AMERICAN ACADEMY *of* ACTUARIES

Report on Principles-Based Reserves for Universal Life with a Secondary Guarantee based on a Shadow Fund from the American Academy of Actuaries' Life Reserves Work Group

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

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This report illustrates principles-based reserves for Universal Life policies with secondary guarantees, and compares the results to current reserves under AG 38.

The policies used for illustration are shadow fund designs, and the assumed premium pattern is level annual premiums. Two issue ages are studied, age 45 and age 75, both for select male insureds. The policies are priced to be profitable under the best-estimate experience assumptions used in this example. Details of the product design, pricing, and experience assumptions are attached in Exhibits 1 and 3. Pricing assumptions are strictly for illustrative purposes and should be presumed to be appropriate for pricing only in the context of these illustrations. Mortality assumptions reflect select experience that is better than 2001 CSO.

The reserves illustrated in this report are based on assumptions beyond the product design and pricing assumptions. The company is assumed to hold an investment portfolio with a book yield of 6.0% net of defaults and investment expenses. Investments in the portfolio are assumed to mature over the 10 years following the valuation date. In addition, the 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 6% and declines by projection year due to assumed re-investment at lower interest rates. All future investments are assumed to be in 10-year bonds, with a net spread of 70 basis points over Treasuries, net of defaults and expenses. The interest rate generator used for stochastic scenarios is the one currently in use for C-3 Phase I RBC.

Exhibit 4 illustrates deterministic reserves at various levels of margins in the assumptions. Levels 1 to 3 are similar to those used in our earlier report on 20-year term. Level 4 margins lead to breakeven at issue. That is, they approximately equate the present value of premiums with the present value of benefits and expenses in the deterministic scenario. Level 5 margins represent the minimum that might be allowed, and are discussed later in the "Note on pricing" section.   Note that Exhibit 4 shows only the deterministic reserve, not the stochastic reserve.

Exhibit 5 illustrates the deterministic and stochastic reserves for a simulated inforce block consisting of business issued over the last 20 years. The results indicate that the stochastic reserve at the 65CTE level exceeds the deterministic reserve by about 6%.   This is an indication of the importance of including the stochastic calculation when reserving for products such as this with significant tail risk.

The results in Exhibit 5 also show that the stochastic reserve at the 65CTE level is 18% less than the current AG38 reserve for this simulated block of business. While it is dangerous to generalize, this suggests that reserves under AG38 are higher than principles-based reserves for this product with the assumed experience.

Exhibit 6 shows how the emergence of earnings might be affected by a change to principles-based reserves and RBC for this product. The operating statement at the top of the page uses principles-based reserves with level 4 margins, while the operating statement at the bottom of the page uses AG38 reserves. Both statements show a substantial first year loss due to heavy acquisition costs. However, most of that loss is recovered in the second year when using principles-based reserves, while significant losses occur in several later years when using AG38 reserves.

The remainder of this report consists of other observations arising from our analysis of the sample UL policies with secondary guarantees.

Competitive nature of the market

The premiums for issue age 45 and 75 were set at a level that would produce a profit in the range of that historically reported by life insurers under the experience assumptions used in this example. The market perspective in Exhibit 2 indicates that the age 45 premium is competitive, but the age 75 premium is not as competitive.

Several observers have noted that the current market at older issue ages is highly competitive. Insurers may be able to earn a profit at lower premium levels if their experience is different than that assumed for purposes of these illustrations. Such experience could include lower expenses, better mortality, higher lapse rates or higher investment returns.

In competitive markets like this, profit margins in pricing can be squeezed. Under the principles-based approach, if premiums are set unusually low, all else being equal, the reserve would be higher. That's because the present value of premiums is an offset to the present value of benefits. If premiums are lowered while the present value of benefits is unchanged, then the reserve will be higher.

Mortality improvement

The best estimate assumptions used in pricing include future mortality improvement. For these illustrations we used a mortality projection scale with rates of improvement that varied by attained age. The rates of improvement used were 1.00% per year for attained ages 0-60, declining by 0.04% per year for each age over 60, to zero at attained age 85. The improvement was applied exponentially, as in $(1-r)^n$ rather than arithmetically, as in $(1-nr)$.

While mortality improvement assumptions were used in pricing, they did not have a significant impact on the premiums set for either cell. This may have resulted from grading off the improvement assumed at older ages, where most death claims occur.

The draft model regulation does not allow a provision for mortality improvement in the reserve assumptions. Nevertheless, we recognize that under current conditions with a long historical trend of improvement, the assumption of no future mortality improvement represents part of the margin for conservatism in the reserve.

Note on pricing

We reflected principles-based reserves and RBC in our pricing of the illustrated products. Since one pricing measure was the IRR on distributable earnings, we needed reserves and RBC by policy duration. Since the stochastic reserve is calculated in the aggregate and not by duration, we needed an approximate way to attribute a portion of the stochastic add-on to the deterministic reserve for the inforce to individual policies at each duration. After some research[1] we developed the following approximations for this purpose:

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[1] Our research amounted to calculating the stochastic and deterministic reserves separately for a) all inforce policies at duration 5, b) all inforce policies at duration 20, and c) all inforce policies at durations 1-20 combined. The formulas shown closely replicated the

Excess of stochastic reserve over deterministic reserve =
18% of premium + 2.7% of deterministic reserve

Excess of capital requirement (for C3 only) over stochastic reserve =
25% of premium + 3.0% of deterministic reserve

Note that the add-on for the stochastic reserve should be considered when determining the level of reserve margins that lead to "breakeven" at issue. The deterministic reserve at issue must be negative if the stochastic reserve is to be zero. With this in mind, Exhibit 4 shows deterministic reserves with margins at level 5, which is "minimum" margins consisting of the deterministic interest rate scenario and no mortality improvement. The deterministic reserve at issue is negative, but with the stochastic add-on the reported reserve would be positive, indicating a loss at issue.

For illustrative purposes, we used 90CTE in our pre-tax calculation as RBC for the C3 risk. The results of the stochastic valuation show that the 90CTE exceeds the 65CTE by 6%.

Z-values

A value called "Z" has been proposed as a measure of the size of risk margins included in a reserve. Z is calculated as:

Z = ((reserve held) - (best estimate liability)) / (present value of projected capital requirements)

where,

the best estimate liability is the deterministic reserve calculated using best estimate assumptions with no cash value floor; and

the present value of the projected capital requirements is the value of an annuity whose annual payment is the amount of capital held in that year to back the liability, using the same discount rates as are used for the deterministic reserve.

Theoretically, Z is the excess of the pre-tax return on equity over the investment yield. However, this theory doesn't explain why the Z values shown for this product are so high. The pricing pre-tax IRR is 12% or 13% (depending on issue age) and the investment return is 6%, so why is Z greater than 7% when measured at time of issue?

The answer lies in the fact that in this situation, the denominator of Z understates the total capital requirement. The denominator includes only the explicit amount of capital held in excess of reported reserves. However, the reserves used in calculating the pricing IRR were at a level that creates a loss at issue. The loss at issue means that the reserves include an implicit extra capital requirement that is not included in the denominator when calculating Z. Because the denominator understates the full capital requirement, Z is higher than the pricing IRR would imply. Nevertheless, this higher value of Z does accurately reflect the degree of margin included in the reserve.

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excess of stochastic over deterministic reserves in all three cases. Since we only tested policies in their first 20 durations, these approximations may not be as good for policies in later durations.

For this study we calculated the pricing IRR using stochastic reserves with minimum margins (level 5). Minimum margins consist of the deterministic scenario for discount rates and no mortality improvement. While the deterministic reserve shown in Exhibit 4 is negative at issue when using level 5 margins, the stochastic reserve would be positive. As was noted earlier in this report, the stochastic reserve would exceed the deterministic reserve at issue by about 18% of premium.

Effect of investment strategy

Some observers have suggested that the investment strategy of using 10-year bonds is not appropriate for this product with its long-term guarantees. Therefore we studied the effect of changing the company's investment strategy from investing in 10-year bonds to investing in 20-year bonds. With that change to both the existing portfolio on the valuation date and the strategy for future new investments, we expected the following effects:

1. The reserve for the inforce block may be reduced because the discount rate would be higher. The discount rates would be higher because the portfolio earned rate would be higher. The existing assets would run off more slowly and less money would be re-invested at current low interest rates. The 20-year strategy also means that future investments would generally be made at higher returns (than under the 10-year strategy) due to the typically positive slope of the yield curve.
2. The tail risk might be reduced due to better matching of assets and liabilities.

Exhibit 7 shows the reserves based on this change in assumed investment strategy. Both the deterministic and stochastic reserves are reduced by about 6% compared to using the 10-year investment strategy under these conditions. However, the stochastic reserve is still substantially higher than the deterministic reserve. Since much of the interest rate risk with this product is related to interest rates at which future premiums will be invested, it appears that lengthening the term of assets that are purchased narrows the distribution of the stochastic reserve only slightly, although the entire distribution is shifted to a lower level.

Exhibit 1

Product Description and Pricing: Issue Age 45

Plan of Insurance:	Universal Life with Shadow Fund
Insured Life:	Male Age 45 Best NonTobacco

Amount of Insurance:	$1,000,000 face
Length of premium paying period:	To Age 100
Mode of premium payment:	Annual
Target Premium:	$8,400
Level Gross Premium:	$8,233

Pre-Tax IRR on Distr. Earnings	13.4%
Profit Margin (PV of Profit/PV of Premium) at 6%	14.2%
Breakeven Year (Profit Accum at 6%)	16

* Required Surplus was calculated as 6% of reserve plus $1.30 per 1000 of Net Amount at Risk plus 25% of premium.

Product Description and Pricing: Issue Age 75

Plan of Insurance:	Universal Life with Shadow Fund
Insured Life:	Male Age 75 Best NonTobacco

Amount of Insurance:	$1,000,000 face
Length of premium paying period:	To Age 100
Mode of premium payment:	Annual
Target Premium:	$51,700
Level Gross premium:	$49,520

Pre-Tax IRR on Distr. Earnings	12.2%
Profit Margin (PV of Profit/PV of Premium) at 6%	4.5%
Breakeven Year (Profit Accum at 6%)	14

* Required Surplus was calculated as 6% of reserve plus $1.30 per 1000 of Net Amount at Risk plus 25% of premium.

Exhibit 1 (continued)

Shadow Fund Description

The shadow fund value at any duration equals the prior shadow fund value plus a net premium less a fund charge accumulated at an interest rate. All items are guaranteed.

- The net premium is 65% of the premium paid in a given year up to the target premium plus 50% in excess of the target premium.
- The fund charge is a defined "COI" times the face amount. Further, to the extent that the total fund charge in any policy year exceeds 65% of the target premium, only $10/13^{th}$ of the total fund charge in excess of the target premium is charged. For example, at issue age 45, the COI charge is 12.157988 per thousand, while the target premium is 8.40 per thousand. The COI charge against the fund is thus $8.40 plus 10/13 of $3.757988, or $11.29076 per thousand.
- The interest rate is prescribed and varies by duration 1-10, 11-20, and 21+. It also varies by issue age.

Details of shadow fund loads, COI charges, and interest rates are shown in the tables below.

	Male 45 Best Class Non-Tobacco					Male 75 Best Class Non-Tobacco			
Duration	Load on Target Premium	Load on Excess Premium	Annual COI per 1000	Credited Rate	Duration	Load on Target Premium	Load on Excess Premium	Annual COI per 1000	Credited Rate
1	35.0%	50.0%	5.167903	5.0%	1	35.0%	50.0%	27.072719	11.0%
2	35.0%	50.0%	3.998931	5.0%	2	35.0%	50.0%	18.565538	11.0%
3	35.0%	50.0%	0.857553	5.0%	3	35.0%	50.0%	10.058360	11.0%
4	35.0%	50.0%	1.001379	5.0%	4	35.0%	50.0%	12.268162	11.0%
5	35.0%	50.0%	1.167401	5.0%	5	35.0%	50.0%	14.016228	11.0%
6	35.0%	50.0%	1.366595	5.0%	6	35.0%	50.0%	16.275393	11.0%
7	35.0%	50.0%	1.604450	5.0%	7	35.0%	50.0%	18.480658	11.0%
8	35.0%	50.0%	1.847954	5.0%	8	35.0%	50.0%	21.676616	11.0%
9	35.0%	50.0%	2.096867	5.0%	9	35.0%	50.0%	26.513034	11.0%
10	35.0%	50.0%	2.356917	5.0%	10	35.0%	50.0%	31.573606	11.0%
11	35.0%	50.0%	2.688881	5.5%	11	35.0%	50.0%	37.667295	11.5%
12	35.0%	50.0%	3.092836	5.5%	12	35.0%	50.0%	44.357235	11.5%
13	35.0%	50.0%	3.435860	5.5%	13	35.0%	50.0%	52.112613	11.5%
14	35.0%	50.0%	3.745707	5.5%	14	35.0%	50.0%	60.791589	11.5%
15	35.0%	50.0%	4.160641	5.5%	15	35.0%	50.0%	70.379176	11.5%
16	35.0%	50.0%	4.680742	5.5%	16	35.0%	50.0%	79.063966	11.5%
17	35.0%	50.0%	5.267187	5.5%	17	35.0%	50.0%	85.503304	11.5%
18	35.0%	50.0%	5.916458	5.5%	18	35.0%	50.0%	95.680492	11.5%
19	35.0%	50.0%	6.585629	5.5%	19	35.0%	50.0%	107.099249	11.5%
20	35.0%	50.0%	7.271603	5.5%	20	35.0%	50.0%	114.965095	11.5%
21	35.0%	50.0%	8.031862	15.0%	21	35.0%	50.0%	122.067105	15.0%
22	35.0%	50.0%	8.800550	15.0%	22	35.0%	50.0%	129.693968	15.0%
23	35.0%	50.0%	9.690891	15.0%	23	35.0%	50.0%	137.751832	15.0%
24	35.0%	50.0%	10.852420	15.0%	24	35.0%	50.0%	146.346185	15.0%
25	35.0%	50.0%	12.157988	15.0%	25	35.0%	50.0%	155.510099	15.0%
26	35.0%	50.0%	13.983359	15.0%					
27	35.0%	50.0%	15.488287	15.0%					
28	35.0%	50.0%	17.247216	15.0%					
29	35.0%	50.0%	19.100739	15.0%					
30	35.0%	50.0%	21.092597	15.0%					
31	35.0%	50.0%	23.260969	15.0%					
32	35.0%	50.0%	25.706424	15.0%					
33	35.0%	50.0%	28.550347	15.0%					
34	35.0%	50.0%	31.853437	15.0%					
35	35.0%	50.0%	35.554334	15.0%					
36	35.0%	50.0%	39.681804	15.0%					
37	35.0%	50.0%	44.168911	15.0%					
38	35.0%	50.0%	48.921664	15.0%					
39	35.0%	50.0%	54.111438	15.0%					
40	35.0%	50.0%	59.882168	15.0%					
41	35.0%	50.0%	66.299714	15.0%					
42	35.0%	50.0%	73.359567	15.0%					
43	35.0%	50.0%	80.989319	15.0%					
44	35.0%	50.0%	89.100430	15.0%					
45	35.0%	50.0%	97.609930	15.0%					
46	35.0%	50.0%	106.086256	15.0%					
47	35.0%	50.0%	114.429734	15.0%					
48	35.0%	50.0%	123.171599	15.0%					
49	35.0%	50.0%	132.389256	15.0%					
50	35.0%	50.0%	142.099329	15.0%					
51	35.0%	50.0%	151.715373	15.0%					
52	35.0%	50.0%	161.104540	15.0%					
53	35.0%	50.0%	171.107914	15.0%					
54	35.0%	50.0%	181.775137	15.0%					
55	35.0%	50.0%	193.156164	15.0%					

Exhibit 2
Market Perspective

Issue Age 45 Best Non Tobacco $1,000,000   Issue Age 75 Best Non Tobacco $1,000,000

	Company	Guaranteed Level Premium*		Company	Guaranteed Level Premium*
1	Company 1	$7,080.00	1	Company 1	$30,352.00
2	Company 2	$7,122.00	2	Company 2	$32,419.00
3	Company 3	$7,498.74	3	Company 3	$33,384.00
4	Company 4	$7,538.00	4	Company 4	$33,477.00
5	Company 5	$7,570.00	5	Company 5	$33,661.00
6	Company 6	$7,571.00	6	Company 6	$33,760.00
7	Company 7	$7,676.00	7	Company 7	$33,760.00
8	Company 8	$7,680.00	8	Company 8	$34,260.00
9	Company 9	$7,800.00	9	Company 9	$34,945.00
10	Company 10	$7,854.00	10	Company 10	$35,061.00
11	Company 11	$7,862.00	11	Company 11	$35,159.00
12	Company 12	$7,900.00	12	Company 12	$35,161.00
13	Company 13	$7,965.00	13	Company 13	$35,556.00
14	Company 14	$7,976.00	14	Company 14	$35,960.00
15	Company 15	$7,990.00	15	Company 15	$36,041.00
16	Company 16	$8,000.00	16	Company 16	$36,100.00
17	Company 17	$8,022.00	17	Company 17	$36,200.00
18	Company 18	$8,025.00	18	Company 18	$36,267.00
19	Company 19	$8,026.00	19	Company 19	$36,788.00
20	Company 20	$8,033.00	20	Company 20	$37,000.00
21	Company 21	$8,181.00	21	Company 21	$37,500.00
22	Company 22	$8,230.00	22	Company 22	$37,656.00
23	**LRWG - UL Shadow Fund**	**$8,233.00**	23	Company 23	$37,712.00
24	Company 23	$8,256.00	24	Company 24	$37,712.00
25	Company 24	$8,282.00	25	Company 25	$37,740.00
26	Company 25	$8,282.00	26	Company 26	$37,924.37
27	Company 26	$8,300.00	27	Company 27	$37,936.00
28	Company 27	$8,300.00	28	Company 28	$38,161.00
29	Company 28	$8,416.00	29	Company 29	$38,323.00
30	Company 29	$8,447.00	30	Company 30	$38,486.00
31	Company 30	$8,624.00	31	Company 31	$38,591.54
32	Company 31	$8,793.00	32	Company 32	$38,799.00
33	Company 32	$8,904.00	33	Company 33	$40,017.00
34	Company 33	$9,003.00	34	Company 34	$40,237.00
35	Company 34	$9,055.00	35	Company 35	$40,250.00
36	Company 35	$9,085.00	36	Company 36	$40,384.00
37	Company 36	$9,187.00	37	Company 37	$40,460.00
38	Company 37	$9,696.00	38	Company 38	$40,714.00
39	Company 38	$9,896.00	39	Company 39	$40,812.00
40	Company 39	$10,109.00	40	Company 40	$41,430.00
41	Company 40	$10,520.00	41	Company 41	$42,119.00
42	Company 41	$10,590.00	42	Company 42	$45,323.00
43	Company 42	$11,985.00	**43**	**LRWG - UL Shadow Fund**	**$49,520.00**
44	Company 43	$12,488.00	44	Company 43	$51,385.00
45	Company 44	$12,784.00	45	Company 44	$62,001.00
46	Company 45	$15,370.00	46	Company 45	$74,050.00
47	Company 46	$16,350.00	47	Company 46	$83,820.00
			48	Company 47	$83,880.00

* source: Blease Research 7/1/2004 Full Disclosure Software

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Exhibit 3, part 1

Valuation Assumptions Issue Age 45

Mortality rates

Attained age	Pricing Estimate per 1000	with mortality improvement*	with margin of 9.375/ex	with margin of 3.5/ex	with 2001 CSO margin
45	0.2813	0.2785	0.5042	0.3645	0.6284
46	0.4122	0.4040	0.6405	0.4974	0.7815
47	0.5314	0.5156	0.7652	0.6187	0.9243
48	0.6280	0.6033	0.8677	0.7175	1.0461
49	0.7104	0.6756	0.9562	0.8022	1.1553
50	0.7950	0.7485	1.0473	0.8892	1.2686
51	0.8798	0.8201	1.1389	0.9765	1.3840
52	0.9700	0.8951	1.2362	1.0694	1.5069
53	1.0763	0.9832	1.3500	1.1785	1.6482
54	1.2463	1.1271	1.5279	1.3514	1.8557
55	1.3965	1.2504	1.6864	1.5048	2.0459
56	1.6659	1.4767	1.9647	1.7775	2.3583
57	1.9469	1.7084	2.2549	2.0619	2.6853
58	2.2653	1.9680	2.5832	2.3840	3.0530
59	2.5505	2.1936	2.8787	2.6730	3.3911
60	2.9004	2.4695	3.2396	3.0270	3.7978
61	3.2322	2.7433	3.5831	3.3632	4.1908
62	3.6383	3.0807	4.0016	3.7739	4.6627
63	4.0717	3.4423	4.4483	4.2123	5.1672
64	4.5611	3.8530	4.9518	4.7070	5.7333
65	5.0969	4.3057	5.5026	5.2483	6.3519
66	5.6951	4.8152	6.1169	5.8526	7.0399
67	6.4157	5.4333	6.8547	6.5796	7.8578
68	7.2148	6.1250	7.6723	7.3856	8.7625
69	8.1245	6.9197	8.6019	8.3027	9.7869
70	9.1022	7.7838	9.6009	9.2884	10.8895
71	10.2531	8.8106	10.7747	10.4478	12.1765
72	11.5673	9.9962	12.1136	11.7713	13.6392
73	13.0314	11.3342	13.6045	13.2454	15.2657
74	14.6012	12.7919	15.2031	14.8259	17.0132
75	16.5055	14.5770	17.1386	16.7418	19.1124
76	18.5090	16.4916	19.1761	18.7581	21.3300
77	20.7674	18.6830	21.4712	21.0301	23.8238
78	23.4040	21.2758	24.1479	23.6817	26.7201
79	26.4708	24.3356	27.2583	26.7648	30.0735
80	29.7182	27.6517	30.5531	30.0299	33.6369
81	33.6283	31.6938	34.5151	33.9594	37.8969
82	37.9923	36.2977	38.9354	38.3444	42.6474
83	42.8760	41.5584	43.8805	43.2510	47.9584
84	47.9476	47.1864	49.0190	48.3476	53.5024
85	53.7720	53.7720	54.9165	54.1993	59.8516
86	60.4335	60.4335	61.6579	60.8906	67.0953
87	67.6116	67.6116	68.9229	68.1011	74.9175
88	75.5387	75.5387	76.9447	76.0636	83.5583
89	84.4779	84.4779	85.9870	85.0413	93.2872
90	94.2091	94.2091	95.8294	94.8140	103.8880

Withdrawal Rates
Level Pay

Att Age	Pricing Estimate	with 30% Margin
45	4.00%	2.80%
46	3.80%	2.66%
47	3.60%	2.52%
48	3.40%	2.38%
49	3.20%	2.24%
50-54	3.00%	2.10%
55-64	1.80%	1.26%
65-89	1.20%	0.84%
90+	1.00%	0.70%

Dynamic Lapse: 0.00% while FV < 0

Expense Assumptions

Non Acquisition		Best Estimate	with 5% Margin
Per Policy		$40.00	$42.00
Per Unit		$0.00	$0.00
Per Death		$100.00	$105.00
Per Surrender		$20.00	$21.00
Prem Taxes		2.50%	2.63%
Acquisition			
Per Policy		73.74	73.74
% of Targ Prem		10	10
Per Unit		1.29	1.29
Commissions	Yrs		
% of Target	1	120%	120%
% of Premium	1-10	5%	5%
% of Premium	11+	2%	2%

* Mortality improvement is assumed on an attained age basis. The assumed rate of mortality improvement is 1.0% per year through attained age 60, then declining by 0.04% per attained age to zero at attained age 85. Since the improvement is by attained age, not by policy duration, no improvement in current mortality rates is assumed for attained ages over 85.

Exhibit 3, part 2

Valuation Assumptions Issue Ages 45 and 75

Mortality rates Issue Age 45 continued

Attained age	Pricing Estimate per 1000	with mortality improvement*	with margin of 9.375/ex	With margin of 3.5/ex	with 2001 CSO margin
91	104.1101	104.1101	105.8502	104.7597	114.7435
92	114.3815	114.3815	116.2514	115.0796	126.0680
93	125.3591	125.3591	127.3704	126.1100	138.2125
94	137.0957	137.0957	139.2612	137.9041	151.2432
95	149.6560	149.6560	151.9898	150.5273	165.2396
96	163.6224	163.6224	166.1398	164.5622	180.7995
97	178.5908	178.5908	181.3061	179.6045	197.5193
98	194.4315	194.4315	197.3582	195.5241	215.2705
99	211.2181	211.2181	214.3680	212.3941	234.1214
100	229.0296	229.0296	232.4100	230.2916	254.1256
101	244.3807	244.3807	247.9904	245.7283	269.8388
102	260.0610	260.0610	263.9076	261.4971	285.7626
103	272.7194	272.7194	276.8066	274.2453	298.5109
104	286.2665	286.2665	290.6190	287.8914	312.1170
105	300.7187	300.7187	305.3648	302.4532	326.5882
106	316.3960	316.3960	321.3680	318.2522	342.2345
107	333.0225	333.0225	338.3545	335.0131	358.7524
108	350.4663	350.4663	356.1962	352.6054	375.9894
109	368.3879	368.3879	374.5598	370.6921	393.5889
110	388.5546	388.5546	395.2275	391.0458	413.3244
111	409.6854	409.6854	416.9095	412.3824	433.8198
112	432.2250	432.2250	440.0481	435.1456	455.4565
113	456.2760	456.2760	464.7170	459.4273	478.2092
114	481.9272	481.9272	490.9186	485.2840	501.9528
115	509.2932	509.2932	518.5517	512.7497	526.4769
116	458.5020	458.5020	467.3170	461.7929	471.5906
117	489.6270	489.6270	499.3517	493.2576	500.4564
118	522.8255	522.8255	533.3724	526.7630	530.6555
119	568.3739	568.3739	579.2395	572.4304	572.4072
120	1000.0000	1000.0000	1000.0000	1000.0000	1000.0000

Deterministic Interest Rates

Projection year	Best Estimate	With Margin
1	6.00%	5.74%
2	6.00%	5.62%
3	6.00%	5.51%
4	6.00%	5.42%
5	6.00%	5.33%
6	6.00%	5.24%
7	6.00%	5.16%
8	6.00%	5.09%
9	6.00%	5.01%
10	6.00%	4.94%
11	6.00%	4.95%
12	6.00%	4.96%
13	6.00%	4.97%
14	6.00%	4.98%
15	6.00%	4.98%
16	6.00%	4.99%
17	6.00%	4.99%
18	6.00%	5.00%
19	6.00%	5.00%
20	6.00%	5.00%

Exhibit 3, part 3

Valuation Assumptions Issue Age 75

	Mortality rates				
Attained age	Pricing Estimate per 1000	with mortality improvement*	with margin of 9.375/ex	with margin of 3.5/ex	with 2001 CSO margin
75	5.4128	5.3911	5.9951	5.6302	7.8103
76	7.5655	7.5111	8.1827	7.7959	10.1760
77	10.3300	10.2312	10.9855	10.5747	13.1764
78	13.8202	13.6661	14.5171	14.0804	16.9268
79	17.7370	17.5251	18.4786	18.0138	21.1297
80	21.2706	21.0166	22.0605	21.5655	24.9776
81	25.5565	25.2717	26.3990	25.8711	29.6121
82	30.0144	29.7275	30.9142	30.3504	34.4554
83	35.3316	35.0780	36.2940	35.6909	40.2006
84	39.5366	39.3787	40.5670	39.9212	44.8790
85	44.8375	44.8375	45.9439	45.2506	50.7150
86	52.3283	52.3283	53.5194	52.7730	58.8090
87	61.1682	61.1682	62.4515	61.6473	68.3180
88	71.0869	71.0869	72.4693	71.6030	78.9721
89	81.5244	81.5244	83.0124	82.0799	90.2110
90	91.2314	91.2314	92.8313	91.8287	100.7885
91	101.2159	101.2159	102.9368	101.8584	111.7319
92	111.7663	111.7663	113.6187	112.4579	123.3431
93	123.1989	123.1989	125.1944	123.9439	135.9515
94	135.4675	135.4675	137.6186	136.2705	149.5211
95	148.8133	148.8133	151.1332	149.6794	164.3043
96	162.5006	162.5006	165.0023	163.4346	179.5699
97	177.0963	177.0963	179.7944	178.1036	195.9043
98	192.7607	192.7607	195.6699	193.8468	213.4752
99	209.6112	209.6112	212.7445	210.7810	232.3948
100	227.7725	227.7725	231.1382	229.0290	252.7596
101	242.9047	242.9047	246.5007	244.2472	268.2670
102	258.8729	258.8729	262.7097	260.3053	284.5088
103	271.8627	271.8627	275.9442	273.3865	297.6188
104	285.7920	285.7920	290.1433	287.4165	311.6352
105	300.7271	300.7271	305.3759	302.4627	326.6114
106	316.4030	316.4030	321.3793	318.2608	342.2636
107	333.0279	333.0279	338.3669	335.0211	358.7919
108	350.4701	350.4701	356.2121	352.6138	376.0473
109	368.3901	368.3901	374.5836	370.7024	393.6796
110	388.5546	388.5546	395.2677	391.0608	413.4735
111	409.6854	409.6854	416.9869	412.4113	434.0782
112	432.2250	432.2250	440.2031	435.2035	455.9169
113	456.2760	456.2760	465.0407	459.5482	479.0502
114	481.9272	481.9272	491.6198	485.5458	503.5146
115	509.2932	509.2932	520.1066	513.3302	529.3628
116	538.4790	538.4790	550.7051	543.0434	556.6324
117	569.6040	569.6040	583.7771	574.8953	585.3872
118	602.8025	602.8025	620.2648	609.3218	615.7665
119	648.3509	648.3509	675.0110	658.3040	658.2472
120	1000.0000	1000.0000	1000.0000	1000.0000	1000.0000

Withdrawal Rates
Level Pay

Att Age	Pricing Estimate	with 30% Margin
75	2.20%	1.54%
76	2.00%	1.40%
77	1.80%	1.26%
78	1.60%	1.12%
79	1.40%	0.98%
80-89	1.20%	0.84%
90+	1.00%	0.70%
Dynamic Lapse: 0.00% while FV < 0		

Expense Assumptions

Non Acquisition		Best Estimate	with 5% Margin
Per Policy		$40.00	$42.00
Per Unit		$0.00	$0.00
Per Death		$100.00	$105.00
Per Surrender		$20.00	$21.00
Prem Taxes		2.50%	2.63%
Acquisition			
Per Policy		73.74	73.74
% of Targ Prem		10	10
Per Unit		1.29	1.29
Commissions	Yrs		
% of Target	1	120%	120%
% of Premium	1-10	5%	5%
% of Premium	11+	2%	2%

Exhibit 4

The tables in Exhibit 4 require some explanation. There are two pages of tables. The first page shows values for issue age 45, and the second page shows values for issue age 75.

The top table on each page shows deterministic reserves by duration at several levels of margin. The columns on the left-hand side of the table shows parameters of the policy being valued, including the fund value and cash value. The right hand side of the table shows the deterministic reserves, with each column corresponding to a different level of margins. The far right hand column shows the deterministic reserve with no margins, that is, using best estimates.

The second table on each page shows the dollar amount of reserve margins. The numbers in each column reflect the excess of the reserve in that column of the first table over the best estimate liability in the right hand column of the first table.

The right-hand column in the second table shows the present value of required capital. This is the denominator for the Z values shown at the bottom of the table.

It is important to recognize that all of the figures shown in Exhibit 4 are deterministic reserves. The excess of the stochastic reserve over the deterministic reserve is not included.

Exhibit 4, part 1

Terminal Reserves by Policy Year
UL Shadow Fund Issue Age 45, Male Best Class, $1M Face

Policy Dur	Gross Prem	Fund Value	Cash Value	Shadow Fund	Formulaic Reserves	Deterministic Reserve — Principles-Based Reserves: Level of Margins (1)	(2)	(3)	(4)	(5)	Best Estimates
0	0	0	0	0	0	13,755	7,487	5,145	92	(522)	(13,865)
1	8,233	4,638	0	312	43	9,185	2,536	148	(5,275)	(5,929)	(20,585)
2	8,233	9,307	0	1,840	6,140	17,128	10,092	7,659	1,935	1,239	(14,778)
3	8,233	14,047	0	6,670	11,947	25,534	18,107	15,633	9,679	8,941	(8,480)
4	8,233	18,901	0	11,595	21,916	34,440	26,621	24,107	18,000	17,219	(1,642)
5	8,233	23,839	0	16,595	32,140	43,875	35,663	33,112	26,932	26,106	5,778
10	8,233	56,429	33,869	41,842	113,966	98,731	88,473	85,753	79,941	78,858	50,560
20	8,233	168,458	166,408	85,792	323,901	238,692	225,090	222,321	217,099	215,495	175,365
30	8,233	318,102	318,102	240,502	536,476	416,693	401,430	398,941	394,106	392,056	353,302
40	8,233	430,113	430,113	483,273	708,521	611,711	596,991	595,020	590,817	588,614	564,420
50	8,233	(59,953)	0	479,268	844,459	784,922	772,730	771,341	772,261	770,446	756,287
60	0	(2,342,634)	0	50,000	936,727	883,833	877,228	876,133	876,798	875,451	868,320
70	0	(2,342,634)	0	50,000	970,246	923,951	923,018	922,036	922,458	921,422	917,734

Reserve Margins (Assuming Floor of Zero)
UL Shadow Fund Issue Age 45, Male Best Class, $1M Face

Policy Dur		Formulaic Reserves	Deterministic Reserve — Principles-Based Reserves: Level of Margins (1)	(2)	(3)	(4)	(5)	PV of Req Cap
0		13,865	27,620	21,352	19,010	13,957	13,865	119,631
1		20,628	29,770	23,121	20,733	20,585	20,585	
2		20,918	31,906	24,870	22,437	16,713	16,017	
3		20,427	34,014	26,587	24,113	18,159	17,421	
4		23,558	36,082	28,263	25,749	19,642	18,861	
5		26,362	38,097	29,885	27,334	21,154	20,328	
10		63,406	48,171	37,913	35,193	29,381	28,298	221,294
20		148,536	63,327	49,725	46,956	41,734	40,130	
30		183,174	63,391	48,128	45,639	40,804	38,754	
40		144,101	47,291	32,571	30,600	26,397	24,194	
50		88,172	28,635	16,443	15,054	15,974	14,159	
60		68,407	15,513	8,908	7,813	8,478	7,131	
70		52,512	6,217	5,284	4,302	4,724	3,688	

Interest Rate Margin:			determ	determ	determ	determ	determ	None
Mortality Improvement:			No	No	No	No	No	Yes
Mortality Margin:			2001/ex	9.375 / ex	3.5 / ex	1.20%	None	None
Lapse Margin:			30%	30%	30%	None	None	None
Expense Margin:			5%	5%	5%	5%	None	None

Z Calculated at Issue:		11.59%	23.09%	17.85%	15.89%	11.67%	11.59%	
Z Calculated at Dur 10:		28.65%	21.77%	17.13%	15.90%	13.28%	12.79%	

Exhibit 4, part 2

Terminal Reserves by Policy Year
UL Shadow Fund Issue Age 75, Male Best Class, $1M Face

Policy Dur	Gross Prem	Fund Value	Cash Value	Shadow Fund	Formulaic Reserves	Principles-Based Reserves: Level of Margins (1)	(2)	(3)	(4)	(5)	Best Estimates
					Deterministic Reserve						
0	0	0	0	0	0	35,426	9,679	5,504	132	(3,059)	(21,986)
1	49,520	11,752	0	8,763	3,332	7,343	(18,463)	(22,565)	(28,334)	(31,644)	(51,626)
2	49,520	20,609	0	26,680	46,828	45,686	19,899	15,880	9,910	6,494	(14,325)
3	49,520	25,709	0	54,621	85,756	84,040	58,343	54,416	48,401	44,895	23,469
4	49,520	25,961	0	83,055	127,782	121,845	96,301	92,472	86,518	82,946	61,142
5	49,520	20,168	0	112,480	175,074	158,842	133,511	129,786	123,955	120,340	98,388
10	49,520	47,951	16,401	258,786	352,869	337,929	314,538	311,409	307,293	303,694	283,340
20	49,520	(343,833)	0	284,855	661,259	657,256	641,655	639,892	641,051	638,602	624,932
30	0	(2,494,000)	0	50,000	936,727	883,863	877,254	876,158	876,821	875,475	868,346
40	0	(2,494,000)	0	50,000	970,246	929,482	928,486	927,401	927,678	926,721	923,443

Reserve Margins (Assuming Floor of Zero)
UL Shadow Fund Issue Age 75, Male Best Class, $1M Face

Policy Dur	Formulaic Reserves	Principles-Based Reserves: Level of Margins (1)	(2)	(3)	(4)	(5)	PV of Req Cap
	Deterministic Reserve						
0	21,986	57,412	31,665	27,490	22,118	21,986	245,316
1	54,958	58,969	51,626	51,626	51,626	51,626	
2	61,153	60,011	34,224	30,205	24,235	20,819	
3	62,287	60,571	34,874	30,947	24,932	21,426	
4	66,640	60,703	35,159	31,330	25,376	21,804	
5	76,686	60,454	35,123	31,398	25,567	21,952	
10	69,529	54,589	31,198	28,069	23,953	20,354	248,837
20	36,327	32,324	16,723	14,960	16,119	13,670	
30	68,381	15,517	8,908	7,812	8,475	7,129	
40	46,803	6,039	5,043	3,958	4,235	3,278	

		(1)	(2)	(3)	(4)	(5)	
Interest Rate Margin:		Determ	determ	determ	determ	determ	None
Mortality Improvement:		No	No	No	No	No	Yes
Mortality Margin:		2001/ex	9.375 / ex	3.5 / ex	1.20%	None	None
Lapse Margin:		30%	30%	30%	None	None	None
Expense Margin:		5%	5%	5%	5%	None	None
Z Calculated at Issue:	8.96%	23.40%	12.91%	11.21%	9.02%	8.96%	
Z Calculated at Dur 10:	27.94%	21.94%	12.54%	11.28%	9.63%	8.18%	

Exhibit 5
Results for the 20 Year Simulated Inforce

["Formulaic"]

Basis	Margins		Reserve	% of Current Formulaic
Fund Value		$	110,674,158	
Cash Value		$	59,749,151	
Current Formulaic (AG38)		$	368,125,424	100.0%
Principles-Based Best Estimates GPV	None	$	231,923,829	63.0%
Principles-Based Deterministic GPV	Level 4	$	283,600,849	77.0%
Principles-Based Stochastic GPV (50 CTE)	Level 4	$	293,161,763	79.6%
Principles-Based Stochastic GPV (55 CTE)	Level 4	$	295,937,222	80.4%
Principles-Based Stochastic GPV (60 CTE)	Level 4	$	298,769,629	81.2%
Principles-Based Stochastic GPV (65 CTE)	Level 4	$	301,891,783	82.0%
Principles-Based Stochastic GPV (70 CTE)	Level 4	$	305,174,636	82.9%
Principles-Based Stochastic GPV (75 CTE)	Level 4	$	308,951,798	83.9%
Principles-Based Stochastic GPV (80 CTE)	Level 4	$	313,369,554	85.1%

Stochastic Reserves GPV Reserve Range	Number of Scenarios
$200,000,000 - $220,000,000	6
$220,000,000 - $240,000,000	28
$240,000,000 - $260,000,000	45
$260,000,000 - $280,000,000	52
$280,000,000 - $300,000,000	40
$300,000,000 - $320,000,000	18
$320,000,000 - $340,000,000	8
$340,000,000 - $360,000,000	3
Total	200

Distribution of Stochastic Reserves
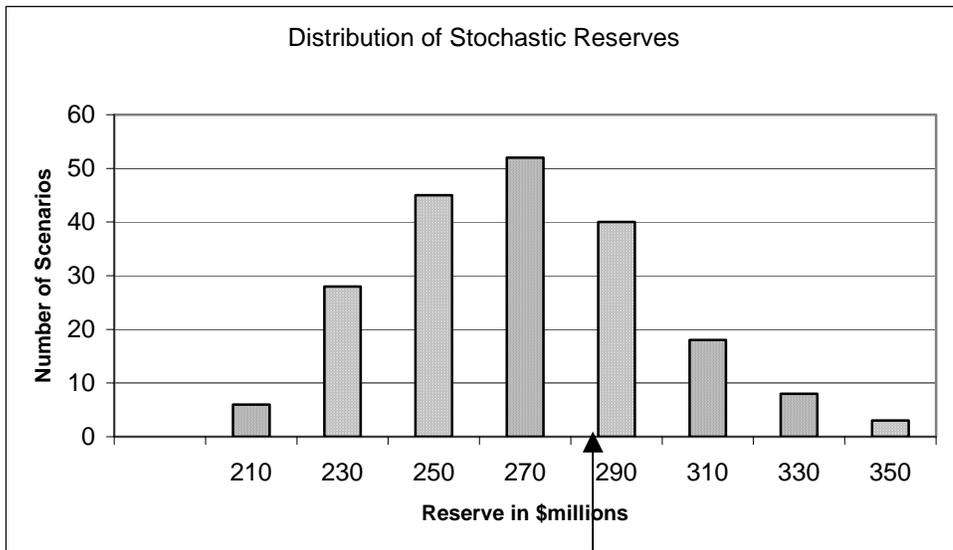
Deterministic Reserve Level

Exhibit 6

Income Statement for Age 45 cell issued 1/1/2005 using Principles-Based Deterministic Reserves										
	12/31/05	12/31/06	12/31/07	12/31/08	12/31/09	12/31/10	12/31/11	12/31/12	12/31/13	12/31/14
REVENUE										
Premiums	8,233	7,901	7,598	7,321	7,068	6,837	6,627	6,423	6,224	6,032
Investment Income	(278)	426	518	925	1,333	1,746	2,164	2,573	2,976	3,373
Total Revenues	7,955	8,327	8,116	8,246	8,401	8,583	8,790	8,996	9,200	9,404
BENEFITS AND EXPENSES										
Surrender benefits	0	0	0	0	0	0	0	154	347	543
Death claims	278	388	476	536	580	622	660	698	743	826
Commissions	10,291	395	380	366	353	342	331	321	311	302
Acquisition expenses	2,204	0	0	0	0	0	0	0	0	0
Maintenance expenses	40	39	38	38	37	37	37	37	37	37
Premium tax	206	198	190	183	177	171	166	161	156	151
Increase in policy reserves	0	1,856	7,072	7,068	7,108	7,174	7,185	7,112	7,029	6,898
Total benefits and expenses	13,019	2,876	8,156	8,191	8,256	8,345	8,379	8,483	8,623	8,756
PRE-TAX BOOK PROFIT	(5,064)	5,452	(40)	54	145	238	412	512	577	649
Increase in target surplus	1,291	16	230	234	240	246	249	247	244	240
Inv Inc on target surplus	0	77	78	92	106	121	135	150	165	180
PRE-TAX DISTRIBUTABLE PROFIT	(6,355)	5,513	(191)	(88)	12	113	298	416	498	589

Income Statement for Age 45 issued 1/1/2005 cell using AG38 Reserves										
	12/31/05	12/31/06	12/31/07	12/31/08	12/31/09	12/31/10	12/31/11	12/31/12	12/31/13	12/31/14
REVENUE										
Premiums	8,233	7,901	7,598	7,321	7,068	6,837	6,627	6,423	6,224	6,032
Investment Income	(278)	428	760	1,050	1,542	2,014	2,449	3,147	3,883	4,585
Total Revenues	7,955	8,330	8,358	8,371	8,610	8,851	9,076	9,570	10,108	10,617
BENEFITS AND EXPENSES										
Surrender benefits	0	0	0	0	0	0	0	154	347	543
Death claims	278	388	476	536	580	622	660	698	743	826
Commissions	10,291	395	380	366	353	342	331	321	311	302
Acquisition expenses	2,204	0	0	0	0	0	0	0	0	0
Maintenance expenses	40	39	38	38	37	37	37	37	37	37
Premium tax	206	198	190	183	177	171	166	161	156	151
Increase in policy reserves	43	5,847	5,129	8,456	8,096	7,471	11,991	12,664	12,110	11,593
Total benefits and expenses	13,063	6,867	6,213	9,579	9,244	8,643	13,185	14,035	13,704	13,451
PRE-TAX BOOK PROFIT	(5,107)	1,463	2,144	(1,208)	(634)	208	(4,109)	(4,465)	(3,596)	(2,835)
Increase in target surplus	1,293	176	152	289	279	258	441	469	447	427
Inv Inc on target surplus	0	78	88	97	115	131	147	173	201	228
PRE-TAX DISTRIBUTABLE PROFIT	(6,400)	1,365	2,081	(1,401)	(798)	82	(4,403)	(4,760)	(3,842)	(3,034)

Exhibit 7, part 1

Results for the 20 Year Simulated Inforce – 20 Year Bonds

Basis	Margins		Reserve	% of Current Formulaic
Fund Value		$	110,674,158	
Cash Value		$	59,749,151	
Current Formulaic (AG38)		$	368,125,424	100.0%
Principles-Based Best Estimates GPV	None	$	231,923,829	63.0%
Principles-Based Deterministic GPV	Level 4	$	269,113,224	73.1%
Principles-Based Stochastic GPV (50 CTE)	Level 4	$	278,736,875	75.7%
Principles-Based Stochastic GPV (55 CTE)	Level 4	$	280,602,944	76.2%
Principles-Based Stochastic GPV (60 CTE)	Level 4	$	282,473,333	76.7%
Principles-Based Stochastic GPV (65 CTE)	Level 4	$	284,440,795	77.3%
Principles-Based Stochastic GPV (70 CTE)	Level 4	$	286,625,138	77.9%
Principles-Based Stochastic GPV (75 CTE)	Level 4	$	289,045,665	78.5%
Principles-Based Stochastic GPV (80 CTE)	Level 4	$	292,006,887	79.3%

Stochastic Reserves GPV Reserve Range	Number of Scenarios
$200,000,000 - $220,000,000	2
$220,000,000 - $240,000,000	27
$240,000,000 - $260,000,000	68
$260,000,000 - $280,000,000	66
$280,000,000 - $300,000,000	29
$300,000,000 - $320,000,000	7
$320,000,000 - $340,000,000	1
$340,000,000 - $360,000,000	0
Total	200

Distribution of Stochastic Reserves
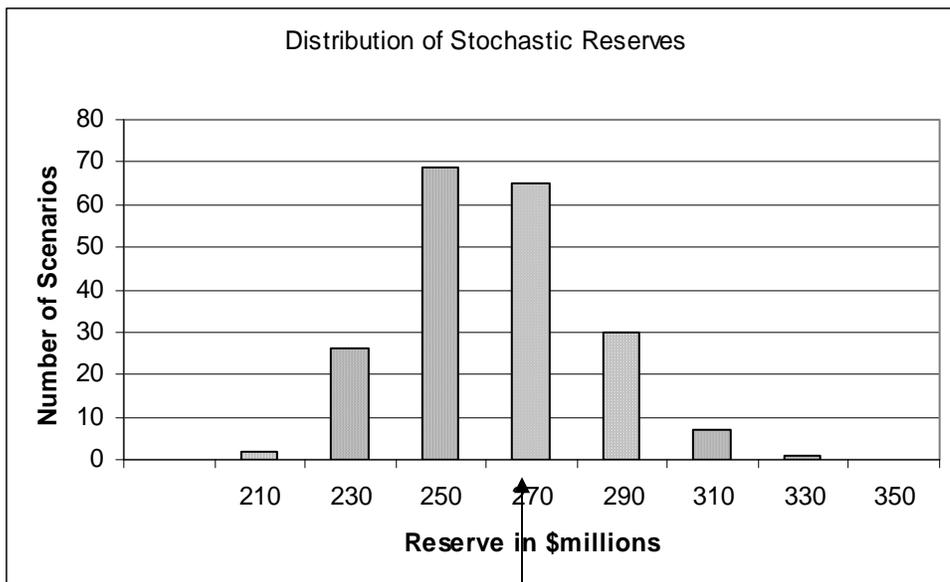
Deterministic Reserve Level

Exhibit 7, part 2

These are the discount rates used in calculation of the seriatim, deterministic reserve in connection with the 20-year investment strategy. Note that the "with margin" interest rates decline more slowly by projection year than those in Exhibit 3, part 2 because the portfolio rolls over more slowly so that the portfolio yield is less affected by the current low level of new money interest rates.

Deterministic Interest Rates		
	Best	With
Projection year	Estimate	Margin
1	6.00%	5.81%
2	6.00%	5.75%
3	6.00%	5.70%
4	6.00%	5.65%
5	6.00%	5.61%
6	6.00%	5.57%
7	6.00%	5.54%
8	6.00%	5.51%
9	6.00%	5.48%
10	6.00%	5.45%
11	6.00%	5.43%
12	6.00%	5.40%
13	6.00%	5.38%
14	6.00%	5.35%
15	6.00%	5.33%
16	6.00%	5.31%
17	6.00%	5.27%
18	6.00%	5.22%
19	6.00%	5.22%
20	6.00%	5.20%
21	6.00%	5.18%
22	6.00%	5.17%
23	6.00%	5.17%
24	6.00%	5.16%
25	6.00%	5.16%
26+	6.00%	5.15%

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