her benefits. Using more lenient assumptions (i.e., higher claims), the policyholder may run out of benefits prior to attaining age 120, the omega age of the 1994 GAM.

The policy with ROB is expected to have paid claims that are considerably larger than the policy without ROB ($8,770.98 versus $3,446.67).

COMPREHENSIVE, ONE-YEAR BENEFIT PERIOD

For the next example, consider replacing the NH benefit with comprehensive benefits (NH, ALF and HC) – still with a single benefit pool. The underlying mathematics are more complicated: three care settings, incidence and termination rates for each, and transfers between the care settings are all considered. Utilization used is 100 percent for the NH benefit, 75 percent for the ALF benefit and 50 percent for the HC benefit.

Differences between one benefit pool and three benefit pools should be pointed out. Most policies have one MLB for the entire policy, while some policies have separate MLBs for each care setting, or perhaps one MLB for facility coverage (NH and ALF) and one MLB for HC. For multiple MLBs, anti-selective transfers should be considered as one of the MLBs is depleted, while another pool has remaining benefit capacity. Multiple-pool policies force the consideration of these last-minute transfers whether the policy has ROB or not.

Figure 2 illustrates the paid claims by age at disablement for policies with and without ROB.

The policy with ROB has approximate paid claims of: 7,679.92 + 4,511.36 + 2,825.00 = $15,016.28 The policy without ROB has approximate paid claims of: 1632.33 + 1,006.15 + 986.70 = $3,625.19. Figure 3 compares the statutory ALR for these two policies.

Note that the benefit without ROB produces negative reserves in the later durations. As the MLB is reduced, due to past paid claims, the higher attained ages generate incurred claims that are less than the net premium, causing the negative reserves.

LONGER BENEFIT PERIODS

When benefit periods of two years, four years, six years and lifetime, we find the following paid claims as shown in Figure 4.

COMPREHENSIVE, FOUR-YEAR BENEFIT PERIOD, 5 PERCENT COMPOUND IP

If we again look at the policy with a four-year benefit period and comprehensive benefit period, and add 5 percent compound IP, we can calculate the statutory ALR. The results can be found in Figure 5.

In Figure 5, the graph for with-ROB includes an increase beginning around duration 46. This anomaly is caused by the mortality rates for these attained ages. The mortality rate, in general, increases with attained age. However, the 1994 GAM mortality rates for ages 112 through 119 are forced to 0.5.

PRICING ROB

The price of the ROB feature varies with the variables that change the cost of benefits. The primary variables include gender, marital status, issue age and the benefit period. The price also varies with the number of benefit pools and level of underwriting.

As a comparison, the Figure 6 illustrates the cost for insureds who are initially married but their spouse did not apply, and 5 percent compound inflation protection.

To calculate these premium percentages for the ROB, a level annual premium was calculated for the base policy without ROB. A hurdle rate of 15 percent was used.

SUMMARY

With a claim-cost model, many policies without ROB have incurred claims calculated as if the policy includes the ROB feature. In this case, a policy without ROB may be thought to have the same claim incurrals as a policy with ROB. This problem may be further exacerbated by analysis of experience data. If utilization is higher than expected, it may be thought that the upper curve (see, for example, Figure 3 or Figure 5) is even higher than it is, and the entire curve may be raised. In reality, most policies are on the lower curve because they do not have ROB. If utilization is higher during the early policy years, the curve will be higher for these durations, but, because policy benefits are limited, the curve will be lowered for the later durations as benefits begin to run out. In addition to the curve being lower at the later durations, the curve may reach zero sooner, and the curve is shortened, as policies expire.

Figure 4. Paid Claims, female, comprehensive benefits.

ROB Option	Benefit Period			
	2-Year	4-Year	6-Year	Lifetime
With	$26,418.30	$37,988.17	$44,849.90	$61,907.50
Without	7,243.37	14,471.48	21,652.09	61,907.50

Figure 5. Statutory ALR, four-year comprehensive benefits, 5 percent compound IP.

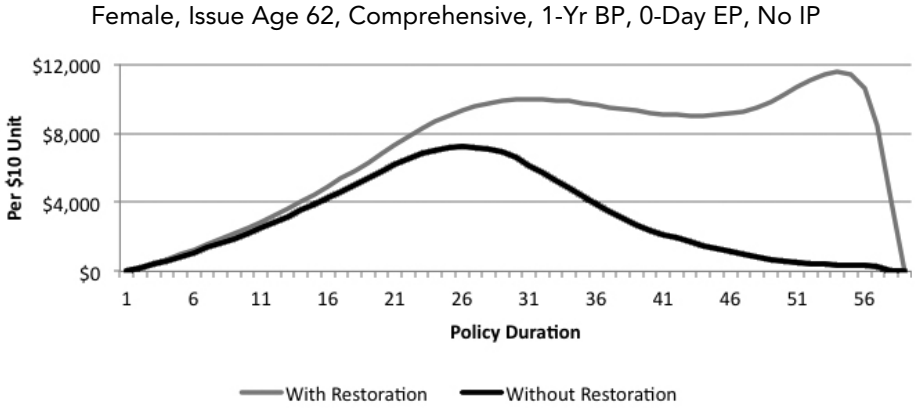


Figure 6. ROB pricing for a single-pool policy.

Benefit Period	Price of ROB as a Percent of Underlying Policy			
	Male		Female	
	Age 22	Age 87	Age 22	Age 87
1-Year	8.9%	14.3%	28.9%	39.7%
2-Year	4.2	6.4	21.8	29.1
4-Year	0.7	1.2	9.5	12.4
6-Year	0.1	0.2	3.5	4.7

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The effect of the ROB can be quite significant for pricing, valuation and projections. The premium for the ROB can also be substantial, especially for females and at the lower MLBs. The move to a first-principles model should reflect this benefit and its importance.

Note: *This is an abridged version of "First Principles LTC – Restoration of Benefits." The article, in its entirety, is available online at* http://www.soa.org/ltc. ■