C-3 RISK AND LIABILITY HEDGING

MESSRS. WILLIAM R. BRITTON, JR., AND DOUGLAS C. DOLL: We will address the relative volatility of participating whole life versus universal life (UL) and the annual-premium versus single- premium basis.

Three things have provided background for our topic. First, at the 1987 Valuation Actuary Symposium there was a panel discussion on the sensitivity of participating products to C-3 risk. The two speakers were Jim Reiskytl and Armand de Palo, who subsequently published an article on the same topic in the September 1987 issue of The Actuary.

Second, the recent cash-flow standards draft put out by the Interim Actuarial Standards Board (IASB) questioned in its introductory letter whether or not cash-flow standards should be applied to participating insurance in addition to other interest-sensitive business.

Third, the Special Advisory Committee on the Valuation Law (SAC/VL) has addressed the topic of relative volatility of different lines of business. Essentially the group is working on an actuarial review versus cash-flow testing. One sentence from the

committee's June 30, 1988, minutes reads: "In some instances, the actuary may be able to make an assumption or methodology review to determine whether the assumptions underlying the current reserves were so conservative that there would be no benefits to cash-flow testing." The committee is working on developing a statement of what it has termed *distinguishing characteristics* of business, which would call for different levels of testing, keeping in mind that multiscenario cash-flow testing is the ultimate against which other alternatives are to be compared.

1987 Symposium Panel on Participating Products

It is appropriate to review the session regarding participating products at the 1987 symposium called "Participating Insurance and the Valuation Actuary." The conclusion was that participating whole life insurance does not need cash-flow testing. Three characteristics of participating insurance were described that seemingly protected against C-3 risk:

- Participating insurance dividends are generally based upon a portfolio interest rate.

- The interest rate in the dividend scale is not visible to the policyholder, which reduces excess lapses.

- There are high premium margins in participating insurance that are available in case of financial problems.

The speakers at the symposium went on to say that, when evaluating participating insurance, the focus should be on (1) the actuary's evaluation of the situation for that block of business, (2) the selling situation (i.e., sold through stockbrokers versus career agents), (3) the protection provided against surrenders and loans (i.e., whether there is direct recognition of loans), and (4) the evaluation of the quality and duration of assets. The assertion was that cash-flow testing could be done at or before issue of the block of business and that it is not necessary to do yearly cash-flow testing on that block of business unless circumstances change beyond what was originally tested.

Much of this assertion hinged upon whether the credited interest rate in the dividend scale is on a portfolio or an index basis. The speakers stated that three fundamentals of participating insurance are (1) to provide insurance at cost, (2) to divide the business into self-supporting classes, and (3) to have an equitable distribution of surplus. Those attributes of participating insurance led the speakers to say that, if you have participating insurance, almost by definition you will be crediting interest on a portfolio basis. Portfolio crediting doesn't have to mean all years of issues grouped together; you could have a single year of issues, or one week's issues portfolio credited. The essence is that you credit a rate based upon what you are earning.

We should define what we mean by index crediting and portfolio crediting. By index crediting, we mean crediting a rate based on the competition or some external index, not based on what the overall earnings are. If you are going to credit based upon an index, then unless your assets are very short, you have a situation that, when interest rates go up, your earnings rate will not follow your credited rate, and you will lose money short term. When interest rates fall, you will earn a high interest spread for a while.

With portfolio crediting, you can maintain a stable situation with a credited rate less than the earned rate under a lot of scenarios. However, if interest rates shoot up, you start getting excess lapses, the cash flow going out will lower your overall earned rate, which, therefore, gives you more excess lapses. It gets worse, and you end up ruined because the lapse rates go out of sight.

There were a lot of numbers shown at the 1987 Valuation Actuary Symposium. In essence, the speakers there took thirty years' issues of participating business, assuming that sales had increased 10 percent a year. The in-force assets and reinvestment strateg were a mix of durations with about ten years' average maturity. The excess-lapse function was a constant times the difference between the market rate and the portfolio-credited rate, squared.

The speakers in 1987 tested several different kinds of whole life: 4 and 7 percent cash values, minimum reserves, reserves grading up to net level, etc. They tested for various pop-up interest scenarios. They also tested the New York scenarios and some scenarios that were like New York's with twice the degree of change in interest rates.

For our purposes, it is sufficient to look only at the pop-up scenarios for the 4 percent whole life plan. Interestingly, for moderate interest rate increases and excess functions, the business had positive ending surplus, even though the lapse rates sometimes went to 100 percent! Only the most extreme cases, plus 6 and 8 percent interest rate pop-ups combined with excess lapse of 0.8 and 1.6 times the square of the interest-rate differential, were sufficient to cause negative surplus.

The panel in 1987 also addressed the loan function. The members of the panel used a situation where the policies had direct recognition. Interestingly, loans had little effect on the results. If you had loan sensitivity to the interest rates and no excess-lapse sensitivity, then there were no scenarios where surplus turned negative. If you had loans combined with excess- lapse sensitivity, then there was some sensitivity. The loans did adversely affect the result, generally only in extreme scenarios. For example, instead of 100 percent lapse and negative surplus occurring in 1993, they occurred in 1992. It seemed to have a fairly small overall effect.

The 1987 panel also tested participating whole life crediting interest on an index basis. The conclusion was that all of the increases in interest rates resulted in short-term losses, but the panel didn't show the results as to whether the long-term gains beyond those short-term losses resulted in ultimate positive or negative results.

Finally, at the end of the panel, a few persons in the audience engaged in a somewhat spirited discussion as to whether everything that had been covered applied to UL or applied solely to participating whole life. Comments were made that UL has an unbundled dividend, but participating whole life has a bundled dividend. In UL, you also can have partial surrenders and flexible premiums. The panel concluded that participating whole life might not need a cash-flow analysis, but it seemed as though UL was considered different. The panelists agreed that theirs was a preliminary discussion of the issue and called for further discussion and analysis. We thought we would do that here. We have done some additional, although by no means definitive, testing.

Universal Life Versus Participating Whole Life

We tried to make UL look like participating whole life in order to fit it into our modeling capability. A similar exercise is taking place with product development actuaries. We know of stock companies coming out with UL products called "par clones," which look like a participating policy to the agent and the buyer. Similarly, mutual companies are coming out with participating products that look like UL to the

consumer. We found that, from a C-3 risk standpoint, the products are beginning to act alike as well.

When we first got into this exercise, we thought of the differences between participating whole life and UL that might result in different risk characteristics:

- Bundled versus unbundled dividends. In participating whole life's bundled dividends, the cloak of the dividend mechanism will effectively disguise the operation of the individual elements, as opposed to UL's unbundled "dividends," where the individual elements are exposed. As a result of bundling, the policyholder will be less motivated to lapse the policy or take other actions when the internal interest rate gets out of kilter with the external interest environment. Unlike the UL policyholder, the participating policyholder is usually unaware of the actual interest rate being credited, the mortality being charged, or the expenses being assessed. This lack of knowledge provides some protection to the company, which will be manifested in a lower sensitivity to lapse rates. This sensitivity can easily be modeled.

  Another consequence of the UL unbundled "dividend" is that its individual components are subject to maximums or minimums. A minimum interest rate must be credited; there are maximum cost of insurance rates that can be charged;

and there is a maximum expense element that can be taken out as a load. In practice, it is likely that the cost of insurance and load constraints will be of more concern than the minimum interest rate.

- Making up past losses. With a UL product, as with other nonguaranteed premium products, you are precluded from making up past losses or crediting past gains. In actual operation, this constraint will be more theoretical than practical.

- Immediate versus lagged reset. With a UL policy you credit experience immediately, whereas with the participating policy, you have the opportunity to lag and stretch out the experience over time. As a practical matter, however, the two products will operate similarly. We did do some initial testing of this and didn't see material differences.

- Flexible premiums and partial withdrawals. Flexible premiums on a UL policy will affect the amount of cash flow that you can expect from the policy in the future. Both UL and a number of the new participating products have the facility for dump-ins. Similarly, on the downside, with UL, premiums may be suspended, but with a participating policy, the same effect can occur if the policyholder decides to take dividends out in cash or take loans on the policy. Finally, for

partial withdrawals, there is a different structural element in the policies, but participating policyholders always have the opportunity to surrender paid-up additions and to take loans.

After considering the structural differences between UL and participating life with respect to C-3 risk, the real question is whether or not level-premium life insurance products need cash- flow testing. To begin providing an answer to that, we decided to look at the considerations of C-3 risk for level-premium products:

1. Portfolio versus index or new-money crediting is clearly something we have to consider.

2. Lapse sensitivity should account for both the level of underlying lapse rates as well as the excess-lapse rates.

3. Surrender charges are thought to be a deterrent to lapsation. Also the presence of a surrender charge acts to insulate against the financial loss on a surrender.

4. Finally, policy loans may not be as important as they were, since most companies have had some sort of policy update mechanism that helped move the old portfolios away from the low fixed-loan rates. Also, most of the new policies that

are coming out contain combinations of variable loan interest rates and direct recognition.

Our case study focused on a couple of elements: the portfolio versus new-money crediting strategies and the lapse sensitivity. For baseline assumptions, we took a UL policy issued to a male nonsmoker age thirty-five. We assumed (1) that there were five years' level issues in force, (2) that the investment policy had been in ten-year, A-rated bonds (we wanted to neutralize the investment element), and (3) that the product had been priced to have a desired spread of 150 basis points. The product also was priced to have about a 15 percent rate of return, after target surplus and federal income tax. This product can be thought of as having a high level of profitability and run-of-the-mill features, so it may not be a product that you could sell in the market, but it was useful for case study purposes since we weren't trying to look at all of the variations in product features.

The competitor rate was intended to be the midpoint in the competitive range. Our excess-lapse formula was:

$$n\,(m - c - .50)^2 - .25\,sc/fv$$

where

n = lapse-sensitivity factor

m = prevailing market interest rate

c = credited interest rate

sc = surrender charge

fv = fund value

We put 50 basis points in as a threshold of sensitivity. We did have a modest recognition of the presence of a surrender charge since we subtracted from the excess-lapse function 25 percent of the ratio of the surrender charge to the fund value. For negative cash flow, we borrowed at a ninety-day rate plus 2 percent.

We projected the results for thirty years and ran both forty and two hundred scenarios. We ran two hundred scenarios on our baseline assumptions for the various products to get a feel as to how they would react overall, then picked the forty-scenario set that seemed to replicate those results the best. We then used this forty-scenario set for the rest of the runs. A final step would be to go back and run all two hundred scenarios to get more assurance that the results are credible. We have not yet done that.

Table 1 illustrates the excess-lapse function for the three test values of n: 3, 1, and 0.25. Note that total lapses were capped at 30 percent. We think that $1 \leq n \leq 3$ is representative of a reasonable range of UL sensitivity to excess lapse, and that $0.25 \leq n \leq 1$ would be a reasonable range of participating sensitivity to excess lapse.

Table 1

Excess-Lapse Function

$n(m-c-0.50)^2$

Interest Difference (m-c)	High (n=3)	Medium (n=1)	Low (n=0.25)
0.5	0%	0%	0%
1.5	3	1	0
2.5	12	4	1
3.5	27	9	2
4.5	30	16	4
5.5	30	25	6

What about participating life? We have constructed a "pseudo-par" product modeled as a UL product. The participating product has a high annual premium, $13 a thousand, versus the $6 UL premium. The death benefit is face plus cash value to simulate the effect of paid-up additions. There is an initial surrender charge of $25 that grades off over twenty years and a commissioners reserve valuation method (CRVM) expense allowance grading off over twenty years, so we have built in an initial surplus strain.

Before discussing the results of stochastic testing, let's look at the results using the "New York Seven" interest rates. Table 2 shows values with n = 1 for the two products.

For these and later results, we have illustrated the present value of ending "market" surplus (market value of assets less statutory reserves) at thirty years, discounted at the ten-year Treasury rate in effect in each quarter. All projections began with $1,000 of reserves and assets.

Note that the "level" interest rate result is the result obtained from the traditional technique of assuming a level spread and level interest rate throughout the projection period. It is interesting to compare this result with the range of results that will later be shown for stochastic interest scenarios.

Table 2
New York Regulation 126 Scenarios
Present Value of 30-Year Ending Surplus
(Lapse Sensitivity Factor = 1)
(1,000s)

	Universal Life		"Par"
Interest Scenario	Portfolio	New Money	Portfolio
Level	$1,210	$1,120	$ 920
Grade Up	970	930	820
Cycle Up	770	920	810
Pop-Up	810	1,020	800
Grade Down	1,380	1,150	1,050
Cycle Down	680	820	770
Pop-Down	1,390	1,100	1,030

UL Results

Results of the UL testing with forty stochastically generated interest-rate scenarios are shown in Table 3. We have chosen to illustrate three numbers from the forty sets of results: the ninetieth percentile value, the median value, and the tenth percentile value. These results provide a shorthand picture, or profit profile, of the underlying forty-value distribution. We believe that values outside this eightieth percentile interval are not as reliable since they can be influenced by (1) unusual interest patterns, (2) unlikely circumstances or (3) breakdowns in the model methodology, formulas or assumptions.

Results are shown for three crediting strategies:

1. A portfolio strategy that credits the earned rate less 150 basis points.

2. A new-money strategy that credits the new-money rate in each period.

3. A "hybrid" strategy that credits the earned rate less 150 basis points but will never credit more than 50 basis points above the competition, nor will it credit less than 200 basis points below the competition.

During periods of rapidly rising interest rates, the portfolio strategy can trigger high excess lapses. The new-money strategy will retain business at the cost of subsidization.

These two represent the extremes of crediting strategies with the hybrid strategy dampening the interplay between subsidization and excess lapse.

For the portfolio and hybrid crediting strategies, results are shown with lapse-sensitivity factors of 1 and 3, a reasonable range for UL. There are no excess lapses with the new-money strategy since the crediting rate is always at the market rate. The results, under both strategies with both tested lapse- sensitivity factors, range from $370 to $1,320, which is comfortable for valuation purposes. Results for the new-money strategy range from $210 to $1,140, which is below the other strategies but still in the comfort zone.

As a further sensitivity test, the portfolio and hybrid strategies were run with a lapse-sensitivity factor of 3, but without capping the overall lapse rate at 30 percent. The results were still positive in this unlikely situation. We can conclude that the tested UL policy appears to be well-insulated against loss under a wide range of crediting strategies and a reasonable investment strategy.

Table 3

Universal Life
Present Value of Ending 30-Year Surplus
40 Stochastic Interest Rate Scenarios
(1,000s)

	Crediting Strategy					
	Portfolio			New Money	Hybrid	
	n = 3*	n = 3	n = 1		n = 3	n = 1
90th Percentile	$1,120	$1,190	$1,270	$1,140	$1,250	$1,320
Median	530	690	870	630	750	890
10th Percentile	100	460	510	210	370	510

*No capping; total lapses capped at 30 percent for other illustrated results.

Participating Results

Table 4 illustrates the results for the participating product under the portfolio crediting strategy with lapse-sensitivity factors of 3, 1, and 0.25. Also illustrated are results for a new-money crediting strategy. As with UL, the results are comfortably positive for the tested lapse sensitivities. The results for the 0.25 lapse-sensitivity factor are representative of the results obtained by Reiskytl and de Palo in 1987. For a lapse-sensitivity factor of 1, our results are more favorable. A lapse-sensitivity factor of 3 simulates the result if the dividend mechanism offered no more protection against lapse sensitivity than that afforded by UL. Even in this situation, the results are good.

Table 4

Participating Whole Life
Present Value of Ending 30-Year Surplus
40 Stochastic Interest Rate Scenarios

	Portfolio			New Money
	n = 3	n = 1	n = 0.25	
90th Percentile	$870	$970	$1,090	$840
Median	550	660	800	390
10th Percentile	370	390	520	120

With these results, we tentatively concluded that level premium portfolio products with a five-year issue history are C-3 resistant. The reasons would appear to be a combination of:

1. More cash flow coming in when interest rates are rising than would be obtained from a single-premium product;

2. Surrender charges acting as a deterrent to lapsation; and

3. The reserves being greater than the cash surrender value. Often the surrender charge can be greater than expected future profitability.

To test this conclusion further, we looked at more mature blocks of in-force participating business. We constructed two more in-force blocks, one with issues of over ten years, the other with twenty years of issue. In each case, production was assumed to have increased by 10 percent per year. We tested a portfolio- crediting strategy with a lapse-sensitivity factor of n = 1.

Table 5 shows the present value of thirty-year ending surplus per $1,000 of initial reserve, a measure that relates future profits to existing assets. Not surprisingly, profit results for the five-year-old block are higher than the older blocks, because future premiums are higher in relation to current assets for the five-year-old block. Interestingly, the profit profiles for the older blocks are narrower (indicating lower risk of future variation) as well as lower. Moreover, the profit profiles for these two older blocks are virtually identical, suggesting a constant profit expectation per unit of reserve for older blocks.

Table 5

Participating Whole Life In-Force Blocks
Present Value of 30-Year Surplus
Per $1,000 of Initial Reserve
Portfolios Crediting Strategy
Lapse-Sensitivity Factor n = 1

	Number of Years		
	5	10	20
90th Percentile	$970	$630	$620
Median	660	400	400
10th Percentile	390	210	220

Table 6 expresses the profit results per unit of in-force business. The profit patterns for all three blocks are quite similar, suggesting that the expected profitability per unit of in-force business for mature blocks of business is relatively constant.

Table 6

Participating Whole Life In-Force Blocks
Present Value of 30-Year Surplus
Per Unit of In-Force
Portfolio Crediting Strategy
Lapse-Sensitivity Factor n = 1

	Number of Years		
	5	10	20
90th Percentile	$29	$33	$27
Median	20	21	18
10th Percentile	12	11	10

This further testing would seem to indicate that annual-premium participating blocks are C-3 risk resistant regardless of the maturity of the block.

Single-Premium UL

Can we extend this conclusion to single-premium products? To provide an answer, we tested a single-premium UL product similar to the annual-premium UL product, except we assumed that the policyholder paid a single premium at issue equal to the guideline

single premium of $125. As Table 7 illustrates, the single-premium profit profiles are substantially different from those of the continuing-premium products.

Table 7

Surplus Premium Universal Life
Present Value of 30-Year Ending Surplus

	Portfolio-Crediting Strategy			New-Money Strategy
	n = 3*	n = 3	n = 1	
90th Percentile	$200	$210	$240	$170
Median	30	90	130	70
10th Percentile	(40)	10	40	(50)

*No cap on excess lapses; total lapse rates capped at 30 percent for other illustrated value.

Unlike the continuing-premium UL policy, negative results appear at the tenth percentile for the new-money crediting strategy as well as for the portfolio strategy with high-lapse sensitivity and an uncapped total lapse rate. Of the forty trials with high-lapse sensitivity and no capping, eighteen had negative surplus and no remaining in-force business. Of the twenty-two trials with positive ending surplus, eleven had no remaining in-force business at the end of the thirty-year period.

Table 8 compares the forty stochastic interest-scenario results with the "New York Seven" results for the tested single-premium product. Note that the profit result for the New York level- interest scenario is substantially higher than the median result with forty stochastic scenarios. This further emphasizes the unreliability of a level-interest scenario result as an indicator of profitability.

The single-premium results lead us to conclude that cash-flow testing is needed for these products, regardless of crediting strategy.

Table 8

Single-Premium Universal Life
Present Value of Ending 30-Year Surplus
Lapse-Sensitivity Factor n = 1

	Portfolio Strategy	New-Money Strategy
40 Stochastic Scenarios		
90th Percentile	$240	$170
Median	130	70
10th Percentile	40	(40)
New York Scenarios		
Level	$240	$200
Grade Up	180	140
Cycle Up	60	60
Pop-Up	40	80
Grade Down	280	250
Cycle Down	180	140
Pop-Down	270	130

Policy Loans

Let's look at some qualitative C-3 risk concerns for policy loans and consider the four different policy-loan forms: fixed loan rate, fixed rate with direct recognition, variable loan rate, and variable rate with direct recognition.

In terms of C-3 risk, the fixed loan will act like a lapse in that the money going out will subject the company to a market- value loss. On the other hand, the policyholder can intelligently select against the other policyholders by borrowing and effectively spreading the cost of that borrowing to all policyholders. A loan is better than a true lapse because, with a loan, there is the opportunity to collect the profit margin on a portion of the policy in the future.

For a policy having a fixed loan rate with direct recognition, the policyholder cannot select against other policyholders. The cash outflow will still cause potential market-value losses, but the company can continue to get profits from the continuing policies.

A policy containing a variable loan rate insulates the company to some extent against the market-value loss because the company can charge a current interest rate for the loan. If there is a variable rate without direct recognition, a policyholder can select against other policyholders when interest rates are declining, and the borrowing rate is less than the internal crediting rate. On the other hand, when interest rates are rising,

policyholders may be encouraged to lapse when they have to borrow at a high rate but not get credit for it through the internal policy mechanism.

A policy having a variable rate with direct recognition eliminates the possibility of market loss by charging the current market interest rate. It also eliminates the portfolio antiselection because the policyholder will be credited with the borrowing rate. Here policyholders who otherwise might lapse are encouraged to borrow so that the opportunity exists for future profit margins.

If these risks are ranked qualitatively, it would appear as though the highest risk occurs with the fixed loan rate, followed by the variable rate, then the fixed rate with direct recognition. Some further work would determine quantitatively whether the loan options would make a material impact on the results presented.

Summary

After reviewing the results of our work, we think that further work should be done in a couple of areas:

- future product cash flows in relation to the in-force assets; and

- expected future profitability in relation to in-force assets.

In addition, the work already done might be expanded to allow renewal UL premiums to vary with differences between the credited rate and external new-money rate, which will have an impact on both future cash flows and profitability. Likewise, participating dividend options might be explored since policyholders have the opportunity to take dividends out in cash, which will reduce the future cash flow. Further, we have not looked at the effect of loans on UL policies, which probably is minimal. More work also needs to be done on the effect of loans on participating policies.

Keep in mind that the tested products have generous margins in them. Before extending these conclusions to any level-premium product, you would need to make sure that your product margins were adequate to result in risk profiles similar to our results.

Finally, there are a number of product features that we know will have some risk associated with them: bailout, persistency bonuses, long-term guarantees, etc. We have not modeled those, and you should not conclude that all level-premium products should be excluded from C-3 testing.

Benefit Hedging

Can a combination of different products hedge the C-3 risk? We are all familiar with the example of combining single-premium immediate annuities with something like single-premium deferred annuities, single-premium life, or deferred annuities. We

decided to try a case study on benefit hedging. We also wanted to combine UL with a no-cash-value whole life. There has been a proposal, which has been made to the National Association of Insurance Commissioners (NAIC) and the states, that companies be allowed to sell whole-life policies without cash values. In fact, three states in the past year or two have adopted legislation permitting whole-life policies to be sold without cash surrender values. The current proposal at the NAIC is not moving at all, and it is probably unlikely to be adopted soon. However, the Society of Actuaries has a committee on nonforfeiture principles that is currently looking at whether or not policies need to have cash surrender values. In Canada, you do have the ability to issue policies without guaranteed cash surrender values, so it is something to consider.

For single-premium annuity and life policies, we decided to piggyback on the earlier work in this session, so we used the same single-premium life product and a simplistic single-premium annuity. We decided to use a twenty-year level-payment, single-premium annuity, assuming that at the beginning of the projection we were holding reserves calculated at 8 percent interest and that the assets of the company bought were evenly divided among maturities of one to twenty years, probably shorter than you would normally match against structured-settlement annuities. We took $1,000 of initial reserves and assumed the same reinvestment strategy for each. We did not comingle the assets, i.e., no surpluses from the immediate annuities were to be used to support the

credited interest rate on the single-premium life. Finally, we calculated the present value of the thirty-year surplus shown in Table 9.

We found a reasonable range on the single-premium annuity and life policies. If you added those two together - i.e., if you were to add the numbers from the top, the median, and the bottom - you get the Additive column. In the Combined column, the scenarios were matched so that the top scenario in the single- premium annuity matched the same scenario in single-premium life. You might expect the range shown in the Additive column, but in practice we got the range shown in the Combined column. You can see the top went down a little bit, and the bottom went up a fair amount, which was what we expected.

Table 9

SPIA and SPL Benefit Hedging
Present Value of 30-Year Ending Surplus
Portfolio Crediting

	SPIA	SPL	Additive	Combined
90th Percentile	$220	$240	$460	$410
Median	170	130	310	280
10th Percentile	70	40	110	200

Table 10 illustrates the results with a new-money crediting strategy for the single-premium life. Again, the range was narrowed by combining the two products. This is

what to expect, since the UL does poorly and the single-premium annuity does well under an increasing interest scenario, and vice versa.

Table 10

SPIA and SPL Benefit Hedging
Present Value of 30-Year Ending Surplus
New-Money Crediting

	SPIA	SPL	Additive	Combined
90th Percentile	$220	$170	$390	$350
Median	170	70	240	230
10th Percentile	70	(40)	30	100

Let's look at a no-cash-value whole life. We faked it here and designed it like a UL policy but fixed the 8 percent credited to replicate the situation where you would have a guaranteed-premium whole life product calculated under certain pricing assumptions. We assumed the premiums were calculated using an implicit 8 percent interest rate. We assumed no premium variance and no lapse, which perhaps is not too realistic in the first few years, but if someone bought one of these policies, you would expect that, after a couple of years, he would essentially be locked in. There is an issue that you still expect a few percent lapses thereafter; in fact, it would be a source of profit. But again, that would be a baseline lapse, and we were trying to get the interest sensitivity of this product, not absolute value of the profit. We took five-year issues and found that the

no-cash-value whole life was extremely sensitive to interest rates, so instead of matching $1,000 of reserves for that against $1,000 for UL, we matched it against $3,000 of UL.

We got the range shown in Table 11. On the no-cash-value whole life, you can see the tenth percentile was negative 1,100 dollars, which is the kind of volatility you might expect, since you are effectively guaranteeing 8 percent throughout the life of the contract, and yet we have no assets, or at most we have one-year's premium to invest. We are totally subject to the future investment rates, and there were a number of scenarios in which the interest rates were expected to increase.

Table 11

Universal Life and No-Cash-Value Universal Life
Benefit Hedging
Present Value of 30-Year Ending Surplus
Portfolio Crediting

	UL	No-Cash-Value UL	Additive	Combined
90th Percentile	$3,800	$3,800	$7,600	$6,900
Median	2,600	2,600	5,200	4,600
10th Percentile	1,500	(1,100)	400	2,200

STOCHASTIC BENEFIT ASSUMPTIONS

MR. ABRAHAM GOOTZEIT: My remarks will cover the following topics:

a. First, I'll look at recent trends. We'll examine the economic environment that makes this study particularly topical.

b. We'll then go over the definitions of risk. I'd like to examine the analysis that the actuarial profession has undertaken recently and the analysis that the profession has omitted from its review.

c. There are several actuarial standards we can find in the literature that might assist us in analyzing benefit assumptions in an economically changing environment.

d. What are the differences in testing on a scenario basis versus testing on a traditional basis?

e. There may be contract, product or market provisions that should be considered when examining benefit assumptions.

f. I'll spend quite a bit of time on the particular liability cash flows that may be candidates for examination during changing economic conditions.

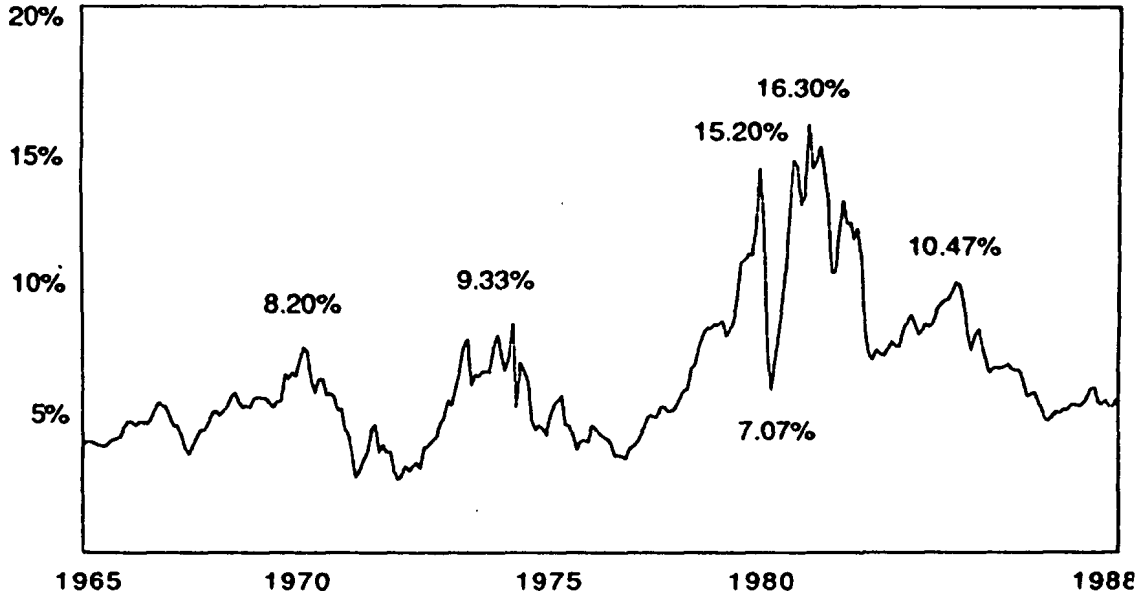
g. Finally, we'll try to make some sense out of these remarks with a universal life case study.

When examining recent trends, we, of course, can notice that there has been increased interest-rate volatility. Slide 1 looks at ninety-day Treasury-bill rates over the last twenty plus years. The significance of the information contained on this chart is that interest rates have been increasingly volatile over the more recent past compared to the more distant past. It's the change in interest rates that makes the management of insurance company cash flows, both liability and asset cash flows, more difficult to predict. When interest rates spike up, competitive pressures always exist to follow a new-money rate. The choices that insurance companies have, either to follow the new-money rate and maintain the business in force, or to maintain the interest rate spread but possibly lose new and existing business, are well-established.

A second trend of note is the changing product mix. Slide 2 depicts annualized new premium of universal life sales as a percentage of all life insurance sales over the past several years. Significantly, universal life insurance has been capturing a smaller percentage of the total market since 1985. The unbundled approach of universal life

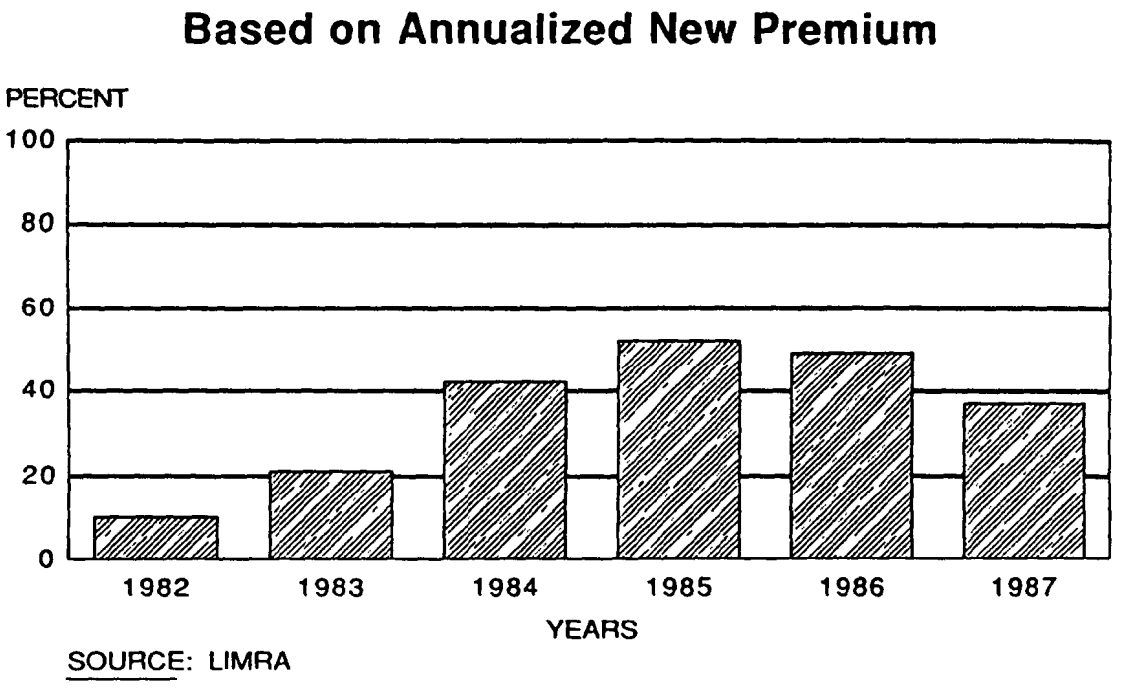
SLIDE 1

90-DAY TREASURY BILL RATES



SLIDE 2

UNIVERSAL LIFE MARKET SHARE



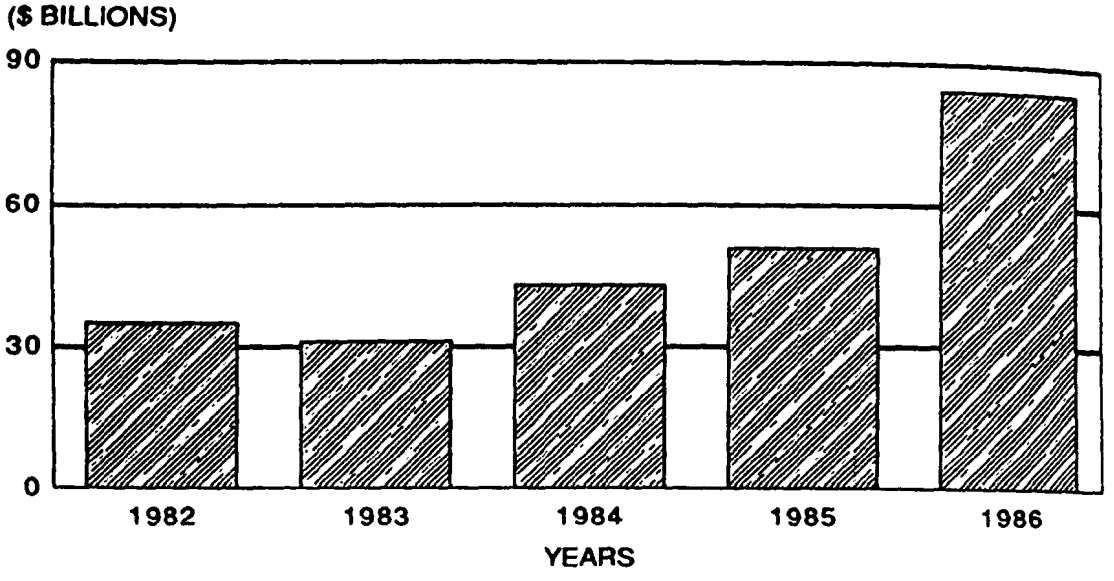
insurance together with high interest rates of the early 1980s made universal life an attractive product for life insurance companies. As interest rates have stabilized over the past couple of years, universal life insurance has captured a smaller percentage of the total market. Has there been anything else to replace universal life?

Slide 3 indicates the large increase in annuity considerations over the past year or two. Large group deferred-annuity, guaranteed investment and individual contracts have captured an increasing amount of new business. The marketplace is still interest sensitive; we will not soon return to the less consumer-efficient products of the 1950s and 1960s. Other products, which have had an increasing share of the market, include excess-interest whole life (and its close relative single-premium whole life) and variable life insurance. The impact of variable life on the marketplace has not been as dramatic as many people have predicted. With the stock market turn in October 1987, variable products are capturing an even smaller percentage of the total market.

Our last trend is that expected profit margins are smaller than ever for insurance companies. Profit-test assumptions at issue are more aggressive with less room for positive adverse deviation. When companies examine profits by source, an exercise done by a small number of institutions, it becomes apparent that modern products are failing to meet projected profit assumptions over a wide range of parameters. Much attention has been focused on the investment risk and the difficulty in achieving satisfactory

SLIDE 3

ANNUITY CONSIDERATIONS



SOURCE: LIFE INSURANCE FACT BOOK

investment margins. Also, other assumptions, such as lapses and expenses, are difficult to meet. Our static actuarial models, which are used for both pricing and valuation, do not do an adequate job of analyzing insurance risk.

Let's turn our attention to the different types of risks, which actuaries are asked to measure and analyze: C-1 risk, or asset defaults; C-2 risk, or the pricing risk; C-3 risk, or interest rate changes; and C-4 risk, or all other risks.

The C-3 risk is defined as the risk of loss due to interest-rate fluctuations. A large body of actuarial literature has been developed indicating the appropriate manner to measure asset cash flows in a changing economic environment. Appropriate methods of crediting interest to liability cash flows have also been studied. C-1 risk, the probability of asset defaults, has been analyzed by our investment associates. As actuaries, we have done a thorough job of analyzing the pricing risk in a static environment. We are trained to perform mortality, lapse, and expense studies as part of our actuarial education.

C-3 risk, however, also covers the risk of loss due to interest- rate fluctuations caused by changes in our traditional liability cash flows. How do we, as actuaries, measure and identify these changes in the traditional liability cash flows?

Let's now examine some actuarial standards which give us guidance in the study of stochastic benefit assumptions. I've been able to identify three published actuarial standards:

a. Draft Recommendation 7, from the American Academy of Actuaries;

b. "Recommendations Concerning Cash Flow Testing," by the Interim Actuarial Standards Board (IASB); and

c. New York Regulation 126.

Draft Recommendation 7 reads in part as follows:

> In projecting insurance cash flows, the actuary should consider contractual provisions as well as non-contractual conditions or assumptions that can affect future cash flows. For example, the following contractual provisions and assumptions are among those that should be considered by the actuary:
>
> a. the amounts and incidence of dividend payments or interest credits which vary in accordance with the company's established practices,
>
> b. the likely amounts and incidence of policy loans, partial withdrawals and surrenders, recognizing surrender charges or other penalties, if any,
>
> c. the likely amounts and incidence of future considerations to be received and the amount of sales and related compensation to be paid,

d. the amount of future maintenance and allocated overhead expenses.

Draft Recommendation 7 goes on to say:

> Each of the above should be examined to determine the extent to which future insurance cash flows may vary due to changes in the prevailing interest rates. For example, the incidence of future premium payments, partial withdrawals, surrenders, health and disability benefits, policy loans, etc. may be expected to vary with interest rates, and expenses may increase with inflation.

Draft Recommendation 7 requires the actuary to vary liability cash-flow items with changes in the economic environment.

Earlier this year, an exposure draft was released by the Life Committee of the IASB entitled "Recommendations Concerning Cash Flow Testing for Life Insurance Companies." The exposure draft does not require the actuary to perform asset/liability cash-flow testing as a routine part of his/her valuation responsibility. However, when circumstances dictate that cash-flow testing be performed, the "Recommendations Concerning Cash Flow Testing" indicate certain items to consider, as follows:

> When performing cash flow testing, the actuary needs to consider the various items which affect the projection of insurance cash flows.
>
> The characteristics and contractual terms relating to liabilities may affect the expected insurance cash flows. In many cases, the cash flow variations are dependent upon the economic scenarios. Examples of such items include cash surrender provisions, policy loan rights, premium payment provisions, and interest rate guarantees.
>
> RECOMMENDATION: The assumptions made concerning the effects on insurance cash flows caused by the liability characteristics and contractual

> terms, and the relationships between such assumptions and the economic scenarios, should be described in the actuarial report.

The last published document, which indicates appropriate ways to analyze stochastic benefit assumptions, is New York Regulation 126. New York Regulation 126 requires New York-domiciled companies and authorized reinsurers to perform asset/liability cash-flow testing for certain annuity contracts. The regulation has been expanded recently to cover single-premium life insurance. It is expected that other forms of interest-sensitive life insurance will be covered in future years. New York Regulation 126 reads, in part, as follows:

> Each of the investment cash flows should be examined to determine the extent to which future cash flows may vary due to changes in interest scenarios. For example, with insurance cash flows, as interest rates rise, future considerations under fixed interest rate guarantee contracts may be expected to decline and future withdrawals may be expected to rise; as interest rates fall, considerations may rise and withdrawals decline. The specific assumptions used in the projections for future considerations and future withdrawals, including the extent to which these assumptions vary with future interest rates, should be covered in the actuarial memorandum.

Additional comments regarding stochastic benefit assumptions can be found later in New York Regulation 126 as follows:

> Recognition must be given to all relevant items such as:
>
> (i) the difference between the new money rate and the assumed interest crediting rate under various interest scenarios;

(ii) any fixed value adjustments such as surrender charges;

(iii) any market-value adjustments;

(iv) loyalty of the business (e.g., single premium annuities sold through stockbrokers may have higher lapse rates than those sold by career agents).

Let's now look at the difference between traditional testing and scenario testing, which is required in order to analyze stochastic benefit assumptions. Traditional testing involves a single interest scenario, which is usually quite uninteresting. The investment income is a level interest rate for the life of the projection. Product cash flows are projected independently of the investment income. This single-scenario static environment does not permit actuaries to analyze interactively product and liability cash flows.

Contrast this with scenario testing over a large number of possible economic environments. Generally, interest rates are projected using a lognormal method or other suitable stochastic methodology. Asset cash flows are driven off of these realistic interest scenarios. Calls, prepayments, reinvestment strategies and other asset characteristics are accurately calculated. Product cash flows are also driven off of the interest scenarios. Liability assumptions are dependent upon the interest rates and the asset cash flows in an interactive manner.

What are some of the key modeling differences between scenario testing and traditional testing?

a. Scenario testing has multiple economic scenarios.

b. There is considerably more asset detail in scenario testing.

c. Investment rates fluctuate in a realistic pattern over a large number of possible scenarios to give a true range of possible outcomes.

d. There are many dynamic assumptions and relationships between asset cash flows and liability cash flows.

There are a number of challenges in performing scenario testing. The development of the economic scenarios may be difficult for the actuary who has never considered this type of testing. Many methods are available, including a stochastic generation method that uses a lognormal distribution based upon historical parameters of volatility, correlation, elasticity, etc. Alternatively, it is possible to formulate deterministic scenarios, which seem reasonable and comprehensive in nature. The choice of dynamic assumptions for both asset and liability cash flows are critical ingredients in effective scenario testing. We will soon begin to look at the selection of dynamic assumptions on

the liability cash-flow side. The measurement and analysis of a large number of possible results is an art and skill in itself. Wading through reams of paper and information in order to make key management decisions requires knowing the purpose of the exercise.

Before examining the liability cash flows and the establishment of the assumption in the stochastic environment, let's review some contract provisions, which should be considered. Do any of the following provisions have an impact when setting liability cash-flow assumptions?

a. A company that has a practice of crediting high interest rates should be able to attract and retain significant amounts of life insurance business. There may be a distinction in the setting of assumptions between those companies on a portfolio interest-credited rate and those on a new-money credited rate.

b. The existence or absence of surrender charges should have some impact on the retention of existing in-force business.

c. Products with market-value adjustments subject the insurance companies to smaller amounts of risk than products without market-value adjustments. Variable products usually have their liability cash flows figured at market rather than book value.

d. The existence of incentives in the form of additional fund credits may positively impact policyholder retention. These persistency incentives may take the form of additional interest credits, return of mortality deductions, or high- surrender-option rates.

e. An additional consideration, which may become more important in the future, is the personal tax advantages that an individual policyholder may enjoy. If certain types of life insurance, such as single-premium life insurance, retain favorable tax status for existing business, it is possible that in-force policies may have superior persistency.

These contract provisions and others should be examined when establishing stochastic benefit assumptions.

Which products are appropriate choices for stochastic benefit assumptions? On the life insurance side, it certainly is true that interest-sensitive insurance will exhibit characteristics that can be modeled using stochastic benefit assumptions. Participating life insurance strives to remain current in the economic environment through its dividend scale. Participating insurance and adjustable-premium life insurance are interest sensitive in the truest sense. The performance of the product should be

enhanced during times of high available investment income returns. All annuity products are candidates for stochastic benefit assumptions.

Other types of insurance, such as group and health, are cyclical in nature. Those cycles may be dependent upon the economic environment. These other products are outside the scope of this discussion.

Let's now examine the liability cash flows, which vary stochastically with the economic environment. In projecting cash-flow items, it is critical to do a good job in setting the crediting-strategy assumptions: both the company and the competitor strategy.

We'll first talk about the competitor rate. The competitor rate is an index representing interest rates credited on similar products by a group of peer companies. The index is usually a function of interest rates, which are available on new investment products, or a rolling average of available interest rates over the recent past.

The competitor rate is a key variable. If the interest rate you are crediting lags behind the competitor rate, you may trigger a significant number of extra lapses. It may be difficult to attract new business when your rates lag behind the competition.

What are similar products? The answer may be obvious: if the product under consideration is universal life insurance, then similar products are other universal life insurance products. The answer may not be so obvious: it may be that the marketing effort of the organization is competing against other products covering a wider range of offerings. Similar products for deferred-annuity contracts might be certificates of deposit and money-market mutual funds. A peer group of companies is significant; agents may have other attractive outlets. It is important to stay competitive in your peer group in order to maintain the agency force and to keep persistency and new- business production at an acceptable level. The marketing department must be involved when determining the competitors of your company.

The competitor rate can be based on a function of scenario rates. At Tillinghast we define scenarios on the basis of Treasuries. Other investment instruments are derived from Treasuries. The competitor rate might be a new-money rate (a function of interest rates available on investment vehicles purchased now), a rolling average of new-money rates over the recent past, or the higher of a new-money rate and a portfolio rate.

In setting the assumption for crediting interest on your insurance policies, it's important to look at the portfolio earnings rate of the assets underlying the block of business. Most companies have a target interest spread they try to maintain, but they restrict themselves to be near the competitor rate. A typical management meeting, in which

credited interest rates are set, will examine both the portfolio earned rate and the competitive pressures. The crediting strategy should also take note of the methodology employed (portfolio or new money.)

Persistency is a liability cash flow that is sensitive to the competitiveness of the credited interest rate. Lapse rates, traditionally, are statically projected based upon historical experience. There should be an additional increment to the lapse rate based upon the competitiveness of the credited interest rate. It may be assumed that your rate can lag behind the market rate by a certain threshold before excess lapses will be triggered. Policyholders tend to have a certain momentum that prevents them from taking action in their economic interest for small profits. If a surrender charge exists on the contract, the impact of additional lapse rates may be reduced. Regardless of how uncompetitive your product may become, the total annual lapse rate is probably limited to something on the order of 30 or 40 percent. Of course, the lapse-rate formulas should vary by product and market.

Lapse-rate formulas equaling a base rate plus an increment, which is dependent upon the competitiveness of your product, are as follows:

a. A 1982 C-3 study had lapse rates equal $5\% + (M - C)^{1.5}$ with an annual maximum of 75%.

b. The *Valuation Actuary Handbook* has an example where the lapse rate is $15\% + 2(M - C)^2 - 3(SC)$.

c. Our case study is equal to $5\% + 3(M - C - .5\%)^2$ with a maximum annual rate of 30%.

M = Market Rate

C = Credited Rate

SC = Surrender Charge

Persistency, which varies according to the competitive posture of the underlying insurance product, is the most common stochastic benefit assumption.

Another important liability cash flow, which may vary according to the economic environment, is the premium payment pattern. For in-force business, consumers have the option of continuing the premium payments of their insurance products. For some products, such as flexible-premium universal life and flexible-premium deferred-annuity contracts, policyholders have the right to change their premium payment, either up or down, subject to contractual and company limits. Consumers are more apt to exercise these options if the company's competitive position deviates significantly from the norm. It's important for actuaries to recognize this phenomenon and accurately assess its

financial significance. The premium-payment assumption should be consistent with withdrawal rates, which vary according to the competitive posture of the product.

It has long been recognized that policy-loan utilization is heavily influenced by the relative advantage of exercising the policy-loan option. The impact of policy loans is most significant for traditional life insurance products such as participating plans. Many companies directly recognize policy- loan utilization in their dividend program. Virtually all companies have the variable, policy-loan interest rate in their more recent life insurance offerings. The combined impact of direct recognition and the variable loan rate have reduced the financial advantages available to policyholders when exercising their policy-loan right. For older policies, significant exposure to the company may still exist. Excess loans are dependent upon the competitive position of market interest rates and policy-loan rates. It has been well-documented that policy loans may be indicative of future surrenders.

A recent liberalization of the policy-loan provision is the single-premium whole life "wash loan" provision. Certain amounts of money are available to be loaned out without direct cost to the consumer. This option should be used quite often.

Current policy-loan utilization formulas are as follows:

a. A presentation at the New York Actuaries Club meeting several years ago had a policy-loan utilization formula of $(M - P)^{1.8}$ where M is the risk-free rate available to consumers in savings and loans and P is the effective policy loan rate.

b. The 1987 Valuation Actuary Symposium had a presentation which expressed the policy-loan utilization rate as $2(M - P)^2$.

M = Market Rate

P = Policy Loan Rate

All of the standards referred to earlier in the presentation (Draft Recommendation 7, "Recommendations Concerning Cash Flow Testing," and New York Regulation 126), indicate that the valuation actuary has a responsibility to appraise the organization on a going-concern basis. This means that expenses may be projected under the assumption that new business is sold according to a prescribed program. The sale of new business will help to maintain efficiencies of scale and keep unit-expense costs from increasing dramatically. If the organization finds itself in a noncompetitive performance posture, excess lapses may be triggered and new business may be reduced, resulting in fewer in-force policies. The fixed expense of running a back-office shop would not be reduced; hence, unit expenses would increase.

Actuaries like to portray expenses on a functional-unit cost basis. In reality, a large portion of the expenses are fixed and independent of the amount of business on the books. A small amount of maintenance expenses are truly variable. We may need to redo our valuation projections to include a relatively large amount of fixed overhead expenses and a smaller amount of variable-unit-type expenses. This exercise may more accurately portray the financial results of the organization over a large range of economic scenarios.

When doing valuation work, it is not necessary to include new business in the projection period. As we have seen, however, achieving the desired amount of new-business production is important if expenses are to be kept reasonable.

Companies with large amounts of participating life insurance must project their dividends when doing valuation actuary work. In a static environment, the assumption that dividends will stay at the current level is probably sufficient. In a changing economic environment, dividends should be projected to vary with available interest rates. A simple way to do this would be to vary the interest factor in the dividend formula with current interest rates. Consumers may exercise their option to lapse their policies if the dividend performance is substandard. The performance indicator of a participating policy is difficult to identify. For universal life insurance, the current credited interest rate has become the performance indicator. (We actuaries know that

this is a flawed measure.) There is no one performance indicator for participating life insurance.

The last liability cash-flow item, which may vary with the economic environment, is mortality. Policyholders may exercise their options to lapse, stop paying premiums, or make policy loans. It is probably true that unhealthy lives are less likely to exercise these options. To the extent that substandard product performance encourages policyholders to leave the fold, extra mortality can be expected. Extra mortality is just one reason why it is important for a company to maintain its competitive position over time within the market and distribution channel in which the company operates.

We've reviewed many of the liability cash flows that should be examined when doing valuation actuary studies in a changing economic environment. We will now turn to a universal life case study, which should quantify many of the items discussed. Here are the baseline assumptions for the universal life insurance product:

a. One year's issue is 1,000 policies to issue-age 35, male nonsmokers.

b. The average-size policy is $100,000 with $800 annual premium.

c. There is a twenty-year projection period.

d. The assets earn 10 percent, and we credit 8.5 percent to the universal life fund.

There are other baseline assumptions for mortality, expenses, lapses, etc. The static result of this projection indicates that the present value of statutory gain from operations after federal income tax is $95,000. We'll now run a series of economic scenarios with a variety of stochastic benefit assumptions to see the impact on the present value of statutory profits.

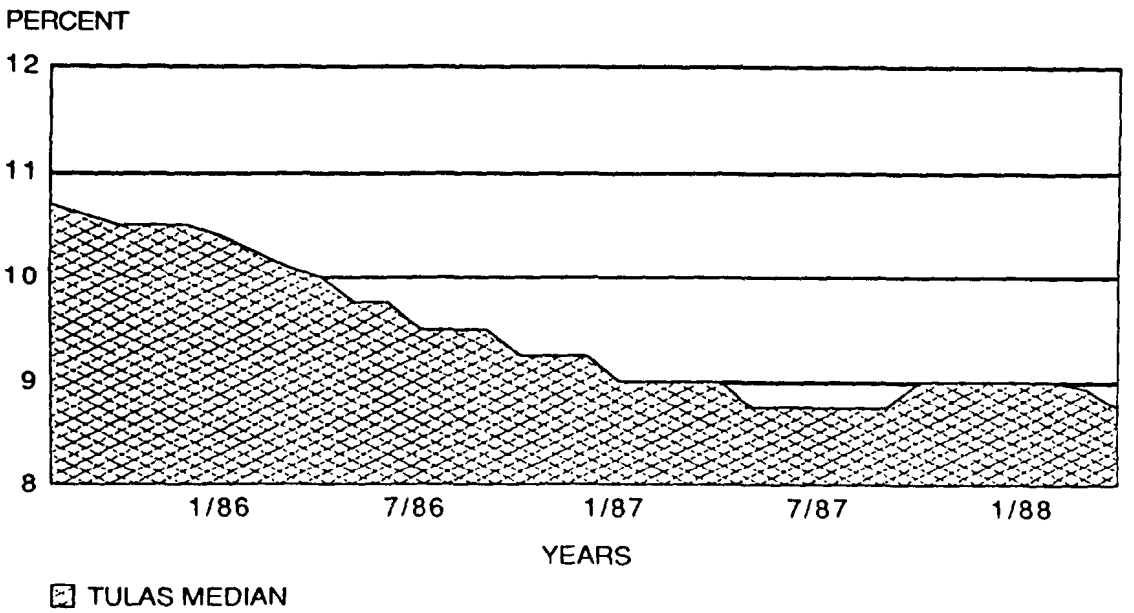
Our baseline dynamic assumptions include two hundred interest scenarios with average volatility. These scenarios are generated based upon the lognormal distribution method, historical volatility and other parameters.

We'll define the competitor rate as a function of the interest scenarios, approximately equal to the TULAS median. TULAS is the Tillinghast Universal Life Analytical Study. At Tillinghast, we have been monitoring the universal life marketplace for many years. Our current study follows over five hundred products written by approximately two hundred and fifty companies.

Slide 4 looks at the median universal life credited rate over the past several years. Slide 5 adds the twenty-fifth percentile of TULAS universal life rates. Slide 6 adds the rate at the top 10 percent in our universal life base.

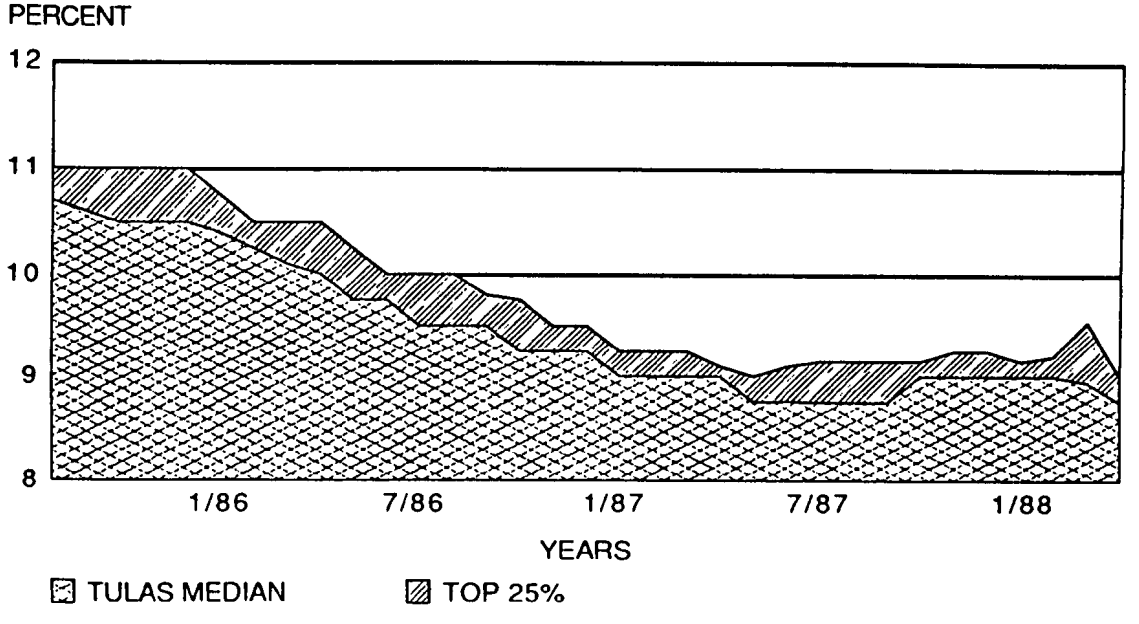
SLIDE 4

COMPARISON OF TULAS RATES



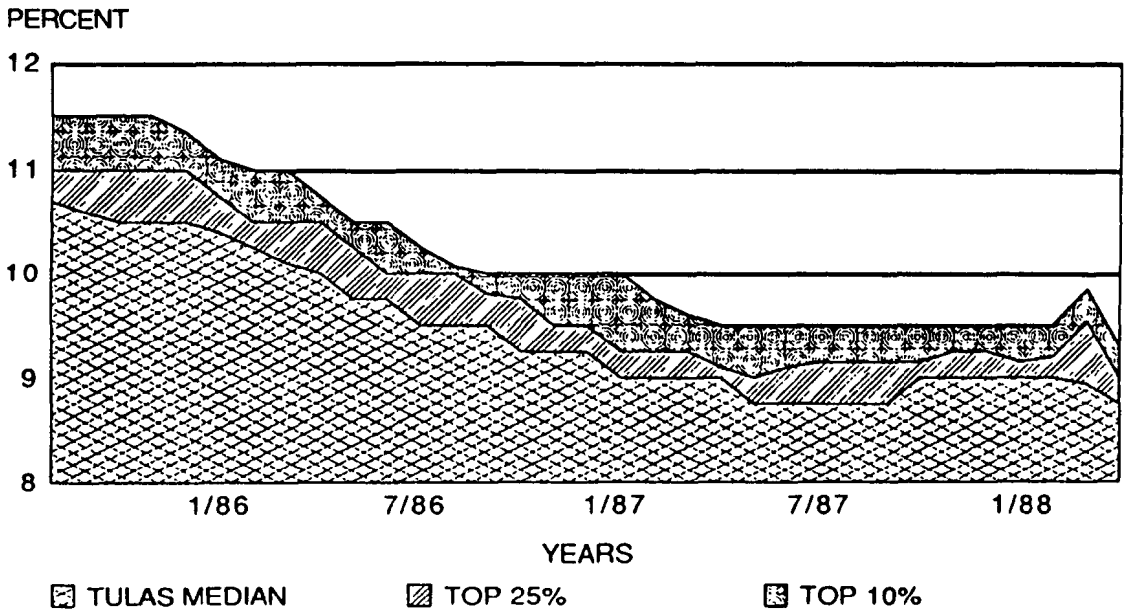
SLIDE 5

COMPARISON OF TULAS RATES



SLIDE 6

COMPARISON OF TULAS RATES



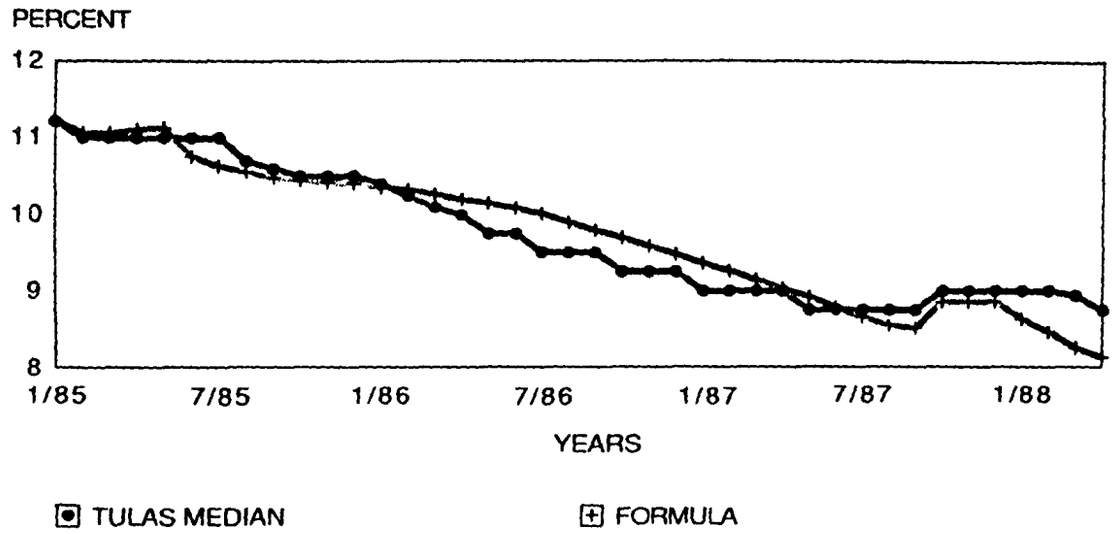
We fitted a formula to the median TULAS rate which is a function of five-year Treasuries. The formula is the greater of 87.5 percent of the two-quarter rolling average of five-year Treasuries plus 131 basis points, and 82.5 percent of the twelve-quarter rolling average of five-year Treasury rates plus 125 basis points. The formula is also the higher of a function of new five-year Treasuries or a rolling average of five-year Treasuries in the recent past.

Let's see how well our sample competitor rate fits the TULAS median. Slide 7 compares the TULAS median and the formula competitor rate. The formula rate fits quite nicely and is what we will use in our universal life case study.

We will now examine the crediting strategy which the organization usually follows. Very few companies clearly articulate a crediting strategy. The strategy on Slide 8, which may have evolved over time, is an attempt to maintain a certain spread (such as 150 basis points) from the earned rate of the portfolio. The marketing department will never allow you, though, to lose touch with the competition. Therefore, this crediting strategy may be typical of many organizations. Since this is a unit of new business, we won't have positive assets for a short period, such as a year. Therefore, we will credit the competitor rate for the first year. Thereafter, we'll credit interest on a portfolio basis trying to maintain the 150 basis points spread. However, we will not allow ourselves to

SLIDE 7

COMPARISON OF COMPETITOR RATE FORMULA
With TULAS Median Rate



SLIDE 8

CREDITING STRATEGY

- Competitor rate for first year
- Thereafter
  - -- Net portfolio yield less 1.5%
  - -- Not higher than competitor plus .5%
  - -- Not lower than competitor less 2.0%

be above the competitor rate by more than 50 basis points. Nor will we allow ourselves to lag behind the competitor rate by more than 200 basis points.

The last dynamic assumption we need is our reinvestment strategy. The positive cash flows will be reinvested in the following instruments: 30 percent in five-year A-rated bonds, 30 percent in ten-year A-rated bonds, and 40 percent in thirty-year commercial mortgages. The bonds are noncallable, and the mortgages are of level principal and interest without a balloon. Our negative cash-flow strategy will be to borrow at the ninety-day Treasury rate plus 200 basis points.

Slide 9 shows the beginning investment returns applicable at the start of the twenty-year projection period. Economic scenarios are generally projected for Treasuries, and we see the five-, ten- and thirty-year bond equivalent yield rate for Treasuries. Other instruments are determined from Treasuries using a multiplier and a spread constant. You can see the beginning bond equivalent yield rates for A-rated bonds with durations of five and ten years, and for thirty-year commercial mortgages. As the Treasury rates vary during the economic scenarios, the available bond equivalent yield rates for A-rated bonds and commercial mortgages will change.

We now want to review the results of running two hundred scenarios with these dynamic assumptions. In order to easily view two hundred results, we at Tillinghast generally use

SLIDE 9

SCENARIO TESTING MODEL

Beginning Interest Rates
Bond Equivalent Yield Basis

	5-Year Maturity	10-Year Maturity	30-Year Maturity
Treasury	8.16%	8.95%	9.14%
A-Rated Bond	9.12%	10.14%	--
Commercial Mortgage	--	--	11.14%

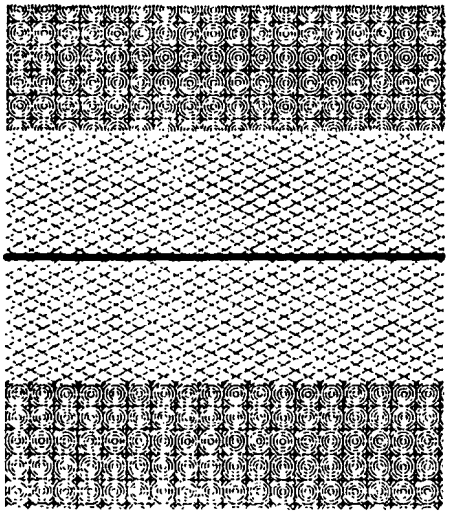
a bar which looks like that in Slide 10. The top of the bar represents the best outcome. The bottom of the bar represents the worst outcome. The middle of the bar represents the median result. The ninetieth percentile and tenth percentile results are also displayed. An optimal result would have a high median within a narrow bar, which would indicate low volatility of expected results.

We'll now examine the results of running two hundred economic scenarios. We can see in Slide 11 that the median result is $88,000, and the bar extends upward for some scenarios to quite high levels. These few high results involve economic scenarios with relatively stable interest rates that decline slowly over time. The median result of $88,000 is slightly below the $95,000 from the static test. We have not yet allowed any of the benefit assumptions to vary stochastically with the economic environment. We will now change a few of them, sequentially, and review the results (Slide 12).

The first benefit assumption we will vary is the additional lapse formula based upon the difference between our credited rate and the competitor rate. If we lag behind the competitor rate by 50 basis points or less, we will not trigger any additional lapse rates. This is the 50-basis-points threshold we discussed earlier. The formula is exponential with an exponent of 2 and a multiplier of 3. Remember that we're constraining the credited rate to always be within 200 basis points of the competitor.

SLIDE 10

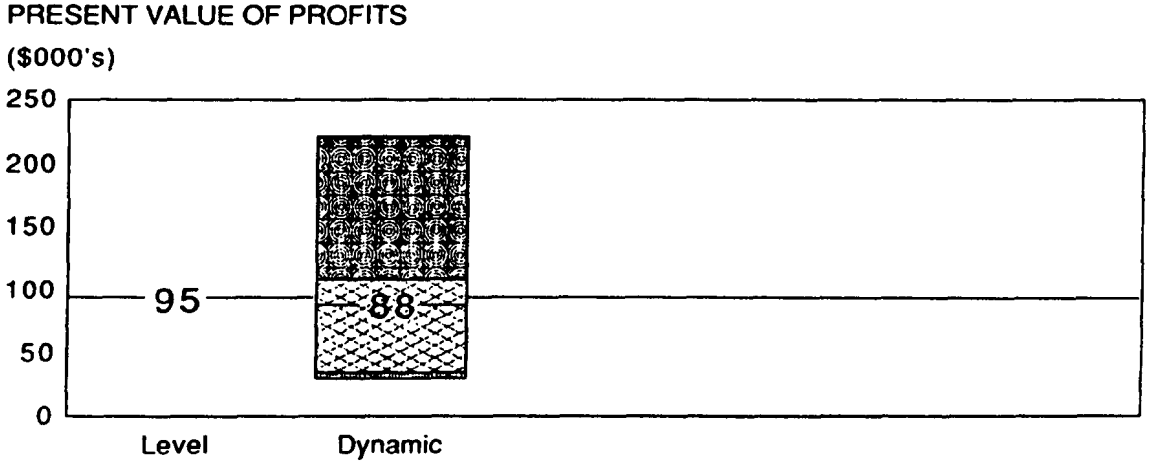
MULTIPLE SCENARIO RESULTS



SLIDE 11

UNIVERSAL LIFE CASE STUDY

(After FIT)



SLIDE 12

ADDITIONAL LAPSE FORMULA

Sample Rates Assuming No Surrender Charge

Competitor Less Credited	Additional Lapse Rate
.50%	.00%
1.00	.75
1.50	3.00
2.00	6.75
2.50	12.00
3.00	18.75

Let's rerun the two hundred stochastic scenarios and allow the lapse formula to reflect additional lapses. The results are not nearly as good (Slide 13). The median result is 77,000, and other parts of the bar have been reduced as well.

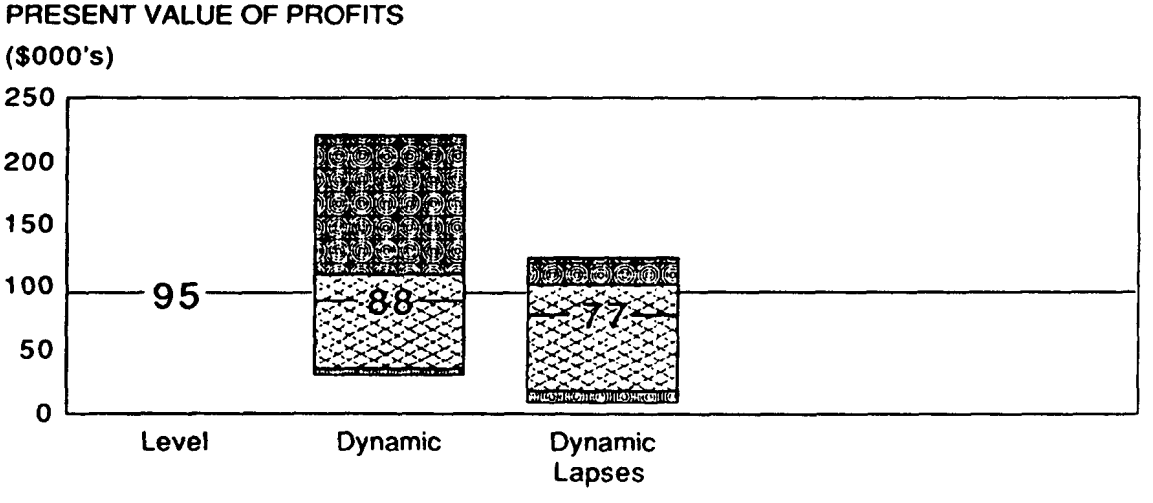
Slide 14 shows the renewal premium of the universal life insurance product. If the credited rate of our universal life product is within 50 basis points of the competitor rate, either plus or minus, the renewal premiums will be as indicated in the baseline assumptions. If we lag behind the competitor rate by more than 50 basis points, we will reduce the renewal premium factor. You can see that the bar starts to go below 100 percent of the baseline assumption towards the right of the chart in Slide 14. If we exceed the competitor rate by more than 50 basis points, we have renewal premiums above 100 percent as indicated on the left side of the chart. Remember, however, that this formula will only operate between negative .5 percent and plus 2 percent, since we are constraining the crediting rate to be close to the competitor rate.

When we add the premium-adjusted factor to the baseline dynamic assumptions and the dynamic-lapse assumption as in Slide 15, the result seems better. The median result is 93,000 rather than 77,000, and there is a modest increase in other parts of the bar, as well. As we're lagging behind the competitor rate, the company is getting fewer dollars of premium. This is at a time of subsidizing the interest rate so that we can be within 200 basis points of the competition. When it is difficult for us to maintain our interest-

SLIDE 13

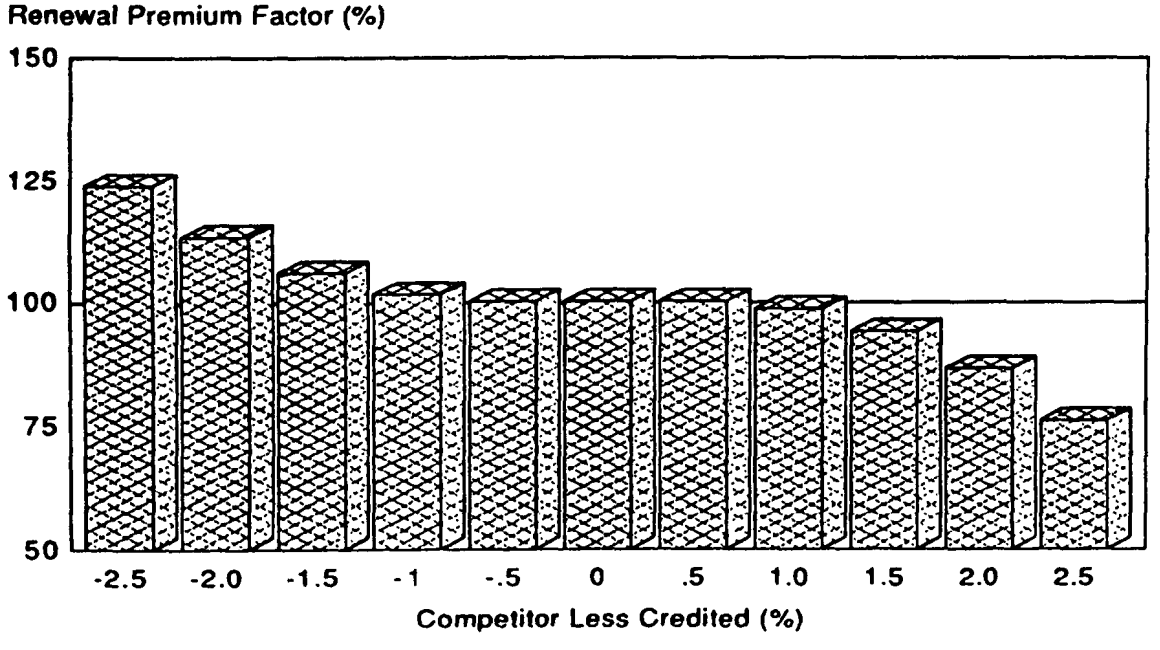
UNIVERSAL LIFE CASE STUDY

(AFTER FIT)



SLIDE 14

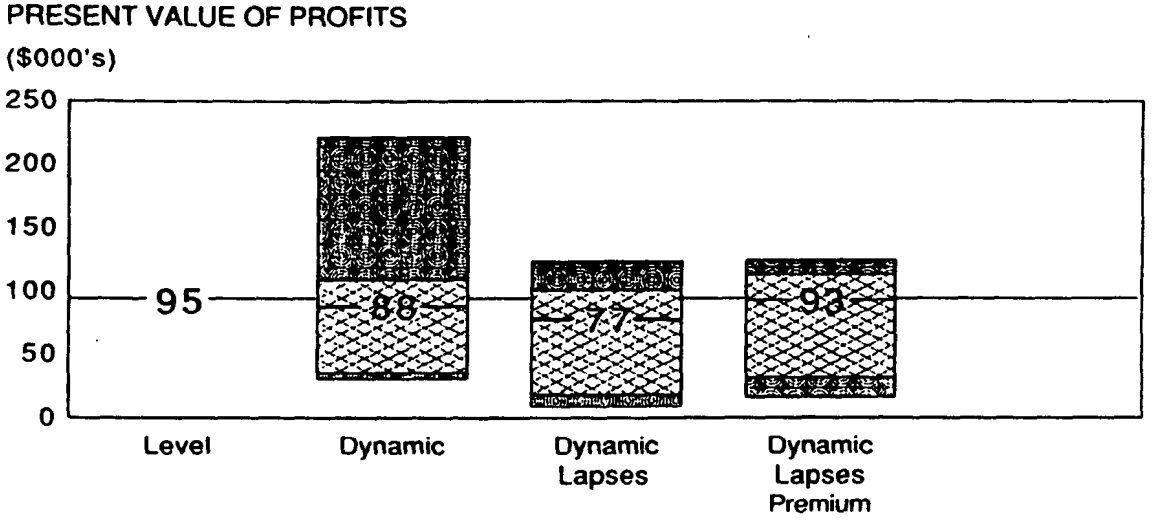
RENEWAL PREMIUM ADJUSTMENT FACTOR



SLIDE 15

UNIVERSAL LIFE CASE STUDY

(AFTER FIT)



rate spread and we are subsidizing the interest rate, we are receiving fewer premium dollars. The result is somewhat counterintuitive.

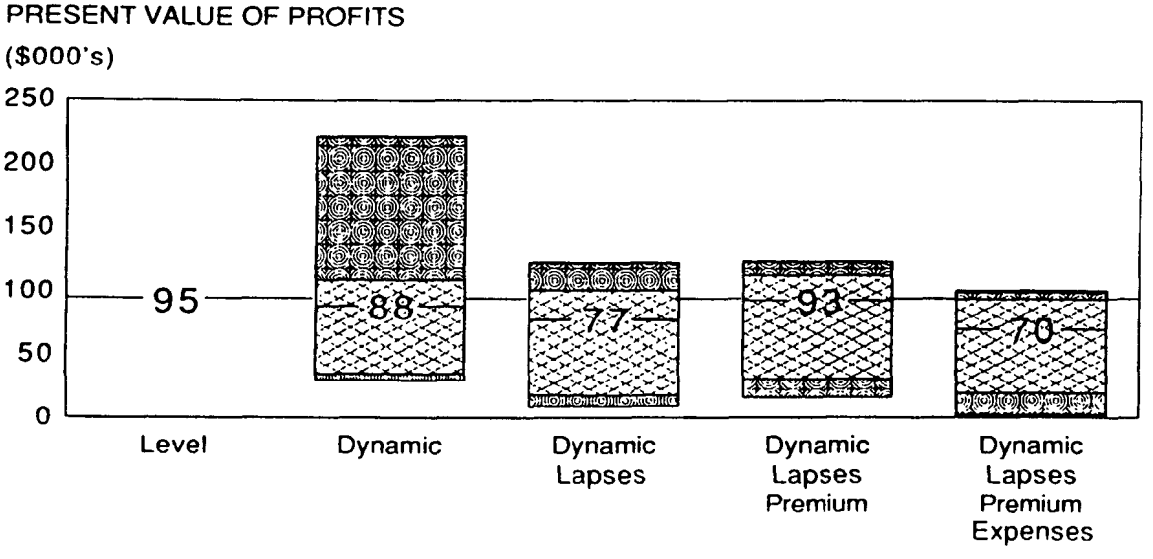
The last dynamic assumption we're going to examine is expenses. As we indicated earlier, many of our back-office expenses are fixed. Only some maintenance expenses vary with the amount of business in force. Let us assume that 60 percent of our maintenance expenses are fixed, and 40 percent of our maintenance expenses are variable. I've projected the maintenance expenses based upon a static model and have varied 40 percent of those projected expenses with the amount of business in force. Making that assumption, along with all the others, reduces the present value of profits (Slide 16). The median result is now $70,000, and other parts of the bar are reduced as well.

This last test is probably the most realistic. The assumptions are dynamic rather than static. We have assumed that excess lapse will be triggered if our interest rate is not competitive. We have assumed that premiums will either be higher or lower than the target depending upon our competitive position. And, we have recognized that certain maintenance expenses are fixed rather than variable. The static result is $95,000. The dynamic result is $70,000. We have approximately a 10 percent chance of exceeding the $95,000, and we have a 10 percent chance of going below $25,000. This range of results is much more realistic than a static number of $95,000.

SLIDE 16

UNIVERSAL LIFE CASE STUDY

(After FIT)



Stochastic-benefit-assumptions analysis has lagged behind the traditional C-1 and C-3 risk analyses. The assumptions we've used are based primarily on judgment and validation but seem to be representative of the things that have been happening and will continue to happen in the future. This kind of analysis is useful in explaining the poor financial results that many life insurance companies have noticed over the past several years. There is no question that there will be increased future activity in stochastic benefit assumptions both on a professional level from the Society of Actuaries and its task forces and from company actuaries as well.