



AMERICAN ACADEMY *of* ACTUARIES

**Report on Principles-Based Reserves for Participating Whole Life
From the American Academy of Actuaries' Life Reserves Work Group Modeling Team**

**Presented to the National Association of Insurance Commissioners'
Life and Health Actuarial Task Force**

San Antonio, TX – December 2006

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Life Reserves Work Group Modeling Team

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This report of the LRWG illustrates principles-based reserves for participating whole life insurance policies, and compares the results to current reserves and cash values.

The policy used for illustration is a generic hypothetical participating whole life policy with level annual premiums for life issued to a male age 35. Details of the product design, pricing, and experience assumptions are attached in Exhibits 1 and 3. Exhibit 2 provides a perspective on the competitiveness of the illustrated product. Any pricing references are for illustration purposes only and do not reflect a recommended pricing for any particular product.

The reserves illustrated in this report are based on assumptions concerning the investment portfolio and level of market interest rates on the valuation date. The company is assumed to hold an investment portfolio with a book yield of 7.0% net of defaults and investment expenses. Investments in the portfolio are assumed to mature over the 10 years following the valuation date. Whenever cash becomes available, the company is assumed to invest in new 10-year corporate bonds yielding a spread of 70bps over U.S. Treasuries, net of defaults and expenses. Market interest rates on the valuation date are assumed to be those of September 2004, when market interest rates were relatively low. As a result, the discount rate used for deterministic reserves tends to start near 7% and declines by projection year due to assumed re-investment at lower interest rates.

Valuation margins for participating business

The proposed draft regulation from the LRWG says that dividends are to be included in the projection of future cash flows, and that normal company behavior in the adjustment of dividends should be simulated for valuation purposes. However, the regulation also says that a valuation margin should be added to the dividends projected in this manner. This means that the dividends projected for valuation purposes should be greater than those the company would actually expect to pay. The excess is the valuation margin.

For purposes of this illustration, the company is assumed to use a three-factor formula for dividends, and a pricing spread has been introduced in each factor. For example, the interest rate used in the interest component of the dividend is priced to be 0.25% less than the total investment return. The mortality rates used in the mortality component of the dividend are 3% higher than actual experience. A small expense spread is also included in pricing.

For purposes of valuation, the authors of this report assumed that dividends will be higher than actual company practice by eliminating all three spreads. Therefore the valuation margins used in this illustration are equal to the pricing spreads, that is, 0.25% on the interest rate, 3% of mortality rates, and a small expense margin. This leads to a near break-even at time of issue.

Deterministic reserves by duration

Exhibit 4 illustrates deterministic reserves both with and without valuation margins in the assumptions. Note that Exhibit 4 shows only the deterministic reserve, not the stochastic reserve.

Principles-based reserves for policy years 2-10 lie between the cash value and the CRVM reserve. At durations 15 and later, the principles-based reserve is very close to the current CRVM reserve.

Note that companies have some flexibility in setting the level of cash values in early years. The guaranteed cash value could be higher than illustrated here, in which case the cash value floor may come into play in determining the principles-based reserve for this kind of contract. One cannot generalize about the comparison between the early duration cash values and principles-based reserves on participating whole life contracts. However, it is reasonable to generalize that the principles-based reserve in later policy durations will be close to current formulaic reserves.

Stochastic reserves

Exhibit 5 illustrates the reserves for a simulated inforce block consisting of business issued over the last 20 years. The authors of this report assumed that 80% of the policies in force apply dividends to purchase paid-up additions, while the other 20% take their dividends in cash.

The stochastic scenarios were generated using the “SS8b” recalibration of the C-3 phase I interest rate model prepared for the American Academy of Actuaries (Academy) Life Capital Adequacy Subgroup (LCAS). This recalibration includes a mean reversion point of 5.4% for the long Treasury rate. Two hundred (200) scenarios were generated, and the starting yield curve was based on interest rates in late 2004 when short-term rates were under 2%.

The valuation results indicate that the stochastic reserve at the 65CTE level lies between the cash value and the CRVM reserve.

The seriatim deterministic reserve is almost the same as the 65CTE level of the stochastic reserve.

It should be noted that the distribution of scenario reserves for this product is narrow. The difference between the 65CTE level and the 95CTE level is just 3%, suggesting that there is relatively little “tail risk” in this product when using the assumed investment strategy. A histogram illustrating the distribution of the 200 scenario reserves is included in Exhibit 5.

A note on mortality improvement

The assumptions used in this report do not include mortality improvement or any kind of trend in mortality. It is common practice for mortality experience to be directly reflected in the pricing margins used to set participating dividends. Any improvement in mortality costs is likely to be distributed by the company as an increase in future dividends. Since future claims and dividends are both reflected in projected cash flows, and any decrease in claims would be associated with an increase in dividends, one can show that mortality improvement would not affect the reserve. Given the lack of any effect on reserves, we elected not to include the complication of mortality improvement in the modeling done for this paper.

Exhibit 1 – Product Definitions

The LRWG provided the modeling subgroup with the following hypothetical participating whole life product. The modeling subgroup made some changes to the product definition to increase the product's cash value performance.

Model Demographic:

Male
Issue age 35
Preferred nonsmoker underwriting class
\$250,000 face
Issue date: January 1st
80% of policies use dividends to buy additions
20% of policies take dividends in cash

Product Description:

Premium

The gross premium is \$12.40/1000, with a \$65 policy fee, for a total premium of \$3,165. This premium is the average of the six products we studied in Exhibit 1. The premium is payable until age 100, at which point the cash value equals the face amount. We assume that we would refund any premium paid past the date of death.

Guaranteed Cash Values

During the first 5 years, cash values are the minimum allowed by the SNFL. After 20 years, the cash value equals the CRVM reserve. For intermediate years, we develop a net premium that will accumulate from the 5th minimum cash value to the 20th CRVM reserve. We use that net premium to develop the cash values. The cash values are based on the 1980 CSO Combined mortality table, 4% interest, and continuous functions.

Dividends

Dividends are based on the contribution method. There is no first year dividend. There are three components to the dividend-interest return, mortality return and expense return. Additionally, the minimum dividend is .20/1000 of coverage. A prorata dividend is paid upon death based on the portion of the current policy year completed by the date of death.

Base Policy Dividends

Interest Return- $(DIR-.04) * NAR$

DIR = dividend interest rate
.04 = valuation interest rate
Initial reserve = previous year's terminal reserve + $.980644 * BETA$
BETA = CRVM net valuation premium

Mortality Return- $(qval-qdiv) * NAR$

Qval = 80 CSO mortality at the beginning of the year
qdiv = dividend mortality
NAR = death benefit – reserve EOY

Expense Return –

We developed the expense return to fit the two profit goals:
(1) Break-even year, when accumulated assets exceed the reserves.
(2) Profit margin.

Policy Year	Expense Return
1 to 14	-4.03 per 1,000
15 to 19	Grade
20 and up	-1.52 per 1,000

Dividends on Additions

Interest Return- Same as base policy

Mortality Return- Same as base policy

Expense Return – A charge of 50 cents per \$1,000 of face of additions

Exhibit 2 - Competitive Perspective

Male Issue Age 35 Second Best Nonsmoker Underwriting Class
\$250,000 Dividends used to purchase additions

	LRWG	Co 1 Product 1	Co 1 Product 2	Co 2 Product 1	Co 2 Product 2	Co 3	Co 4
Base Premium	3,165	3,295	2,848	3,333	3,788	2,883	2,845

Comparison of Current Cash Values assuming 2006 Dividend Scale

Year	LRWG	Co 1 Product 1	Co 1 Product 2	Co 2 Product 1	Co 2 Product 2	Co 3	Co 4
1	0	0	0	0	0	0	0
2	50	2,615	50	555	3,064	68	128
3	2,453	5,791	2,456	3,857	6,370	2,141	3,077
4	5,675	9,059	5,674	7,245	9,931	5,732	6,135
5	8,983	12,417	8,982	10,747	13,761	9,311	9,314
10	28,695	32,235	27,889	33,230	38,488	28,923	27,362
20	93,088	96,074	86,296	113,272	126,807	84,593	84,723
30	209,817	214,305	190,965	265,736	298,135	180,992	191,078

Cash Value Internal Rate of Return Comparison

10	-1.79%	-0.40%	-0.38%	-0.05%	0.29%	0.06%	-0.71%
20	3.54%	3.47%	3.81%	4.82%	4.68%	3.52%	3.65%
30	4.72%	4.61%	4.78%	5.73%	5.66%	4.41%	4.79%

Death Benefit Internal Rate of Return Comparison

10	36.51%	35.88%	38.25%	36.02%	34.78%	38.14%	38.49%
20	13.17%	12.90%	13.63%	13.58%	13.55%	13.66%	13.90%
30	8.17%	8.03%	8.31%	8.95%	8.90%	8.14%	8.56%

Exhibit 3 – Pricing Assumptions

Net Earned Rate and Dividend Interest Rate

Net earned rate = 7.00% all years (net of defaults and expenses)
 After tax earned rate = 4.55% all years = 7.00% times (1 – tax rate)
Dividend interest rate = 6.75% all years
 DIR spread = 0.25% all years

Mortality

Experience = grading scale of the SOA 1975-80 Select & Ultimate table
 Dividend = 103% of the grading scale of the SOA 1975-80 Ultimate table
 Grading scale = 35% to age 65, then grade linearly to 100% at age 100.

Lapses

PY	Rate	PY	Rate
1	11.0%	11	5.8%
2	10.5%	12	5.6%
3	10.0%	13	5.4%
4	9.5%	14	5.2%
5	9.0%	15	5.0%
6	8.4%	16	4.8%
7	7.8%	17	4.6%
8	7.2%	18	4.4%
9	6.6%	19	4.2%
10	6.0%	20 +	4.0%

Commissions

PY	Comm % of Premium
1	100%
2-4	20%
5-10	5%
11+	2%

Expenses

Acquisition – policy year 1 only:

Per Policy: \$120
 Per Unit: \$1.74
 Per Premium: 18%

Non-Acquisition – all policy years:

Per Policy: \$60
 Per Unit: \$0.13
 Per Premium: 2%
 Inflation: none

Valuation

Formulaic reserve:

Statutory reserves:
 Fully continuous CRVM

4.0% interest
1980 CSO Combined mortality

Tax reserves:

Fully continuous CRVM
4.5% interest
1980 CSO Combined mortality

Target surplus:

400% of the RBC formula:
C-1: 1.3% of assets multiplied by 1-.2625 to account for taxes.
C-2: 0.0009 times NAR
C-3: 1.15% of reserve
C-4: 3.08% of premiums
$$RBC = 0.85 * (C-1 + C-2 + C-3 + C-4) / 2$$

Federal income tax:

Tax rate = 35%
DAC tax % = 7.7% and 100% premium is nonqualified

Profit Measures

Pricing horizon = 30 years
Dividend option = All dividends are paid in cash
Break-even year = 14 as defined as accumulated assets minus reserve
Profit margin = 2.4% (PV 30th year surplus / premiums @ 4.55%)
After Tax ROI = 30 year = 6.7%, lifetime = 7.4%
(Statutory book profits adjusted target surplus)

Exhibit 4 – Deterministic reserves by duration

\$250,000 Whole Life, Issue Age 35 male, Annual Premium of \$3,165, Dividends taken in cash

<u>Duration</u>	<u>Cash Value</u>	<u>CRVM reserve</u>	Principles-based <u>Reserve (no floor)</u>	Best-estimate <u>Liability</u>	<u>Margin</u>
at issue	-	-	210	(341)	551
1	-	-	(1,382)	(2,038)	656
2	-	2,950	1,010	236	774
3	2,353	5,983	3,570	2,651	919
4	5,515	9,100	6,257	5,179	1,078
5	8,763	12,298	9,680	8,405	1,275
10	26,910	29,498	28,510	26,537	1,972
15	47,300	48,733	49,230	46,598	2,633
20	69,900	69,900	70,939	67,728	3,211
30	115,848	115,848	116,920	112,854	4,067
40	161,555	161,555	162,492	158,217	4,275

Exhibit 5 - Results for the 20 Year Simulated Inforce

Basis		Reserve
Cash Value	\$	27,239,681
Current Formulaic (CRVM)	\$	30,278,404
Principles-Based Best Estimates GPVAD	\$	25,793,173
Principles-Based Deterministic GPVAD	\$	28,702,635
Margin ratio *		16%
Principles-Based Stochastic GPVAD (95 CTE)	\$	29,682,207
Principles-Based Stochastic GPVAD (90 CTE)	\$	29,300,164
Principles-Based Stochastic GPVAD (85 CTE)	\$	29,124,369
Principles-Based Stochastic GPVAD (80 CTE)	\$	29,006,007
Principles-Based Stochastic GPVAD (75 CTE)	\$	28,919,128
Principles-Based Stochastic GPVAD (70 CTE)	\$	28,854,007
Principles-Based Stochastic GPVAD (65 CTE)	\$	28,798,524
Principles-Based Stochastic GPVAD (60 CTE)	\$	28,751,803
Principles-Based Stochastic GPVAD (55 CTE)	\$	28,707,756
Principles-Based Stochastic GPVAD (50 CTE)	\$	28,667,350

* In accordance with guidance recently drafted for computation of the margin ratio by the LRWG, the denominator is based on a level of capital equal to statutory RBC at the company action level. For pricing purposes the company was assumed to actually hold capital of twice that level.

