

**1986 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS**

SESSION 4

SETTING APPROPRIATE ASSUMPTIONS FOR THE VALUATION PROCESS

(JOINT SESSION)

MR. DENNIS L. CARR: Over the past couple of years, Tillinghast has been involved in doing asset/liability cash flow analyses for interest-sensitive life and annuity products. Over that time period, we have learned a great deal about the assumptions involved in such modeling. The assumption-setting process is not new to actuaries; however, setting assumptions that vary with different interest scenarios is rather new, so we are still very much in the learning mode.

Assumption setting can be a rather dry topic. In order to make it a little less so, our discussion will center around a case study. I will discuss the assumption-setting aspects of this case study today, and Mike Tuohy will discuss the results in another speech.

The title of our case study is "Mismatch Life Revisited." For those of you who attended last year's symposium, these next few minutes will be a review; for those who did not, it will be new material.

I'd like to begin our case study by introducing some of the key employees at Mismatch Life. First, we have our chief marketing officer, Sal A. Lott. Sal started out selling as an agent and worked his way up through the ranks. He is quite proud of his marketing achievements at Mismatch Life.

Next, we have our chief investment officer, Max M. Yield. Times have been tough for Max. As new money yields declined and the pressure was on to keep credited interest rates high, Max sat in the hot seat. There was a lot of pressure to go with longer-maturity and lower-quality investments.

Next, there is the chief actuary, Ernie D. Spread. Ernie has been at Mismatch Life for several years and hopes that the valuation actuary proposal will become law one year after his retirement date.

I'd like you to meet our final character first as we saw him last year and then as he is today. Last year, Manny Sennarios was the assistant actuary at Mismatch Life. As you can see, Manny was quite involved in doing the actual cash flow projections. Manny's attitude last year was expressed by the statement, "There goes my study time!" I'm pleased to announce that Manny has had a very good year. As you can see from the new plaque on his office wall, Manny passed his final exam and now is an FSA. You also will note that he received a promotion—to assistant vice-president and actuary. Manny has cleaned up his office a bit. Those piles of computer runs from last year have been replaced by a few graphs on his office wall. Manny has learned to better manage the mass of data produced by the cash flow studies by reducing the data to pictures, when possible.

Now that you've met the people at Mismatch Life, let's take a look at some general background information concerning the case study. Mismatch Life is a simple one-product company. It sells a typical back-load universal life product. It began issuing this product in January 1981. Our case study will consider the

valuation to be done on December 31, 1990. Finally, it is important to keep in mind that we have made the simplifying assumption that the statutory reserve is equal to the cash surrender value.

In order to get a better feel for Mismatch Life's block of universal life business, let's take a look at some historical data. The following table shows the historical sales growth of the company:

TABLE 4-1

<u>Year</u>	<u>Annual Premium</u>	<u>Lump Sum</u>	<u>Total</u>
1982	\$ 16	\$ 4	\$ 20
1984	80	40	120
1986	112	55	167
1988	136	30	166
1990	160	16	176

Table 4-1 shows the sales statistics for selected years in terms of annual premium/periodic premium sold and additional lump sum premium received, as well as the total sales figure. The pattern of sales is meant to represent a typical situation. There is rapid growth in sales through the early 1980s. Lump sum premium increases throughout the first half of the 1980s and then tapers off as 1990 approaches. Annual premium increases at a decreasing rate as time passes. Note that in the last half of the 1980s, the total premium income tends to be fairly flat. This is due to a slowing growth rate in annual premium and a decrease in the lump sums received.

Table 4-2 shows the historical growth in the policy liability for selected years:

TABLE 4-2

<u>Year</u>	<u>Fund Value</u>	<u>Cash Value</u>
1982	\$ 25	\$ 2
1984	200	44
1986	608	241
1988	1,208	638
1990	2,012	1,235

Both the growth of the fund value and the cash surrender value are traced in this table. Considering the rather flat total premium sales of the last half of the 1980s, as shown in Table 4-1, it is interesting to look at the rapid growth in fund values that occurs between year-end 1986 and year-end 1990. The fund value more than triples over this 4-year time period. The growth in the cash surrender value is even more rapid, increasing fivefold over that same 4-year period. Of course, the cash value growth is accentuated by the grading off of the surrender charges over time. What does this tell us? I think it says that universal life could quickly come to account for a major portion of our reserves, even if such is not the case today. It also says that as surrender charges wear off, the amount of "demand deposit" funds will grow substantially over the years.

Table 4-3 shows the growth over the years on the asset side of the balance sheet:

TABLE 4-3

<u>Year</u>	<u>Book Value</u>	<u>Market Value</u>	<u>Ratio (Market/Book)</u>
1982	\$ 1	\$ 1	100%
1984	57	61	107
1986	280	289	103
1988	696	686	98
1990 ^a	1,235	1,325	107

^aBook value adjusted to equal statutory reserve.

Over the time period shown, Mismatch Life has invested in a mixture of 5-year and 15-year A-rated corporate bonds. Both book values and market values are shown for the portfolio. The last column shows the ratio of market value to book value. In general, the interest rate environment has been stable or declining over the period; therefore, the ratio has been greater than 100 percent. At the end of 1990, you will notice that the book value of assets has been adjusted to be equal to the amount of the liability for valuation purposes. As the valuation starts, the market value of the assets exceeds the book value by 7 percent.

Table 4-4 shows the pattern of historical interest rates for the 1980s:

TABLE 4-4

<u>Year</u>	<u>Net Portfolio Yield</u>	<u>Credited Rate</u>	<u>Competitors' Rate</u>	<u>Spread</u>
1982	12.4%	11.1%	11.1%	1.3%
1984	12.5	10.5	10.0	2.0
1986	9.7	8.4	7.9	1.3
1988	9.3	7.8	8.0	1.5
1990	9.7	8.1	8.6	1.6

The first column after "Year" shows Mismatch Life's portfolio yield net of investment expenses. The early 1980s produced high yields. Unfortunately, as rates dropped in 1985 and 1986, the majority of Mismatch Life's 15-year bonds were called, and funds had to be reinvested at the lower prevailing rates. The effect of calls is shown quite dramatically by the drop in portfolio yield from 12.5 to 9.7 percent between 1984 and 1986.

The next column shows the credited rate for the various periods. The next column after that shows the rate credited by competitors on their universal life products. Mismatch Life historically has considered both its net portfolio earnings rate and the competitors' rate in establishing its credited rate. The final column illustrates the spread between the net portfolio yield and the credited rate. In 1984, with new money rates at a rather high level, Mismatch Life was running a 2 percent spread. That spread dropped to 1.3 percent in 1986 and stabilized at about 1.5 percent in 1988 and 1990.

Now that we've given you some of the historical background on Mismatch Life, it's time to move on to our major topic, which is assumption setting. Our approach will be to look first at the standard assumptions that were chosen for doing the opinion. After reviewing these standards, we will back up and take a look at the sensitivity analyses that were performed in determining what the standard assumptions would be. As the standard assumptions are described, comparisons and contrasts will be made, when appropriate, between the approaches used for last year's and this year's case studies.

The central assumption in cash flow modeling is the choice of interest rate scenarios. For last year's opinion, Ernie D. Spread made up some hand-picked scenarios. After Manny Sennarios had run the cash flow models, Max M. Yield, the chief investment officer, debated the results, claiming that several of the interest rate scenarios just didn't make sense. Most of this debate centered around scenarios for which the results were less than satisfactory.

This year, since Manny does not have to study for any actuarial exams, he is much more involved in the process. Manny heard some of the prior year's arguments between Max and Ernie; therefore, he involved Max and the investment area in the choice of interest scenarios early in the process.

This year, Manny is taking a much more sophisticated approach to generating interest scenarios—he is using a stochastic generator program. Although current regulations mandate model runs under only seven interest scenarios for the opinion, Manny is doing sensitivity analyses based upon interest scenarios generated by this program. Let's take a look at some of the advantages of this stochastic approach:

- o The use of a set of stochastic scenarios causes less bickering. Because the scenarios are chosen to provide a full range of results, the arguments caused by hand-picked scenarios are generally avoided.

- o The volatility of interest rates can be selected. With the guidance of historical volatility experience, management can choose a volatility assumption based upon its current outlook.

- o Results are easier to communicate. Because a full range of results is obtained, displays of the variation in results and average results are easily produced. We have found graphic displays to be the most effective in communicating results.

Let's next consider some of the details of the stochastic interest rate generator:

- o The 90-day and 10-year rates are considered random variables. The change in each rate is assumed to be log-normally distributed. This distribution is supported by several studies of historical interest rate patterns.
- o The movements of the 90-day and 10-year rates are assumed to be correlated. Historically, this correlation in movement has been about 70 percent. This was the assumption used to generate Mismatch Life's scenarios.
- o There are absolute minimum and maximum levels for both the 90-day and 10-year rates. It is assumed that, at some point, the government would intervene and not allow further movements in rates.
- o There is a maximum difference allowed between the 90-day rate and 10-year rate for any period. Again, this maximum is based on historical data.

The boundary conditions imposed on Mismatch Life's 40 scenarios were as follows:

- o The minimum rates were 2 and 5 percent for 90-day and 10-year maturities, respectively.

- o The maximum rate was 28 percent for both maturities.

- o The difference between the 90-day rate and the 10-year rate was limited to ± 4 percent.

One of the key assumptions fed into the stochastic generator is the volatility assumption. For our pure mathematicians, this volatility is the standard deviation of the log of the ratio of the interest rate at time $t + 1$ to the interest rate at time t . The most important thing to note is that the higher the volatility assumed, the more the interest rates bounce around.

Table 4-5 gives the volatility assumption used for the Universal Life case study, followed by historical volatility measures for the three seven-year periods commencing in 1965:

TABLE 4-5

	UL <u>Assumption</u>	<u>1965-71</u>	<u>1972-78</u>	<u>1979-85</u>
90-Day	.14	.139	.143	.191
10-Year	.08	.072	.045	.098

The assumption used for our study was about average for the full 21-year historical period. As one would expect, the period from 1979 to 1985 clearly had the highest level of volatility.

The interest rates generated by this stochastic process are Treasury yields. Rates for maturities other than 90 days and 10 years are obtained by interpolation. These Treasury yields are then converted to yields for other investment instruments (for example, A-rated corporate bonds) using historical spread relationships.

Keep in mind that all of the sensitivity analyses described in the remainder of this presentation were performed under the stochastically generated set of interest rate scenarios.

There are several other assumptions that vary with the changes in interest rates under the various scenarios. We are going to take a look at what we consider to be the four key assumptions for testing a universal life plan.

The first key assumption is the investment strategy—that is, how positive cash flows are invested in future years. As described earlier, Mismatch Life has historically invested in a mix of 5-year and 15-year A-rated corporate bonds. Max M. Yield has still not developed a written investment policy for the universal life plan, even though the need for such a statement was recognized last year.

The second key assumption is the interest crediting strategy, or how the credited rate on universal life funds will be determined in future years. Once again, Mismatch Life recognized the need for a written statement of its crediting strategy, and once again it has not been completed. This time, the culprit is Ernie D. Spread.

The third key assumption is the withdrawal rate formula, or how withdrawal rates are expected to vary with changes in the interest environment. This assumption is highly judgmental, since Mismatch Life's universal life business has yet to be subjected to an interest rate spike. Concurrent with the withdrawal rate formula, the premium payment pattern for the product should be established. More premium income can be expected when Mismatch Life has a competitive rate, and less premium income can be expected when its rate is less competitive. For purposes of our case study, simplifying assumptions were made that all withdrawals would be full withdrawals and that all premium payments would remain level.

The fourth key assumption is the competitors' rate—that is, the rate we expect competitor companies to credit on their universal life products under the various scenarios for future interest rates. Mismatch Life has continued to study its competitors' products on a monthly basis. It has noticed a definite hesitation to drop credited interest rates when the general interest level declines. Again, since the universal life business has not been subjected to an interest spike, Mismatch Life is not sure what competitors would do in that situation.

Now that we've defined in general these four key assumptions, let's look at the actual standard assumptions chosen by Mismatch Life in each case for its valuation.

The standard investment strategy assumes all funds are invested in A-rated corporate bonds. The mix of investments is 50 percent in 5-year maturities and 50 percent in 15-year maturities. The 15-year bonds are assumed to be callable after five years. This standard assumption was developed by Manny Sennarios, with a great deal of reliance placed on Max M. Yield.

In developing an assumption for the standard crediting strategy, Manny used as input the minutes from the Interest Rate Committee meetings. It was fairly obvious from the minutes that Ernie was generally arguing that the spread be maintained at all costs. On the other side, Sal A. Lott generally argued that Mismatch Life needed to be competitive at all costs. Max was left with the referee's job-trying to find investments that would satisfy both Ernie's need to make the spread and Sal's need to be competitive. This usually was a difficult task.

Based on this standoff and Mismatch Life's actual history on credited rates, Manny developed the following standard crediting strategy:

- o Net earned rate on the portfolio less 1.50 percent.
- o Not greater than the competitors's rate plus 0.50 percent.
- o Not less than the competitors' rate less 0.50 percent.

Note that the standard competitors' rate will be defined later in this presentation.

The standard withdrawal rate assumption is composed of several elements. First, there is an underlying base withdrawal rate that is equal to the withdrawal rates used in traditional level interest assumption pricing work. To this base withdrawal rate is added an additional withdrawal rate generated by a formula. This formula has two basic elements. First, if the credited rate falls behind the competitors' rate, additional withdrawals are assumed to occur. Second, this additional withdrawal function is dampened by the existence of surrender charges. The last element in the withdrawal assumption is an overall maximum imposed on the total of the base and additional rates.

Mismatch Life's additional withdrawal formula is illustrated in Table 4-6:

TABLE 4-6

Competitors' Rate Less Credited Rate	Additional Withdrawal Rate
1%	2%
2	8
3	18
4	25
Maximum total	30

Note that the additional withdrawal rates from the table are reduced based upon the amount of surrender charge in effect.

The standard definition of the competitors' rate was chosen as a function of 5-year Treasury yields. It was taken as the greater of the new money rate less

0.25 percent and the eight-quarter rolling average of the past new money rates less 0.50 percent. Manny derived this assumption from an extensive study of the competitors' universal life plans that he maintains.

These represent the final, or standard, assumptions chosen by Mismatch Life. With them in mind, let's review the standard results for the scenarios. The results are shown in Figure 4-1.

We're going to consider Figure 4-1 on a fairly detailed basis, because the remaining figures all follow a similar format. The item graphed is the present value of surplus. For each scenario, this present value is calculated by applying a discount factor to the difference between the market value of assets and the statutory reserve at the end of 30 years—that is, the end of the model period. The discount factor is calculated by running each scenario twice, with the second run starting with an additional \$1,000 of cash at time zero. By looking at the difference in ending values for these two runs, a composite discount factor can be calculated for each scenario based on the interest rates contained in that scenario. This present value of surplus figure is essentially the same as the cash flow-based surplus number developed by the research done at Aetna Life by Mike Mateja and Jim Geyer.

The present value of surplus numbers for each of the scenarios are ranked from highest to lowest. This range is represented by the bar in Figure 4-1. The vertical axis is in thousands of dollars—that is, from (\$1,000,000) to \$1,000,000. The shaded area in the bar represents the middle 90 percent of the results, with the unshaded areas representing the highest 5 percent (the best two) and the

Mismatch Life - Universal Life
Present Value of Surplus
Invest in 5 Year/15 Year Bonds
Standard Crediting Strategy

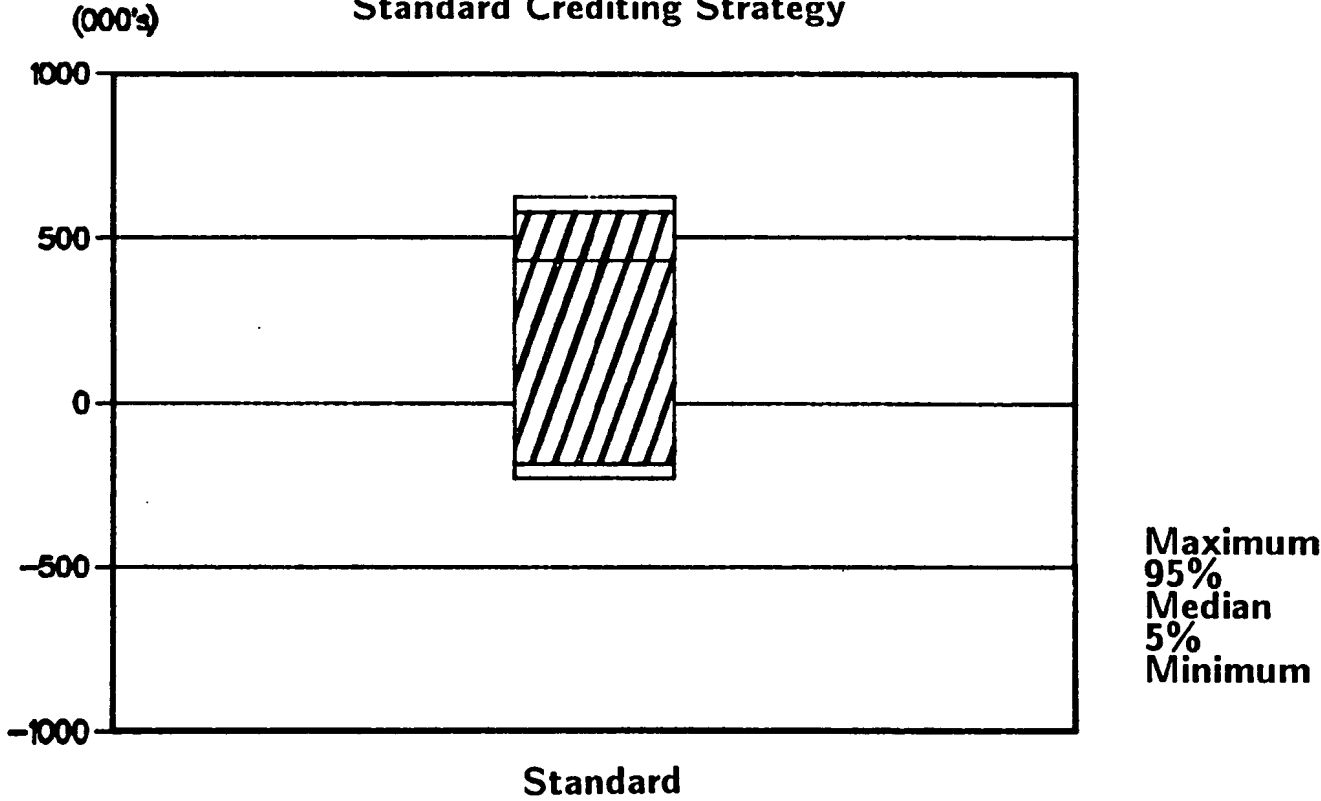


FIGURE 4-1

lowest 5 percent (the worst two) of the scenarios. The line within the shaded area represents the median result; that is, results are better for half and worse for half of the scenarios.

The median result is between \$400,000 and \$500,000 for present value of surplus. This is fairly substantial in relationship to our beginning statutory reserve of just over \$1,200,000.

In doing his work, Manny separated out the middle 90 percent of the results as a first cut at the definition of reasonable. In other words, the shaded area represents the reasonable results. While the median result looked quite healthy, the results for the shaded, or reasonable, area do extend below the 0 line; therefore, the graph is telling us that there may be a need for additional reserves, based on Manny's definition of reasonable.

Figure 4-1 represents the final conclusions drawn from the sensitivity analyses performed by Manny. Let's now look at the work that led up to this choice of the standard assumptions.

First, we are going to review a couple of sensitivity tests performed with regard to the structure of the interest rate scenarios. In reviewing some of the regulations published by various state insurance departments, Manny noticed sets of recommended interest rate scenarios. For all of these scenarios, it was assumed that interest rates would remain level after 10 years. Manny thought it would be interesting to look at the standard results with a revised set of interest scenarios. This revised set of scenarios would be the same as the standard

except that rates after the 10th year would be held level at the rates in effect at the end of the 10th year.

Figure 4-2 shows the results of this sensitivity test. The first bar, labeled "Std," represents the standard results. The second bar, labeled "Level -10 Yr," represents the results for the scenarios with level rates after 10 years. As you might suspect, the results for the "level after 10 years" scenarios are much better. In fact, the shaded, or reasonable, area stays above the line for these scenarios.

Should the scenario rates vary for 30 years, or should they vary for 10 years? I'm not sure on this point. Logically, it seems that a test of solvency employing years of interest rate variation should be sufficient. In any case, the length of time for which rates are variable has a substantial effect on results.

In our case study, Manny decided to continue to test 30 years of variation, since he felt the company should manage toward meeting this test.

In last year's case study, results were run for 20 years. This year the time period was extended to 30 years. Manny ran a sensitivity test that looked at the 20-year results versus the standard 30-year results. These results are illustrated in Figure 4-3.

The first two bars in Figure 4-3, labeled "Std 20" and "Std 30," represent the standard scenario results for 20 and 30 years. The shaded areas are very similar for these two sets of results. This tends to indicate that a 20-year run would be sufficient to determine the range of reasonable results.

Mismatch Life - Universal Life
Present Value of Surplus
Standard Assumptions
Different Scenarios

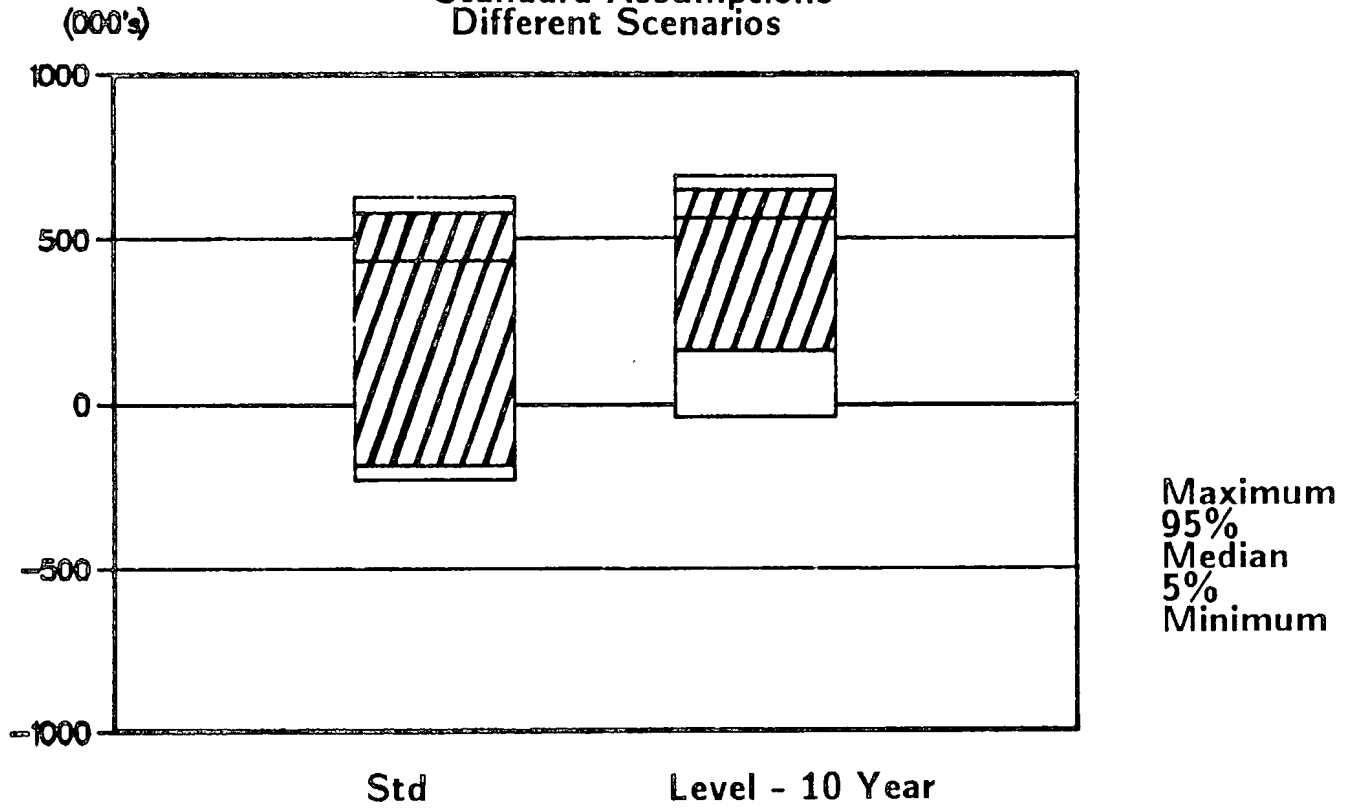


FIGURE 4-2

Mismatch Life - Universal Life Present Value of Surplus Standard Assumptions 20 Years vs 30 Years

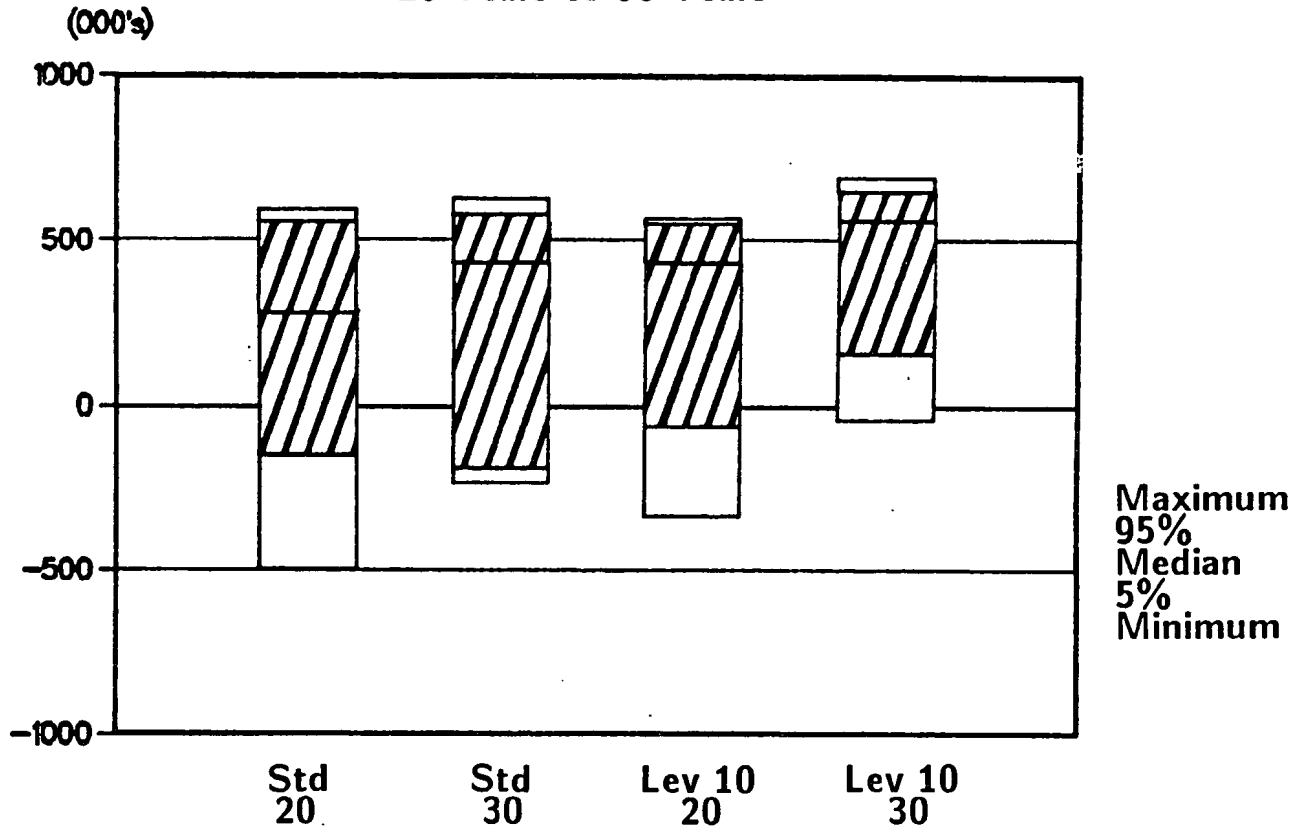


FIGURE 4-3

The last two bars, labeled "Lev 10 20" and "Lev 10 30," represent the results for the scenarios with level rates after years. This shows that if rates are level for a longer period of time, results tend to improve. In this case, it appears that the 20-year run may present a more realistic view of the risk profile than does the 30-year run.

Not only did Manny run these sensitivity tests on the interest scenarios, he also looked at sensitivity test results for each of the four key assumptions described earlier. Unless specifically described otherwise, all other assumptions were held constant at the standard level, while the key assumption being tested was varied.

The first assumption tested was the investment strategy. The results are shown in Figure 4-4. In addition to the standard investment strategy (50 percent 5-year bonds, 50 percent 15-year bonds), labeled "5 Yr/15 Yr," strategies investing 100 percent in 5-year bonds ("5 Yr") and 100 percent in 15-year bonds ("15 Yr") were tested. The 5-year strategy produces a reasonable range of results that lies entirely above the zero line. The 15-year strategy produces a very large range of results, and the standard strategy is in between. Ernie and Manny used this set of results to try to convince Max that he should stop buying 15-year bonds. Only time will tell whether or not they were successful.

The next sensitivity test concerns the interest-crediting strategy. These results are shown in Figure 4-5. The first bar is labeled "Earned." This represents the strategy of following the net earned rate on the portfolio less a spread of 1.50 percent, with no regard to what the competition is crediting. This is Ernie D. Spread's favorite strategy. The second bar, labeled "Comp.," represents

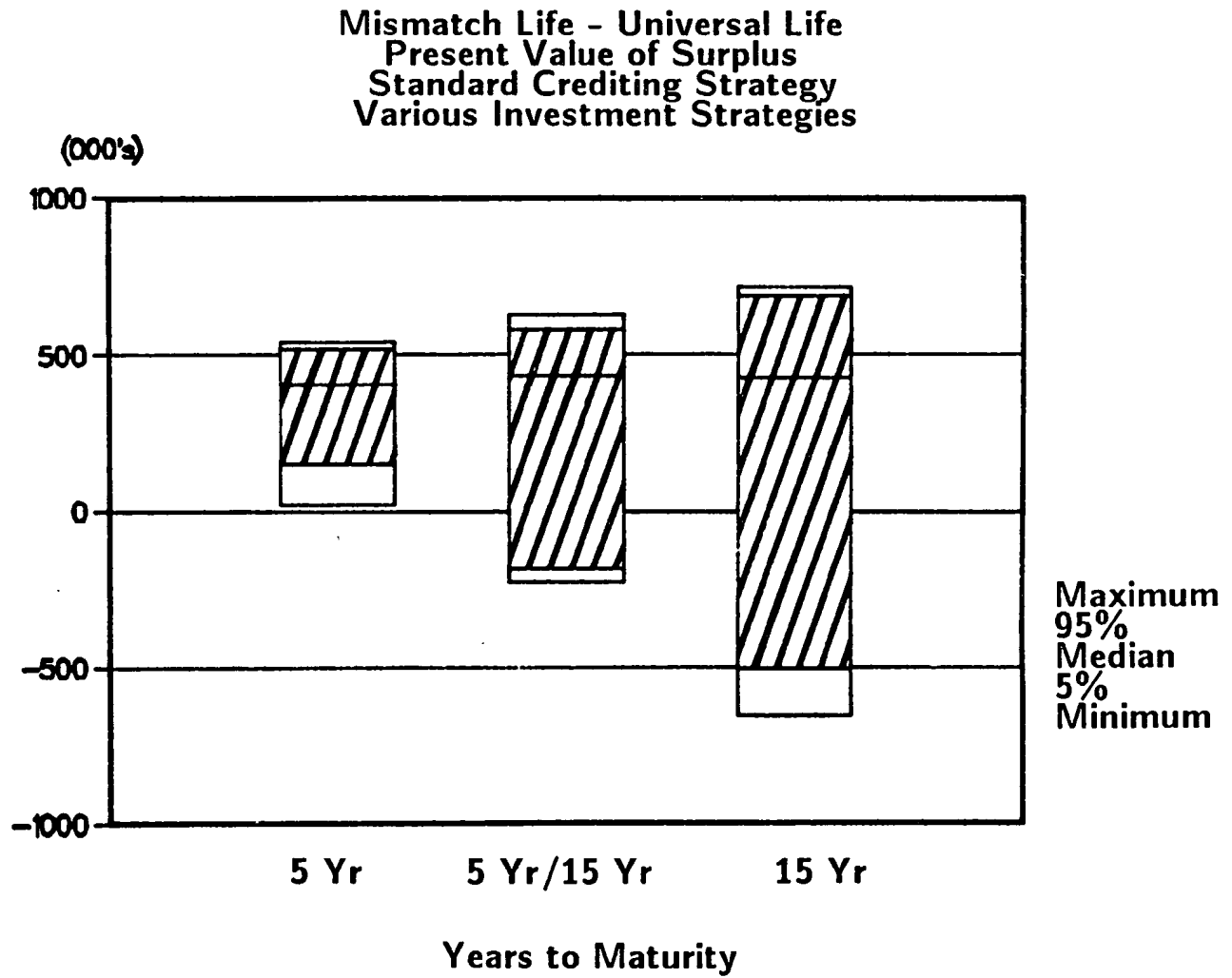


FIGURE 4-4

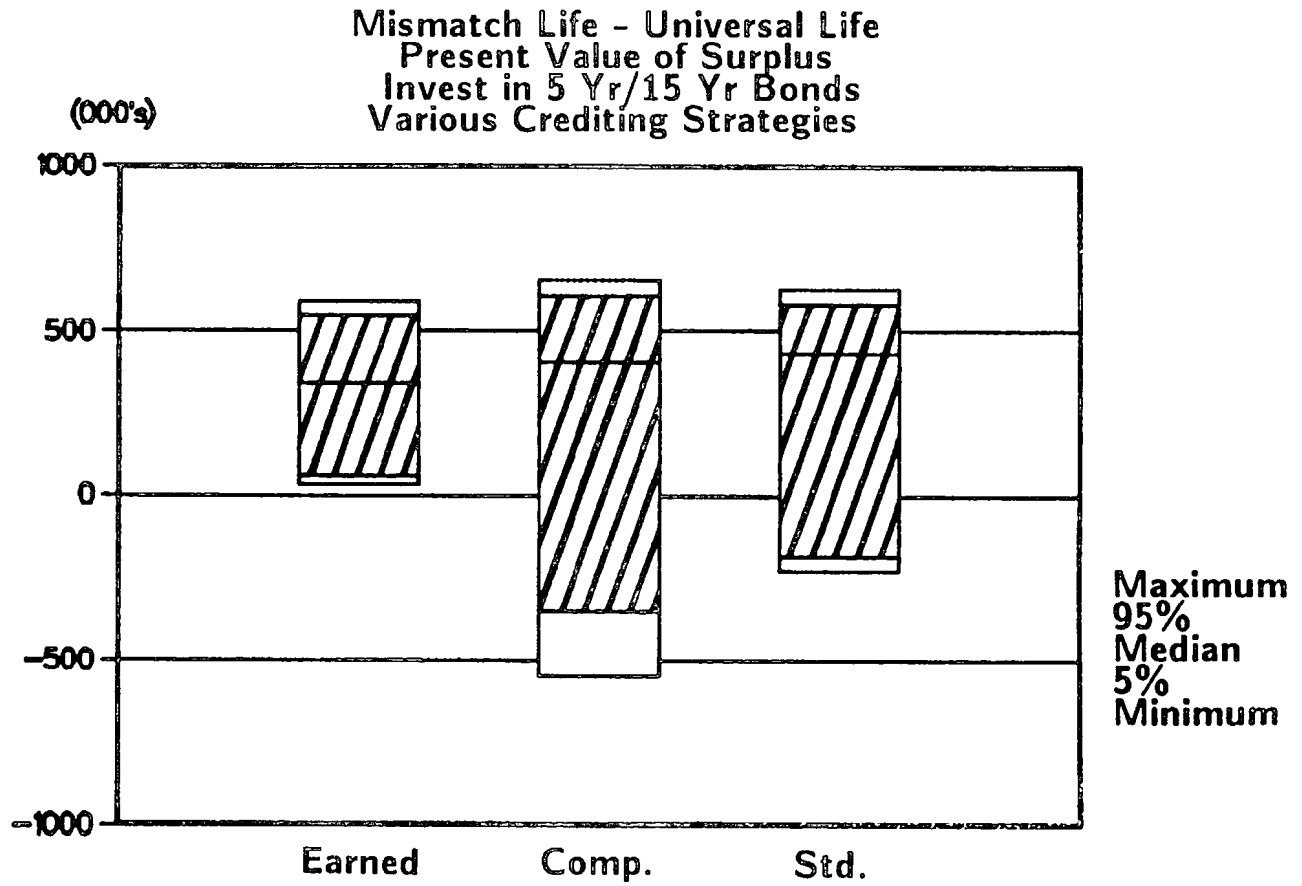


FIGURE 4-5

the strategy of following the competitors' rate without regard for the earnings on the portfolio. This is Sal A. Lott's favorite strategy. The third bar, labeled "Std.," represents the standard strategy, which is to follow the net earned rate less 1.50 percent, but never to credit more than 0.50 percent more or less than the competitors' rate.

Obviously, if the company can make it work, the earned strategy produces the best financial results. All of the shaded area falls above the line for the earned strategy. As might be suspected, the strategy of following the competitors' rate produces the largest variation in reasonable results, and the standard strategy falls in between.

With the earned strategy, one does not pay attention to the competitors' rate; therefore, larger variations in lapse rates occur. This can result in much more variation in the amount of business remaining in force. Figure 4-6 shows the range of the in-force percentage after 30 years for the standard and the earned strategies.

For the standard strategy, 15 to 17 percent of the business remains in force—a very tight range. For the earned strategy, this in-force percentage varies from near 0 percent to about 13 percent. The median percentage is about 1 percent. In a very large number of the scenarios, the earned strategy results in nearly all of the business lapsing off the books. One must ask whether this is a reasonable result, or whether the company would actually give in and follow the competitors to some degree.

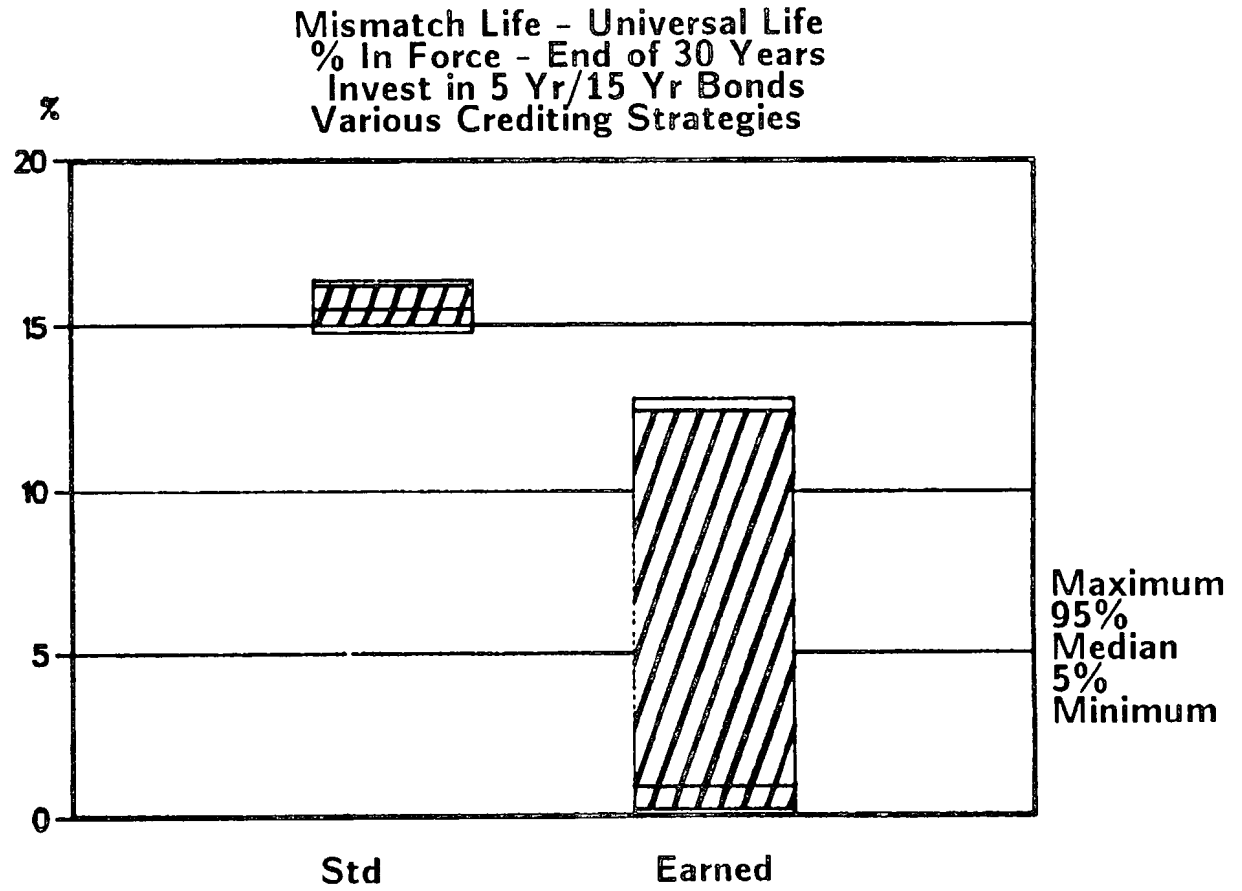


FIGURE 4-6

The next key assumption is the withdrawal formula. Table 4-7 shows the additional withdrawal rates for the standard formula and for a "lower formula":

TABLE 4-7

<u>Competitors' Rate Less Credited Rate</u>	<u>Standard Formula</u>	<u>Lower Formula</u>
1%	2%	2%
2	8	4
3	18	6
4	25	8
Maximum total:	30	15

The lower formula assumes that the universal life funds would be much less volatile; that is, the money is not as "hot." Both of these formulas are dampened in a similar fashion for any surrender charges in effect.

Figure 4-7 shows results for the two different withdrawal formulas. These results are for the "earned less 1.5 percent" crediting strategy, since the standard crediting strategy avoids nearly all additional withdrawals because it follows the competitors' rate closely. The first bar, labeled "Std," represents the standard formula results; the second bar, labeled "Lower," represents the lower formula results. As one might suspect, the lower assumption creates much less variation in results.

The last key assumption is the definition of the competitors' rate. Figure 4-8 shows the results for two different definitions of competitors' rate. The first bar represents the standard assumption. The second bar, labeled "Higher,"

Mismatch Life - Universal Life
Present Value of Surplus
Earned less 1.5%, 5 Yr/15 Yr Bonds
Variation in Withdrawal Formula

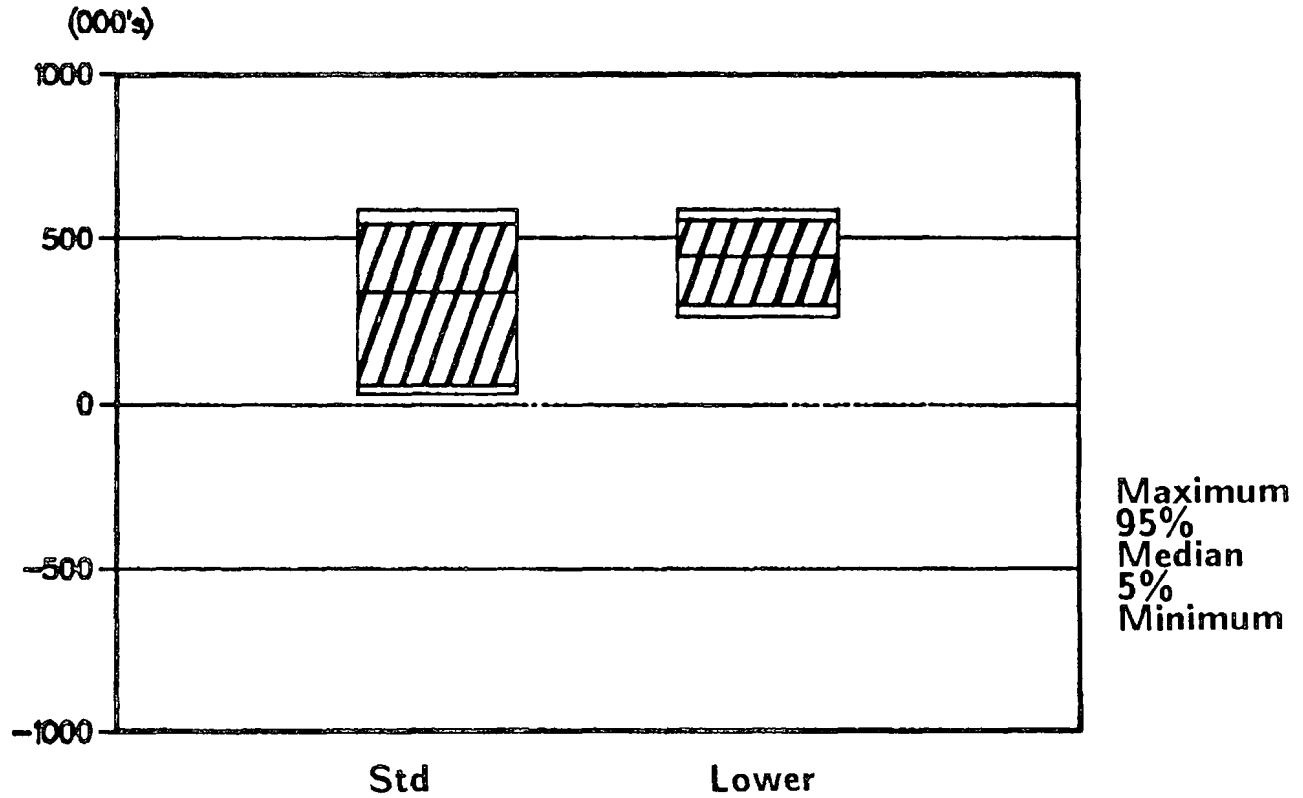


FIGURE 4-7

Mismatch Life - Universal Life
Present Value of Surplus
Standard Assumptions
Variation in Competitor Rate Definition

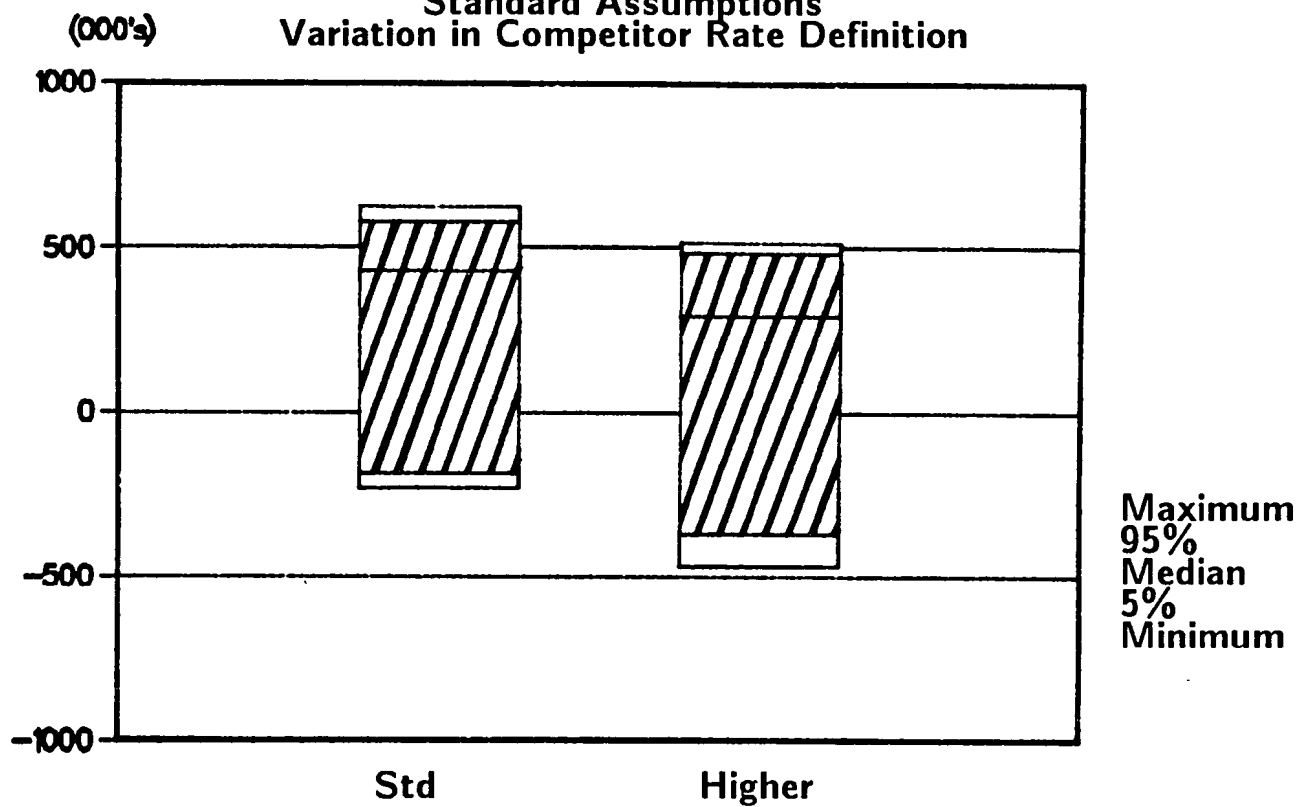


FIGURE 4-8

represents the standard competitors' rate assumption increased by 0.5 percent in all years. Because the standard crediting strategy is to follow within 0.5 percent of the competition, this increase in the level of competition shifts the results significantly downward.

Four key interest-sensitive assumptions have been discussed in our case study. Time will not permit showing results for the other interest-sensitive assumptions, but I thought it would be instructive to define some of them briefly:

- o Asset default. It is fairly easy to allow for asset default through a level reduction in the yield. This is a simplifying assumption, however, and a more exact modeling approach would be more appropriate.
- o Borrowing. When negative cash flows occur in the modeling process, they must be funded. Generally, a borrowing assumption is utilized; however, one might also consider selling assets to raise cash.
- o Expense inflation. The maintenance expense levels are expected to vary with the general level of interest rates in the scenario.
- o Premium suspensions. On flexible premium plans, the premium payment pattern can be expected to vary depending on the competitive posture of the company. If the company is very competitive, more premium will be received. If it is less competitive, increased premium suspensions can be expected.

- o Asset prepayments. Bond calls and mortgage prepayments need to be varied with the interest rates in the scenario. The past year has taught many of us the importance of this assumption.

In closing, I'd like to leave you with some general comments regarding this assumption-setting process:

1. There are a lot of new assumptions that actuaries will be called on to make.
2. Many times, there will be limited experience data available, and a great deal of judgment will have to be used.
3. The first two points underscore the importance of sensitivity analyses. Testing only one expected assumption is probably insufficient.
4. Actuaries generally develop one expected value in most of their work. The range of results produced by scenario testing will create new challenges for most actuaries as they analyze the data produced.
5. The concept of scenario testing needs to be extended to the pricing process, as well as to the valuation process. The time to catch mismatch problems is before they start.

6. Actuaries will have to learn to be better communicators. In order to make the scenario-testing work meaningful to management, a great deal of communication will be necessary.

Certainly, new and exciting challenges face our profession as we move forward with the valuation actuary concept.

MR. PAUL WINOKUR: A speech to a group of valuation actuaries on the topic of setting appropriate assumptions cannot commence without a discussion of "appropriateness." The problem becomes acute when we recognize the diversity of background in the audience, so let's pass on this for now.

Bob Hammond provided an overview of the current Canadian reserving requirements, as well as their likely future direction. It might therefore be helpful to provide an overview of some of the particulars concerning Canadian statutory reserving requirements with comparisons to U.S. statutory and U.S. GAAP. The overview of the current Canadian statutory approach will be helpful to our U.S. audience. It appears that this is a direction in which U.S. statutory is evolving, just as the responsibility of the valuation actuary in Canada has grown since 1978. Later in this program there is a U.S. session concerning reports to regulators, and the Canadian context should be of interest. I also wish to touch upon the current requirements of the federal Department of Insurance in Canada concerning not only reserving, but also the reporting requirements.

CANADIAN STATUTORY REQUIREMENTS

In most of my comments, the methods and assumptions described apply to both the worldwide business of Canadian companies and to the Canadian business of foreign branches operating in Canada. Of course, some of my observations may become obsolete in the near future as a result of the various developments Mr. Hammond mentioned.

Statutory assumptions are not restricted to mortality and interest, but rather must be made for any contingencies the actuary considers to be appropriate to the circumstances of the company and the policies in force. We therefore include lapses as an assumption, although we are allowed to hold reserves by assuming a zero lapse rate and a cash value floor.

Deferral of acquisition expenses is provided through a modified reserve method with a limitation based on 150 percent of the net level valuation premium or the actual acquisition cost, if lower. In this way, rather than have a separate deferred acquisition asset, the actuarial reserve can in fact be negative, which is similar to a net GAAP liability. Our method is called the 1978 Canadian Method.

Solvency standards are provided by means of surplus appropriations equal to the amount of any negative reserves or cash value deficiencies and are determined on a policy-by-policy basis.

The concept of a premium deficiency reserve is provided in law by the restriction that the valuation premium cannot exceed the gross premium less a provision for future administrative expenses and dividend expectations. In

Canada, margins for adverse deviation are required to the same degree regardless of the level of the gross premiums, whereas under U.S. GAAP in a "Type 3" gross premium situation, the margins can be reduced until the GAAP net premium equals the gross premium.

The amortization of the deferred acquisition expense differs slightly from that of U.S. GAAP in that it commences in the second policy year rather than the first policy year. Another difference pertains to the area of the lock-in principle, which does not apply in Canada. The valuation actuary is obligated to review reserve bases continuously and is at liberty to strengthen or weaken reserves as appropriate, so long as the changes are fully disclosed and are acceptable to the superintendent.

The assumptions the actuary uses must not only be "appropriate," but the resultant reserve must also make "good and sufficient provision" for all the unmatured obligations guaranteed under the terms of the policies in force. This latter provision enables the valuation actuary, in practice, to be more conservative than the law requires.

For example, some actuaries prefer to hold the cash value floor as a reserve, whereas others like to hold the greater of the reserve and cash value after a period such as twenty years. Most stock companies, however, happen to have valuation actuaries providing for cash value deficiencies through surplus appropriations. It should be noted that these requirements apply equally to both stock and mutual companies.

Separation of participating and nonparticipating accounts is mandated in Canada, and shareholder distributions from the par fund and investment income and expense allocation rules are fairly rigid. This does cause certain problems that do not always exist under U.S. GAAP.

In light of the move toward minimum surplus requirements, it would seem that statutory reserves will be as realistic as possible if a company is concerned about meeting the minimum surplus requirements that are related to reserves.

It may or may not be evident from the foregoing that Canadian statutory is a blend of U.S. statutory, historical GAAP, and purchase GAAP.

CIA REQUIREMENTS

Mr. Hammond also referred to the concept of the CIA Recommendations and Valuation Technique Papers, both of which are binding on members. The Recommendations also have Explanatory Notes, which are not binding.

In setting assumptions and performing sensitivity testing, the following definitions and requirements should be considered. I quote liberally, verbatim, as they are quite succinct.

Appropriateness. Each assumption should be appropriate to the circumstances of the company and the policies in force.

Assumptions Needed. The Member should make an appropriate assumption about each contingency which materially affects the company's net income for the policies in force over their lifetime.

Materiality. A difference is material if it is significant to a user of the financial statements. The Member should choose a standard of materiality which will reasonably satisfy each normal user of the financial statements.

In the Explanatory Note for this item, one example given is that the total effect of all approximations is material if they represent more than, say, 1 percent of the total actuarial liability or if the total surplus is changed by more than 10 percent. Other criteria discussed in Canada and elsewhere have been ½ percent of revenue and 5 percent of pretax income.

Provision for Adverse Deviations. The Member should:

- a. always make some provision for adverse deviations in each assumption, but the cumulative effect of all provisions should be reasonable.
- b. make a provision which increases policy benefit liabilities.
- c. make a larger provision (compared to the expected experience) where
 - i. he is less confident of the expected experience,
 - ii. he is using an approximation with less precision,
 - iii. the event assumed is farther in the future, or
 - iv. the event assumed is more subject to statistical fluctuations, and a smaller provision when the opposite is true.
- d. subject to c., make a provision which is consistent among generations of policies and consistent among lines of business.

The provision for a participating policy may be less than the provision for a comparable non-participating policy by an amount which depends on:

- e. the size of the policyholder dividends, and
- f. how readily the company will adapt its dividend scale to changing conditions.

The provision in the company's assumption for premium rates is not necessarily appropriate for the valuation.

The Member should not make provision in the policy benefit liabilities for abnormal adverse deviations from expected experience, for catastrophic events, or for major unexpected alterations in mortality or morbidity.

From the Explanatory note we have the following:

In determining the size of the provisions, the Member should use an "Expanding Funnel of Doubt", the vertex representing the point of certainty, i.e. the valuation date, and the base representing the range of possible variations in the future.

Predicting certain assumptions over longer periods would need increased margins, whereas the assumptions applicable to shorter periods could be ascertained with a reasonable degree of confidence. Accordingly, the future average life of the block of business must be taken into account in determining the margins in the various assumptions.

Antiselection. Where a policyholder may create, prolong, or stop a policy benefit, the Member should assume that policyholders who benefit from doing so will tend to act to the company's detriment.

Where the company's reinsurance assumed may be recaptured, the Member should assume that a ceding company who benefits from doing so will tend to act to the accepting company's detriment.

Test of Reasonableness. The assumptions are not reasonable to the extent that projected profits:

- a. are negative for any year (other than at issue), or
- b. are a consistently decreasing proportion of the concomitant premiums, investment return, or some other element of income or outgo which is a reasonable base, or
- c. are unstable year-by-year.

Gross Premiums Not Fixed. Where the gross premiums payable after the valuation date are not fixed by the terms of the policy, the Member should assume a scale of gross premiums which makes provision for adverse deviations. (More on this one later.)

Reinsurance. (From the Explanatory Notes:) The excess of the portion of policy payments to be funded through reinsurance agreements over the expenses of purchasing such reinsurance is equal to the reinsurance deduction. (Clearly, we have more scope on this one as compared with the U.S. statutory situation.)

Investment Return. For new money investment rates, the Member should make a provision for adverse deviations which reflects the fact that no one can with any confidence predict new money rates beyond a short time following the valuation date. Provision for adverse deviations should reflect the company's ability and willingness to compensate for an adverse deviation by a reduction in policyholder dividend scales, experience rating formulae or excess interest credits. . . . The Member need not verify the existence and ownership of the assets owned at the valuation date. He should, however, base his assumption upon their characteristics and his appraisal of their quality.

Income Tax (Only the Explanatory Note mentions income taxes:) Where the income tax is based on the profit of the company, the member should be aware that future taxable income may exceed future statutory profit. In such a situation, the income tax should be treated as an administrative expense. (This is the closest we have to a discussion of deferred income taxes. To my knowledge, few Canadians follow this suggestion.)

SUMMARY

You will note that no reference has been made to any specific values or tables that we are obligated to use, either in the legislation or in the Recommendations. The nonbinding Explanatory Notes do provide examples or suggestions such as the following: "For investments to be made ten or more years in the future for a non-participating policy group the rate of interest could be taken as one-half the present new investment rate but be limited to not less than 4% or more than 5%."

Clearly, Canadian actuaries have had a great deal of flexibility. Five or six years ago, on SPIAs and SPDAs it was not uncommon to observe valuation interest rates in the 15 to 17 percent range for the first 15 years or so. We continued to have a good deal of flexibility until 1985.

TECHNIQUE PAPERS

Valuation Technique Paper #1 was produced by the CIA in 1985. It addresses something often called lapse-supported products, which some actuaries prefer to call lapse-sensitive products. A level premium product paid up at, say, age 65, or payable for life, with minimal or no nonforfeiture values, is clearly lapse sensitive. The guaranteed premium per 1,000 for a male nonsmoker, issue age 45, can range from less than \$9.00 for those with cash values upon becoming paid up after 20 years, to as low as \$5.00 per 1,000 for those with longer premium paying periods and/or lower nonforfeiture values.

The challenge is to determine the ultimate lapse rates, as well as the ultimate interest rate. Other features have been offered on certain products, such as refund of premiums at the end of the premium paying period. Some of these products can generate deficiency reserves as high as, say, \$50 per 1,000, with an ultimate 0 percent lapse rate and perhaps as low as several dollars per thousand where the pricing reflects an ultimate lapse rate of, say, 3 percent. The 3 percent lapse rate is mandated as the maximum ultimate lapse rate.

This type of product is currently more popular in Canada than universal life and has therefore been of significant interest to valuation actuaries of both direct writers and reinsurers. The significance of the technique paper is that it is one of the first statutory or professional restrictions of a somewhat arbitrary nature imposed since the valuation rules were rewritten in 1978. On the one hand, some valuation actuaries dislike the restriction on their freedom. On the other hand, some of the "lonely" actuaries in the smaller companies who are responsible for both pricing and valuation are somewhat relieved, for they can point to specific guidelines to assist them. Perhaps all valuation actuaries will be grateful for this type of guidance or "safe harbor" as our scope is expanded.

The significance of this type of product is that the potential positive cash flow remains positive longer than one would normally expect on a traditional life insurance product. The percentage of policies issued still in force after 20 years could easily be in the 30 to 35 percent range or higher.

At this point our hands are not tied by any specific rule with respect to the valuation interest rate. Some valuation actuaries will use an ultimate rate after the 20th year of 4.5 to 5.0 percent, while others may be using 6.5 percent or more. It will be Technique Paper #5, maybe, that will take care of this one, from what I understand.

In the meantime, one useful tool in Canada is an annual consensus survey of twenty prominent economists produced by Peat Marwick. Excerpts from the

1986 survey performed in December 1985 gave median predictions for the 1992-to-2001 period as follows:

Returns on MYW 40 Bond Index: 9.8 percent.

Yield on 3-month T-bills: 8.1 percent.

Consumer Price Index: 5.5 percent.

Level of the Dow Jones Industrial Average: 3075.

Technique Paper #2 addresses renewable term products and, specifically, selective lapsation and mortality deterioration. It requires us to perform the valuation over the entire premium-paying period rather than just the current term period, which had been a relatively common practice. Further, specific provision must be made for selective lapsation and mortality deterioration of remaining lives.

In the United States, the analogy is the "unitary approach." We have not had to go to the lengths that some U.S. carriers did by creating artificially high gross premiums at the higher attained ages in order to lower deficiency reserves, since the mortality table itself is not fixed. However, we do have some informal guidelines that I believe are officially "unwritten," although the department has indeed written to certain actuaries on the topic.

For example, many actuaries in Canada believe that current nonsmoker mortality is running at 50 to 55 percent of the CIA 1969 to 1975 table, which is a 15-year select and ultimate table. It is highly unlikely that the department would permit a nonsmoker basis of less than 60 percent level by attained age.

However, where the valuation actuary uses, say, 55 percent of the table under a certain attained age grading to, say, 75 percent or more of the table at the higher attained ages, this should be acceptable to the department. There appears to be a bias toward the concept of the ratio of smoker-to-nonsmoker mortality decreasing at the higher attained ages, a concept that is being challenged by some.

On a composite, smoker/nonsmoker combined basis, it would appear that current Canadian experience is running in the low 70s. For comparison, the CIA table represents about 90 to 92 percent of the 1965 to 1970 basic tables, or about 112 to 115 percent of the 1975 to 1980 basic tables. Valuation actuaries are currently using anywhere from 80 to 115 percent of the CIA table for valuation purposes. Our life is further complicated by the concept of "never-smoked" policies offered by several insurers.

Deficiency reserves on renewable term products can run anywhere from several dollars per thousand to over \$10.00 per 1,000.

This gives a clear indication of the current situation where the actuary can be reasonably conservative. This is because, in his report, he says that the "amount of the policy benefit liabilities makes proper (emphasis is mine) provision for the future payments under the company's policies" and "a proper charge on account of those liabilities has been made in the income statement." In other words, the word "proper" currently allows for this type of latitude.

The Valuation of Reinsured Policies is a technique paper (#4, perhaps) currently in the works. The most recent draft I have seen is 11 pages long. This compares to about one page with respect to reinsurance in the Academy Financial Reporting Recommendations. My understanding of the current intent of the authors is to follow a practice that has informally been suggested by the department—that is, to ensure that the net cost of reinsurance is spread over the premium-paying period of the direct policy in proportion to its gross premiums in the same manner the direct and other cost streams are currently handled.

The authors are proposing that we first compute the net expected cash flow arising in each policy year under the terms of the reinsurance agreement and then discount these to compute the additional valuation premium required to fund this stream of additional net reinsurance costs. The adjustment to the direct policy reserve due to reinsurance is then the present value at the valuation date of the net reinsurance cost arising after the valuation date less the present value of the reinsurance component of the valuation premium.

The profits that emerge will follow the same pattern as those that emerge on a corresponding unreinsured policy adjusted by a leveled net cost of reinsurance. There will then be no difference in the manner that profit emerges between a YRT agreement and a coinsurance agreement that produce the same present value of net reinsurance costs. If the net reinsurance cost is negative, then there will be a negative present value of net reinsurance costs representing the present value of the expected profits that will be released as earnings in

proportion to gross premiums over the premium-paying period of the direct policy.

It must be emphasized that all features are recognized. In particular, no portion of any coinsurance or similar allowance will remain to be allocated to offset the acquisition costs under the policy.

The authors are also proposing that it is incumbent upon the valuation actuary to look through to his reinsurers and their retrocessionaires and consider their financial strength and reserving policies relative to the amount of risk being transferred. While such a review may of necessity be somewhat subjective, if he feels there are any signs of potential weakness, he should increase his provisions for adverse deviation accordingly. In the extreme situation of the impending collapse of a reinsurer, he should probably ignore the reinsurance altogether and increase his provision for adverse deviation to the level appropriate for his company without any reinsurance protection.

In performing any recoverability tests, the actuary must include the net reinsurance costs which may affect the amount of the acquisition expenses that may be deferred or the amount of any deficiency reserves that may be required.

I am grateful to the authors for providing me with an advance copy of this paper, which is still subject to discussion and review by both the Financial Reporting Committee and the Council of the Institute.

Academy Recommendation #4 indicates that, in practice, "the degree of materiality of reinsurance adjustments is such that most companies will be able to use simplified approaches without materially destroying their financial statements." I would have to disagree with this statement in the Canadian context in that many small and medium-sized companies will have quite elaborate calculations to do, and the concept of a proportional reserve credit for coinsurance will probably become obsolete.

While on the subject, we should consider reinsurance assumed. In the United States, I believe it is not uncommon for reinsurers to provide for very short guarantee periods for YRT rates in order to avoid excessive deficiency reserves. In Canada, if a reinsurer were to offer a short guarantee, our Recommendations would pretty well require us to look to the entire premium-paying period and recognize the realities of the marketplace. Similar considerations apply for direct adjustable products. In this regard, watch for Technique Paper #3, which is on the way.

ADVERSE DEVIATION

The CIA has a task force looking at appropriate margins for adverse deviation. Valuation actuaries are very much awaiting the report of the task force.

The task force hopes to come up with some fairly specific guidelines as to the degree of adverse deviation that should be provided in reserves versus surplus and an appropriate weighting of an expected assumption versus an assumption

including "maximum" margins. Factors to be considered in determining the weighting may include considerations of misestimation of the mean, as well as deterioration of the mean either due to the company and/or due to causes external to the company.

In cash flow matching, the concept of a "reserve fund" has often been put forward. I could envision that as our knowledge in this area develops, "reserve funds" for aggregate reserve sensitivity testing could be the order of the day. This seems to be consistent with the current development and thinking within the Institute.

It is interesting to note that the 1981 Society of Actuaries monograph on "Adverse Deviation" suggests an 80 percent probability of adequacy of GAAP reserves, whereas this would be unacceptable as a standard for solvency purposes. It does, however, provide for us a guideline as to the inclusion of margins in reserves versus surplus and leads to the reasonable versus plausible deviation aspects discussed in the United States.

The monograph suggests a 1.5 percent delta for adverse deviation with respect to mortality, which is surprisingly low by Canadian statutory standards. In terms of standard deviations, it would seem that most Canadian actuaries would be providing a significantly higher value for statutory purposes.

If we return to our lapse-supported products, we can consider the interplay between interest and lapses.

In the area of future scenarios testing, we must consider future income taxes.

THE REPORT

The Report of the Valuation Actuary, which must be filed with the department along with the annual statement, is basically a free-form report, although the instructions from the department have evolved over the years to the point where there is now a "memorandum" 25 pages long setting out the procedures used in reviewing reports and giving guidance as to the detail and nature of discussions to be included. Reference is also made to the CIA Recommendations.

The department indicates that questioning of valuation actuaries with respect to the contents of their reports may take place over a period of several months following their filing on March 1.

The requirements with respect to universal life insurance consist of two simple paragraphs that basically require full disclosure concerning the implicit or explicit treatment of any deferred acquisition expense and the application of the cash value minimum reserve test.

With respect to flexible premium deferred annuities, we have the following: "the reserves should not be less than the present value of future benefits and

administrative expenses. The valuation assumptions will be deemed to produce adequate reserves provided that (1.) future administration expenses are provided for to the extent they are not charged directly to the policyholder and (2.) the valuation interest assumption is based on the interest earnings of notionally matched assets."

In discussing matching of assets and liabilities, we must "illustrate the extent to which the Company has matched its portfolios by duration and yield." Also, "an opinion as respects the likely impact of the company's financial position of a precipitous and material fluctuation in new money rates should be provided."

The variety in reports is great. I believe that some are still only five to ten pages long, while others run closer to a hundred when all exhibits are included. Although the foregoing may seem awfully simple, be assured that the department does ask a lot of questions, particularly of those actuaries who disclose little detail.

