

1985 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS

SESSION 4

USING DETERMINISTIC SCENARIOS

TO TEST VALUATION RESERVES FOR UNIVERSAL LIFE

MR. DENNIS L. CARR: Our main purpose today is to review the process involved in making an actuarial opinion and in developing the related actuarial report to management. This will be accomplished through a case study approach, specifically covering a universal life product. In building this case study, several assumptions had to be made. Mr. Tuohy and I tried to be as reasonable as possible in deriving these assumptions; however, I will warn you that they may not be appropriate for any particular company. The considerations involved in setting the assumptions and completing the cash flow projections will be discussed in this presentation. **(The case study materials appear at the end of this chapter.)**

Let's begin by looking at the background of this case study. The case study company, appropriately enough, is named Mismatch Life Insurance Company. Mismatch Life Insurance Company started business January 1, 1983, and we assume that today is December 31, 1987. Mismatch Life has been selling one type of product — a universal life product. It has no other sales, and now has an existing block of business representing five years of sales. This existing business was used for the projections, with no provision for future sales, as discussed in the American Academy of Actuaries' discussion draft on the valuation actuary. We also assume that the Academy guidelines, as they are now proposed, passed in 1986. This is not a likely occurrence, based on recent developments; but, nonetheless, we will use that assumption for instructive purposes. We then

assume that the first new opinion for the entire company is required as of year-end 1987.

I would now like to introduce some of the personnel at Mismatch Life. First is the Chief Marketing Officer. His name is Sal A. Lott. Sal has won many personal sales awards, and runs a very successful sales force. Sal's view of this valuation actuary project is that he really can't understand all the concern and effort being expended. "After all, all we need is a competitive credited-interest rate, and the sales force can take it from there."

Next is the Chief Investment Officer, Max M. Yield. Max is a graduate of the Harvard Business School. As far as the valuation actuary concept is concerned, Max's biggest problem is that he feels this somehow will put some limitations on his freedom to invest funds. He's quick to point out that, over the past several years, the company would have lost money without the investment income generated by his department. Thus, he sees no reason to limit his freedom.

Third is the Controller, E.Z. Earnings. Now, E.Z. admits to not knowing much about this project; however, it has caused his department, the accounting department, a great deal of work. Most of this work has involved pulling together information on the investments for Max M. Yield.

The fourth officer is the Chief Actuary, Ernie D. Spread. Ernie is quite concerned about the results of this valuation actuary project. His biggest concern is that he's going to get an answer he doesn't want to present to management. In other words, he may have to say that additional reserves are going to be necessary. He's also bothered by all of the various assumptions in the

cash flow projections. He's particularly concerned with the investment-related assumptions, because he doesn't feel comfortable in that area.

The last character is not an officer, but is a very integral part of this project. I think he's somebody we all can relate to. He is the assistant actuary, Manny Sennarios. Manny has been extensively involved in this project, and when asked about it his comment is: "Well, so much for my study time this spring."

Now I'll review some of the key happenings and proposals affecting the valuation actuary over the past year. As I said, throughout our case study, we're going to assume that these items are the law, whereas, in fact, they are not. There have been three major developments over the past year. The first was the Joint Committee Report issued in February, 1985. This was passed by the boards of both the Society of Actuaries and the American Academy of Actuaries. The second item is the discussion draft published by the American Academy of Actuaries in July, 1985. Third, the NAIC Special Advisory Committee guidelines were proposed in August, 1985. Let's take a look at a few more details on each of these.

First, the Joint Committee Report is an official position. In this document, the concept of valuation actuary is defined. It then states that the valuation actuary is to be appointed by the Board of Directors of the company. There is also an introduction to the ideas of "reasonable" and "plausible." The report contains discussions about reserves being sufficient under all reasonable assumptions and scenarios, and reserves plus internally designated surplus being sufficient under all plausible assumptions and scenarios.

The NAIC proposed guidelines would be an interim step. The purpose is to fill in the gap prior to the full company opinion. As an interim step, these would apply to only interest-sensitive products, but would affect the management report. It would be necessary to develop the actuarial management report for interest-sensitive products for the insurance department examiner to review should he sense financial problems. The proposed guidelines do call for cash flow analyses under various scenarios and assumptions. As of today, the proposed management report will be required for the first time at year-end 1986. When these guidelines were originally proposed, the due date was year-end 1985, but a few concerned companies managed to get the date moved back.

Probably the most important proposal for our example is the Academy discussion draft. It is made up of three basic pieces: The qualification standards, the actuarial opinion, the actuarial report to management. The first specifies both education and experience standards. The education standard generally will be met by passing the Society exams, while a minimum of three years work experience is required to meet the experience standard. The "good and sufficient" condition has been removed from the actuarial opinion. It has been replaced with wording similar to "appropriate according to presently accepted actuarial standards of practice." There is, of course, the new controversial second part to the opinion covering cash flow sufficiency testing. Assets are to be allocated such that they are equal to reserves at the beginning of the projection period, and cash flow projections are to be performed under reasonable interest scenarios. If, under a reasonable scenario, the company falls short of cash at the end of the projection period, it would need to provide an additional reserve. The new opinion also is likely to contain a requirement to rely on the chief investment officer. He is expected to provide detailed

information on assets and investment policy. Finally, because of the cash flow assumptions, the opinion is likely to be more limited than in past proposals. One such limitation would be on the duration of the opinion. Another would be on potential developments related to key assumptions. For example, if the federal income tax law changes dramatically, the opinion may no longer be valid.

The proposed requirements for the actuarial report to management have been in existence for several years and are described in the American Academy of Actuaries' Interpretive Opinion 3. Proposed Interpretation 7B in the discussion draft would require the valuation actuary to disclose the actuarial assumptions and methods used and the scope of work performed as well as the results of the work completed in arriving at the opinion. The management report would also describe any amounts of additional internally designated surplus needed as determined by tests under plausible scenarios. The management report is further meant to contain comment on any intermediate insolvency problems indicated by the cash flow projections, on the viability of the company as a going concern, and on the availability of the company to pay policyholder and shareholder dividends. Disclosure of break-point interest-rate scenarios may be provided optionally. Break-point interest scenarios show the points at which changes in interest rates are severe enough to cause the need for additionally designated surplus.

MR. MICHAEL R. TUOHY: In order to analyze our Mismatch Life case study, we will need to examine some theoretical and practical aspects of cash flow projections.

To perform cash flow projections, it is necessary to bring into play some assumptions that interact with each other. What are these assumptions? There are seven:

- o Future interest scenarios - the level and shape of future yield curves
- o Future investment strategy - the type, quality and term of the assets in which future positive cash flow will be invested
- o Expected interest to be credited by competitors
- o Future interest - crediting strategy to be employed for the product under consideration
- o Withdrawal rates - how they vary depending on level of interest credited
- o Maintenance expenses - how these move with inflation which will be a function of the future interest scenario
- o Level of prepayment of assets, for example, the take-up rate of call provisions

Let's consider each of these a bit more closely. Interpretation 7B specifies some of the scenarios that should be tested in projecting cash flow. An inverted yield curve must be included. In other words, one scenario must have short-term interest rates higher than long-term interest rates. Also required is a scenario

that has increasing interest rates, one that has decreasing rates and one with cyclical interest rates. In addition, a level interest-rate scenario should be projected as a reference against which to measure the others. These scenarios should be set far enough into the future so that the majority of the projected insurance cash flow has taken place. The investment returns assumed to be earned on the assets should be the net of any assumed defaults and investment expenses.

When selecting scenarios, it is reasonable to use the current yield curve as a starting point. But what are the appropriate future scenarios? What are the reasonable scenarios? What are the plausible scenarios? One's only real point of reference is to look at what has happened to yield curves over the last twenty years.

In Table 4-1 are data on average relationship between the ninety-day, three-year, ten-year and twenty-year yields on government bonds for various periods from January 1965 to September 1985. The spread of yields since January 1984 has been much wider than the average experience over the earlier years.

TABLE 4-1

**Average Ratios of Yields on
Various Maturities
U.S. Government Securities**

3-Year Maturity = 100%

	<u>90-Day</u>	<u>3-Yr.</u>	<u>10-Yr.</u>	<u>20-Yr.</u>
1/65 - 9/85	90%	100%	102%	103%
1/75 - 9/85	88	100	104	106
1/80 - 9/85	90	100	103	103
1/84 - 9/85	81	100	107	109

In Table 4-2 are highlights of the extreme positions of the yield curve during the period studied and at September 1985. The September 1985 position is close to the extreme experienced in April 1977.

TABLE 4-2
Ratios of Yields on Various Maturities
U.S. Government Securities

3-Year Maturity = 100%

<u>Month</u>	<u>90-Day</u>	<u>3-Yr.</u>	<u>10-Yr.</u>	<u>20-Yr.</u>
04/77	73%	100%	117%	122%
12/80	121	100	94	91
09/85	78	100	111	116

Table 4-3 contains a summary of the frequency of yield curve inversions. The definition of inversion was the ninety-day rate being higher than the three-year rate.

TABLE 4-3
Yield Curve Inversions
U.S. Government Securities
90-Day Greater Than 3-Year

	<u>Number of Months</u>	<u>% of Total Time</u>
10/65 - 9/75	25	21%
10/75 - 9/85	28	23
10/65 - 9/85	53	22

A comparison of the three-year rate and the ten-year rate does not indicate consistent numbers. These are the types of statistics that should be reviewed before selecting the future interest scenarios. Among other statistics to study could be the historic volatility of the yield curve. It would probably be both beneficial and politic to ask for input from the company investment people on this subject.

When the projections are completed, the actuary may be tempted to reassess his opinion of future interest rates when the results don't quite come out as planned. Therefore, the selection of future interest scenarios should not be left entirely up to individual actuaries. The Academy, Society or the NAIC should develop some guidelines as to what are appropriate, reasonable and plausible scenarios.

The second assumption to be addressed is investment strategy. What type of assets are you going to invest in? What quality of assets are you going to invest in? If the projection is to be manageable, the assumed future investments should be as simple as possible. Side tests can be performed to see whether assets of similar average duration give similar results. Tests of historic data have shown this to be the case. Therefore, assume a simple strategy such as investment in a certain term of bonds. Also, you could be ambitious and vary your investment strategy with each interest scenario. That's a possibility, but it is not recommended as it considerably complicates the procedures.

The future investment strategy can have an important effect on the results, and there needs to be some form of justification for the strategy assumed. One needs to review prior investments that have been allocated to the universal life line of business. One also needs to look at where current new money is going.

It's difficult to justify an assumption that future cash flow will be invested in five-year Treasuries when current new money is going into thirty-year junks. It's sensible to have a strategy paper written on the investment philosophy for universal life policies. One needs to sit down with the investment people to draft a strategy paper for the investment of universal life assets and then make assumptions consistent with that.

Another important point that must be considered is the handling of negative cash flow. In the example Mr. Carr will describe later, we will assume borrowing. But the borrowing assumption can be dangerous. It's fine if enough cash flow is available from other product lines, but make sure a realistic interest rate is charged. Also, some limit should be set as to the extent of the borrowing. If the borrowing gets too out of hand, then an assumption must be made as to realization of investments.

The next assumption we have to address is the competition's credited rate. The importance of this rate relates to the withdrawal-rate assumption. If the rate you are crediting is significantly below the rest of the market, you can expect withdrawal rates to increase. Therefore, throughout the projection the company's credited rate must be compared to those of its competitors.

If you turn to Exhibit 4.C.1 of the Case Study, Financial Data Section, you'll see an excerpt from a publication called TULAS that is prepared once a month at Tillinghast and analyzes some 260 universal life crediting rates. Comparisons are shown to various new money interest rates. At the top of the page are the month by month new money rates, based on the rates current on the first Friday of the month, from April through October. The rates shown are actually coupon rates, and I've converted these to annual equivalents displayed in Table 4-4.

TABLE 4-4
RECENT INTEREST RATE EXPERIENCE

	<u>4/85</u>	<u>7/85</u>	<u>10/85</u>
1-Year Treasury	9.77%	7.81%	8.12%
5-Year Treasury	11.65	9.76	9.95
20-Year Treasury	12.28	10.81	11.04
Mean UL Rates	10.91%	10.68%	10.53%

As you can see, there was a significant drop in interest rates between April and July. You'll also note that the average credited rates have lagged behind the new money rates. Now that is worrying to some, but let's think about it. In Exhibit 4.C.2 of the Case Study, Financial Data Section, some rolling average rates are shown. Consider the five-year Treasury yield as illustrated in Table 4-5. In October, it was 9.95 percent. However, if you had invested the same amount each month in five-year treasuries for the last twenty-four months, the portfolio would be earning 11.77 percent. And if you had been investing that way for the last sixty months, the portfolio would be earning 12.64 percent. Now, those rates are much more consistent with average credited rates than the current new-money rates.

TABLE 4-5
5-YEAR TREASURY YIELDS
(OCTOBER 1985)

Current	9.95%
24-Month Rolling Average	11.77
60-Month Rolling Average	12.64
Mean UL Rates	10.53%

Several companies have a small amount of inforce universal life cash value contracts. Of these companies, some are crediting more than would yield the planned interest margin, the rationale being that the marketing gains from the high credited rates more than outweigh the losses on the spread during a period when cash values are small. In addition, some companies are reducing the quality of their assets to push up the yield — not necessarily a very good idea. Other companies are achieving higher yields by going further down the current steep yield curve and investing in long-term bonds. Yet other companies don't really know what they're earning on their assets and only follow the market.

What's going to happen in the long term? I believe that there will be a return to sanity. The small cash values will get big, and the cost of not earning the spread will be too great to be justified on marketing grounds. The junk bond proponents will be hurt with defaults and have to reflect them in their credited-interest rate. Companies investing too long will suffer during the next interest-rate spike.

The fourth assumption relates to crediting strategy. We have considered three alternatives. The first is the rate earned on the assets less X percent at all times. The second is the competitors' rate plus Y percent. I expect several of you in the audience have been involved in meetings called to decide what next month's credited rate should be. Generally, the opinions are very diverse. However, a compromise will generally win out and a mixture of the two strategies will result. The formula could be the earned rate less X percent, but not less than the competitors' rate less Y percent.

In Table 4-6 results of a mixed approach to the crediting strategy are displayed. The formula was 1.25 percent less the earned rate, but never less nor more than 1.00 percent different from the competitors.

TABLE 4-6
CREDITING STRATEGY

Mixed Approach

<u>X</u>	<u>Z</u>	<u>Earned Rate</u>	<u>Competitors' Rate</u>	<u>Credited Rate</u>
1.25%	1.00%	11.50%	10.50%	10.25%
1.25	1.00	11.50	11.50	10.50
1.25	1.00	11.50	8.50	9.50

In practice, most companies will be forced to take account of competitors' rates if their own formula rates are too far out of the line with the market, as they would be in danger of losing both their field forces and their in-force business.

What assumption should one use as to future crediting strategy? To decide, comparison should be made of past earned rates and past credited rates. It will probably be necessary to create, in retrospect, a segregated asset portfolio for the product if this has not already been done. The earned spread should be reduced to reflect any low-quality investments, even if no defaults have occurred to date. Several companies have decided to invest in lower-quality bonds which, as yet, have not suffered any defaults. These companies may be satisfied with their spreads, but this is a very short-sighted attitude as defaults are bound to occur in the future.

After analyzing the past, it is necessary to review the procedures involved in setting the rate. Is the rate set by monthly negotiation, or is some formal method used to set it? I strongly recommend the use of some formal procedure. The formula need not simply be whatever is earned on the assets less a margin, but could also be a function of competitors' rates. If this approach is taken, the important competitors need to be identified and their rates closely monitored.

The withdrawal assumption can be broken down into two parts — the standard rate and the additional rate (a function of credited interest). First of all, the standard withdrawal assumption should be similar to a GAAP assumption with a margin for adverse deviation. The additional withdrawal rate should be a function of credited rate and competitors' rate. Also the level of surrender charge may be included in the formula, as it is reasonable to assume that additional withdrawals will be less if a surrender penalty must be suffered. The rather complicated algebra exhibited in Table 4-7 is an example of an additional withdrawal formula.

TABLE 4-7

ADDITIONAL WITHDRAWAL RATE FORMULA

$$C_1 (\text{Competitors' Rate} - \text{Credit Rate} + C_2)^{C_3} (\text{SCAF})$$

(where SCAF = surrender charge adjustment factor)

Note Less Than Zero

Subject to a Maximum

The additional withdrawal rate would never fall below zero, and a maximum should probably also be imposed. Review of the troubled SPDA companies shows that in no year did withdrawal rates exceed 40 percent. There are certain policyholders who will never withdraw however bad the situation is.

In Table 4-8 are results of a numerical application of the formula. In this case, a surrender charge adjustment was not included. Additional withdrawals begin to occur once the credited rate falls below that offered by the competition. If the difference is 50 basis points, withdrawal rates increase by .5 percent; a 100 basis points difference causes a 2 percent increase and so on.

TABLE 4-8
SAMPLE ADDITIONAL WITHDRAWAL RATES

C1 = 200 C2 = 0 C3 = 2 SCAF = 1

<u>Competitors' Rate Less Credited Rate</u>	<u>Additional Withdrawal Rate</u>
0.5%	0.5%
1.0	2.0
1.5	4.5
2.0	8.0
2.5	12.5

The formula just illustrated was, to a large extent, plucked out of the air. I've seen some detailed analyses of SPDA business, but no real research of any universal life experience. However, there is no doubt that withdrawals will increase the more a company's credited rate falls below those of its competitors. Initially the formulas used to reflect this will not be based on any extensive

evidence. Monitoring systems should be established to provide this evidence as it develops. Experience throughout the industry will be very diverse, principally because the additional withdrawal function will vary significantly by distribution system.

The last two interactive assumptions are maintenance expenses and asset prepayments. The base maintenance expense assumption should assume the company to be a going concern, and be adjusted with an inflation rate that is consistent with each investment scenario. The assumed level of investment prepayments in respect of, for example, exercise of call options and mortgage prepayments, should be consistent with the level of new money interest rates.

Before Mr. Carr takes you through the Mismatch Life valuation, I would like to touch on some practical considerations. Interpretation 7D requires that the chief investment officer provide details of the assets, including segmentation into a minimum of four categories matching the following product lines:

- o Participating, Excess Interest and Indeterminate Premium Products
- o Indexed Products
- o Other In-force Business
- o Capital and Surplus

One would probably want to segment further. If a big block of universal life business existed, then it would be advisable to isolate the assets matching this business from those matching the earlier participating issues. Reactions to the idea of asset segmentation have varied. In some cases, concern has been expressed over the difficulty and the expense of asset segmentation, particularly by the investment people. The process need not be undertaken in intricate

detail, and I believe that a segmentation process sufficient for the purposes of the valuation actuary can be completed with limited expense. Mr. Stephen Radcliffe recently published an interesting paper outlining an approach that made a lot of sense and wasn't too burdensome to conduct.

After segmenting the assets, it is necessary to feed the data into the projection process. The quality of data could vary significantly by type of asset. Generally, bond data is in pretty good shape. It's often on tape, and the items that need to be extracted include: book value; par value; coupon rate; coupon frequency; maturity date; call information.

Quite often mortgage data is kept on scraps of paper in somebody's bottom drawer, but the information required for projection includes: book value; principal outstanding; interest rate; payment amount; payment frequency; maturity date; prepayment details.

Information on stocks is generally in good shape and for real estate it is often necessary to obtain some indication of projected rental income. Policy loan information is generally readily available.

The decision then has to be made as to whether to model the assets or perform a seriatum projection of the asset cash flow. I recommend strongly that some form of model is used during the first attempts to perform the projection. The seriatum approach would be very time consuming and, even if done accurately, it would be more difficult to analyze the results. However, if the bond portfolio is easily accessible, it may be more convenient to use the seriatum approach with those assets. The projection of future investment income should be the net of

any investment expenses and provision for defaults. The other investment-related assumptions in the projection, such as investment scenarios, investment strategy, inflation and asset prepayments, have been discussed earlier.

What about the liability side of the projection? The in-force business needs to be modeled, which is a familiar task to us actuaries. However, the liability model should also be kept as simple as possible. The interactive nature of the projections requires the models of both assets and liabilities to be as simple as possible to save computer time and to aid understanding. If the use of a simple liability model is a cause for concern, then a more detailed model should be constructed and projections made using both models with constant interest assumptions. The difference between these two projections can then be used to adjust the results of the dynamic projection using the simpler model. The assumptions needed as input to the projections include the normal ones, such as mortality, base withdrawal rate, maintenance expense, premium taxes, renewal commissions, outstanding first-year commissions, income taxes and expected shareholder dividend distributions. Where applicable, the assumptions should be set with margins for adverse deviation. As discussed earlier, additional assumptions for the interest-crediting strategy and the additional withdrawal rate are also required.

MR. CARR: Let's take a look now at some of the specifications for Mismatch Life's product. (This information is contained in the Case Study Actuarial Management Report.) The product is universal life with a level amount at risk. There are two policy loads: 6 percent of premium in all policy years and \$36 per policy in all policy years. The surrender charge is equal to 100 percent of the

target premium in years one through five, grading to zero in policy year fifteen. Therefore, this is a back-loaded product.

The current interest rate on this product as of the valuation date December 31, 1987 is 10.75 percent. The guaranteed interest assumption is 4 percent. Next, let's review the various specific assumptions made in the Mismatch Life study.

In determining the mortality assumption, Mismatch Life's basic pricing assumption with an additional 5 percent margin for adverse deviation, as suggested in the Academy guidelines, was used.

In determining interest-rate scenarios, one needs to be aware that all of the interest-rate scenarios needed may not be specified by the various bodies —the NAIC, Society or Academy. The valuation actuary may have to devise some interest-rate scenarios of his own. In order to create those scenarios, one needs to consider several items. First is the length of the projection period. As Mr. Tuohy mentioned earlier, the projection period needs to be long enough that the majority of the product cash flows run out as well as the cash flows from the initial assets. Mismatch Life chose a twenty-year projection period. This assumption created some discomfort because not nearly all of the product cash flows seemed to be completed by the end of the projection period. If Mr. Tuohy and I had been able to do one sensitivity test on Mismatch Life, it would have been to extend the projection period to thirty or forty years to see if the results changed significantly. A problem with using such a long projection period, however, is that one has to extend the interest-rate scenario out to thirty or forty years, and extending interest-rate scenarios is very difficult. Or, if you

would level off the scenario for the last thirty years of the projection period, I am not sure you could really learn a whole lot.

In defining the interest scenarios for Mismatch Life, maturities of ninety days, three years, ten years, and twenty years were used. Therefore, a specific yield curve was defined by setting the rates for each of these maturities. In building the scenarios, variations in the yield curve were considered; in other words, the yield curve did not keep a constant shape. All of the various interest-rate scenarios began with the same basic yield curve, which was based on the rates as of December 31, 1987, the valuation date.

In order to account for the default risk, Mismatch Life used rates for A-rated bonds, since the default risk on those should be fairly minimal. The Academy guidelines say that you do not have to take the C-1 or default risk into account in doing these projections; however, any wide variation in asset quality should be considered in the projections. Finally, each of the rates in the interest-rate scenarios are the net of investment expenses.

One of the most useful ways to define scenarios is to consider historical interest rates and yield curves. When defining a scenario, it may be appropriate to take the average yield curve relationship over a long period of time and attempt to come out with something close to the 90 percent, 100 percent, 102 percent, and 103 percent in the top line of Table 4-1, discussed earlier. Of course, you just don't assume a constant yield curve relationship. You need to take a look at the variations. Recall that Table 4-2 contained some extreme yield curve

relationships. The yield curve does swing fairly wildly, with April 1977 having a rather steep upward slope. In December 1980 there was a very inverted yield curve.

In Table 4-3 we looked at the historical experience on yield curve inversions; Ninety day rates historically have been greater than three-year rates. However, over the twenty-year time period from October 1965 to September 1985, inversions occurred approximately 20 percent of the time. This is why the Academy discussion draft suggests that one should, in fact, test an inverted yield curve.

The historical rates can be used as a guide in developing interest scenarios. It is helpful to look at shapes of yield curves that have occurred in the past and also to look at the absolute variations which have occurred over a given time period. Of course, history is not always a great predictor of the future.

For Mismatch Life, eleven interest-rate scenarios were developed. These are described in Exhibits 4.C.5 and 4.C.6 of the Case Study, Section on Actuarial Report for Universal Life.

Let's briefly review the scenarios. As I discuss these scenarios, I am going to track the pattern of the three-year bond rates. You should note that the yield curve does invert in these scenarios. It does change shape, with the yield curve generally inverting in times of interest-rate peaks.

Exhibit 4.C.5 of the Case Study, Section on Actuarial Report for Universal Life, contains the five reasonable scenarios. There is a classic level scenario with an

11 percent three-year bond rate. There is a slow-up-and-level scenario. (One needs to be rather imaginative in naming these scenarios.) Under the slow-up-and-level scenario, the three-year bond rate goes from 11 percent up to 20 percent over a ten-year period. Next is the cyclical-up-2 percent scenario. In this scenario, the three-year bond rate jumps up at a rate of 2 percent per year for three years, then down for two years by 2 percent per year, and then up again for three years, down for two years and so on. At some stage, it begins to cycle up and down in two-year periods, so the interest rate does not get too far out of line on the high side. It peaks out at 21 percent. There is a slow-down-and-level scenario for which the three-year rate goes from 11 percent down to 6 percent in year eleven and stays level thereafter. Finally, there is a cyclical-down scenario which goes down three years, up two years, down three years, up two years, similar to the other cyclical scenarios. It bottoms out at a three-year bond rate of 6 percent.

Exhibit 4.C.6 of the Case Study, Section on Actuarial Report for Universal Life, contains six plausible scenarios. You'll notice that the plausible scenarios look a lot like the reasonable scenarios, but they contain more extreme variations. First there is a fast-up-and-level scenario where the three-year bond rate goes from 11 percent to 20 percent by the end of the fourth year and remains level thereafter. There is a further-up-and-level scenario where the three-year rate goes up over a four-year period to 24 percent and levels out. Next there is cyclical-up-2.5 percent scenario which operates the same as the cyclical-up-2 percent scenario except it does it in larger steps, topping out at a rate of 23.5 percent for the three-year bond. Next there is the fast-down-and-level scenario which goes from 11 percent to 6 percent in a four-year period. Then there are a couple of Cycle-about-11 percent scenarios, where the cycle starts at 11 percent

and goes up 2 percent per year until it tops out at 17 percent; then it goes all the way down to 5 percent; afterward it starts to track its way back up to 17 percent. So it cycles about 11 percent, plus or minus 6 percent. There are two of these scenarios: one starts by going up — Scenario A; one starts by going down — Scenario B. Max M. Yield at Mismatch Life definitely will have something to say about these scenarios and the shapes of the yield curves to be tested.

Our next key assumption is the interest-crediting strategy. I'd like to begin this with an illustration from Mismatch Life. Just this past week, the Mismatch Life interest-rate committee met. This committee is composed of Sal A. Lot, the Chief Marketing Officer; Ernie D. Spread, the Chief Actuary and Max M. Yield, the Chief Investment Officer. The meeting began with Ernie making his usual plea that the company needed to have a 1.25 percent spread on its product in order to earn the company's stated profit goal. Sal, never to be silent for very long, pipes up and says: "Well, we need an 11 percent credited rate. That's what the market is. We've got to have that credited rate or our sales force is going to leave us in droves. We might as well not even be in business if we can't credit 11 percent." That leaves Max M. Yield to be stared at by the other two. Sweat bullets pour off of Max, who says: "Well, we've been investing in ten-year bonds. I suppose if we stretch out to fifteen-year bonds, we can get a yield of 12.25 percent. That yield less the 1.25 percent spread gives us a credited rate of 11 percent. Everybody thinks about the situation for a minute. Again Sal, never to be quiet for too long, pipes up and says: "Let's do it." The meeting adjourns.

Before discussing the more disciplined interest-rate crediting strategy used for our Mismatch Life example, I'd like to define a "competition rate." I believe this is a very important concept. It can be viewed as a function of new-money rates

which, as we learned from Mr. Tuohy's discussion, are not always the best indicators. We can also view the competition rate in terms of rolling average rates that might be more representative of a portfolio earnings rate. Finally we can use a combination of these two views, that is, the procedure used in our Mismatch Life Case Study yielding a three-year rolling average of the three-year-bond rate minus 50 basis points as the rate the competitors would credit, the competition rate.

However, in no case was this rate to be less than the current three-year-bond, new-money rate less 200 basis points. In summary, there is a rolling average base, but the competition rate never gets too far away from the new-money rate. This definition says that in a stable or down interest environment, there will be a tendency to follow a portfolio average rate, whereas when rates start rocketing up, there will be more and more pressure to follow the new-money rate. In using an offset of 200 basis points on the new-money rate, there should be more of a lag or cushion than provided by the 50 basis points used with the rolling average rate.

Now with that definition of the competition rate, let's get into the specific interest-crediting strategy used for Mismatch Life. In general, a couple of extremes are possible. There is the extreme that Ernie D. Spread prefers to follow, where the credited rate is set as portfolio rate less a spread, regardless of the situation. This can be unrealistic in certain situations. For example, Mismatch Life wouldn't let all of its business run off the books. The other extreme is to follow the competition (or follow the market and forget what is being earned on the actual company portfolio). You can lose a lot of money if you don't pay attention to what you're earning on your own assets.

For Mismatch Life, a blended strategy was used. The strategy was to credit the portfolio rate less a 1.25 percent spread, but to never be more than 1 percent away from the competition rate. If Mismatch Life falls more than 1 percent behind the competition, at that point it will start to chase rates, so to speak, in order to preserve its in-force business.

Table 4-6 illustrated the strategy employed by Mismatch Life. Notice that Z is the value for its competitive constraint.

The next important assumption is what is used for Mismatch Life's investment strategy. Understanding this requires a look at the assets in the current portfolio. Mismatch Life had invested rather simply, buying only bonds at par. Future plans for investment are to follow the same simple strategy. The Target portfolio mix on the bonds was to be 2 percent in ninety-day paper, 10 percent in three-year bonds, and 88 percent in ten-year bonds. The projections assumed that the cash flows were invested in order to meet this target mix; however, the model did not assume that assets would be sold each period to get exactly the target mix. In effect, the model was chasing this target mix.

For Mismatch Life it was decided to assume that borrowing was used to fund negative cash flows. A borrowing rate was chosen to equal the ninety-day new-money rate plus 2 percent. This was arrived at by looking at the prime interest rate and comparing it to the current ninety-day rate. It was necessary to charge a little extra for borrowing in order to penalize earnings. Before moving away from the borrowing assumption, I would like to mention that it should be a caution flag if a projection run has large amounts of borrowing. If that is the case, you have to assess whether your borrowing assumption is realistic and

consider modeling asset sales. The latter will complicate the model with things like capital gains and losses and their federal income tax treatment. So, selling assets is not going to be a popular strategy element, but it may be necessary if huge amounts of borrowing occur in any scenario. Finally, on investment strategy, it was assumed that the ten-year bonds had call provisions.

The next assumption is the withdrawal assumption. As you'll remember from Mr. Tuohy's discussion, the withdrawal rate assumption is based on a base lapse-rate scale, which is the normal pricing lapse rates plus an additional lapse rate generated by some formula. Now for Mismatch Life, the base lapse-rates were set equal to the pricing rates plus an additional 2 percent margin for adverse deviation. Since this was an in-force model, the margin for adverse deviation in the persistency assumption is difficult to figure. With a renewal block of business, the first-year lapse rate becomes less important, and one probably wants to add something as a margin for adverse deviation. The lapse rates, including the margin, ranged from 20 percent per year in the first policy year to 7 percent per year in policy years four and later. To this base lapse assumption was added an additional withdrawal rate calculated by a formula based on the relationship between the competition rate and actual credited rate in the scenario. One thing to consider is the effect of surrender charges on withdrawal rates; however, that effect was ignored in the Mismatch Life projections. I would suggest that, if you do these projections for your company, you consider the surrender charge effect. The actual formula used for Mismatch Life was

$$200 \times (\text{Competition Rate} - \text{Credited Rate})^2.$$

The additional withdrawal rate was not allowed to be negative. The maximum total withdrawal rate for Mismatch Life was 30 percent. In other words, the base lapse rate plus the additional formula lapse rate was not allowed to exceed 30 percent. In order to get a better understanding of the additional withdrawal rate formula, Table 4-8 illustrated some sample rates. When you develop an additional withdrawal rate formula, you probably should complete a table like this first, using your best judgment as to the additional withdrawals that would be created by a given difference between the credited rate and the competition rate. What additional withdrawals could be expected? This is probably an assumption you will test.

Let me describe how this all ties together. If it is assumed that there is a difference between the credited rate and the competition rate of 2 percent, there would be an additional withdrawal rate of 8 percent. If this is in years four and later, where the base lapse rate is 7 percent, there would be a total lapse rate of 15 percent. This is then compared with the 30 percent maximum, and since it is under the maximum, the result is 15 percent.

Next let's take a look at the specific expense assumptions used for Mismatch Life. First there was a commission assumption of 5 percent. There was no first-year carry over business, so it ended up as a 5 percent level commission rate. Premium tax was 2 percent of premium. The maintenance expense was set equal to \$37 per policy, which reflected the pricing assumption of \$35 plus a margin for adverse deviation of \$2. The maintenance expense inflated each year based on a rate equal to the three-year bond new money rate less 5 percent. So the inflation rate on the maintenance expense followed the scenario. For federal income tax, it was assumed that the gain from operations was taxed at 36.8

percent. It was also assumed that there could be a tax credit for this block of business; that is, a negative tax was allowed. At this point, I would echo the comments of our previous panel members, that taxes are quite important and each of these assumptions regarding taxes do affect results quite a bit. As an example, if you didn't allow for negative taxes, and there were losses in certain years, your projection results could change dramatically. The Mismatch Life assumption was that capital gains were not significant because they assumed borrowing was used to fund negative cash flows. If there were significant capital gains, it would be necessary to examine the tax assumptions, looking perhaps at the tax rate on capital gains and losses and also at the assumption as to whether or not a tax credit will be allowed. In other words, one would need to make an assumption as to whether capital gains could be offset by capital losses from another segment of the business. This assumption gets to be tricky in that the environment in which assets would be sold at a capital loss would be a negative cash flow environment, and it may not be possible to have offsetting capital gains. This should be considered in establishing a capital gains tax assumption.

The handling of surplus in the cash flow projections is quite important. For Mismatch Life, the simplifying assumption was made that it would pay no shareholder dividends. As Mismatch Life is a five-year-old company, E.Z. Earnings has determined that it will not have any shareholder dividends for at least the next twenty years. Also, the surplus tax was ignored since Mismatch Life is a stock company. (Mutual companies need to be concerned with that part of the federal income tax formula.) Surplus was assumed to accumulate at an after-tax rate. This means that, in the projections, investment income on the surplus accumulates at .632 times the investment rate. So an after-tax accumulation rate based on an after-tax discount procedure was used.

Now that the basic assumptions have been reviewed, let's take a look at some of the results of the projections for Mismatch Life. First, turn to Exhibits 4.C.5 and 4.C.6 of the Case Study, Section on Actuarial Report of Universal Life. There are two tables. The first contains a summary of results for the reasonable interest-rates scenarios. Given in this table are the values of the assets and the reserves at both the beginning and end of the twenty-year projection period. As you'll notice, the market value of assets at the end of the projection period was always sufficient to cover the reserve under the reasonable scenarios. Therefore, it was determined that no additional reserves were needed.

The second table contains the results of the plausible interest scenarios. Again one looks at the market value of assets and the reserve. By the way, the book value of assets is to be equal to the reserve at the beginning of the projection period, as was done for Mismatch Life. If you look at the reserves at the end of the modeling period under the plausible scenarios, you'll notice that under three of the scenarios there were not enough assets at market value to cover the reserves. Some additional projections therefore became necessary. In these additional projections, an additional amount of assets was added to the beginning assets. The additional amount was derived such that the ending market value of assets would just cover the reserves. In our case, this ended up being solved by iteration. There is another column labeled "additional internally designated surplus required." For the scenarios where we fell short, it was necessary to designate additional surplus amounts. The biggest number in that column is \$5,851, which was approximately 5 percent of the initial reserve for the universal life plan.

Also contained in the Case Study, Section on Actuarial Report for Universal Life, in Exhibits 4.C.5 and 4.C.6, are some additional summary results. We won't take the time to go through all of these results; however, we will look at a few of them. Values are shown for each of the scenarios for:

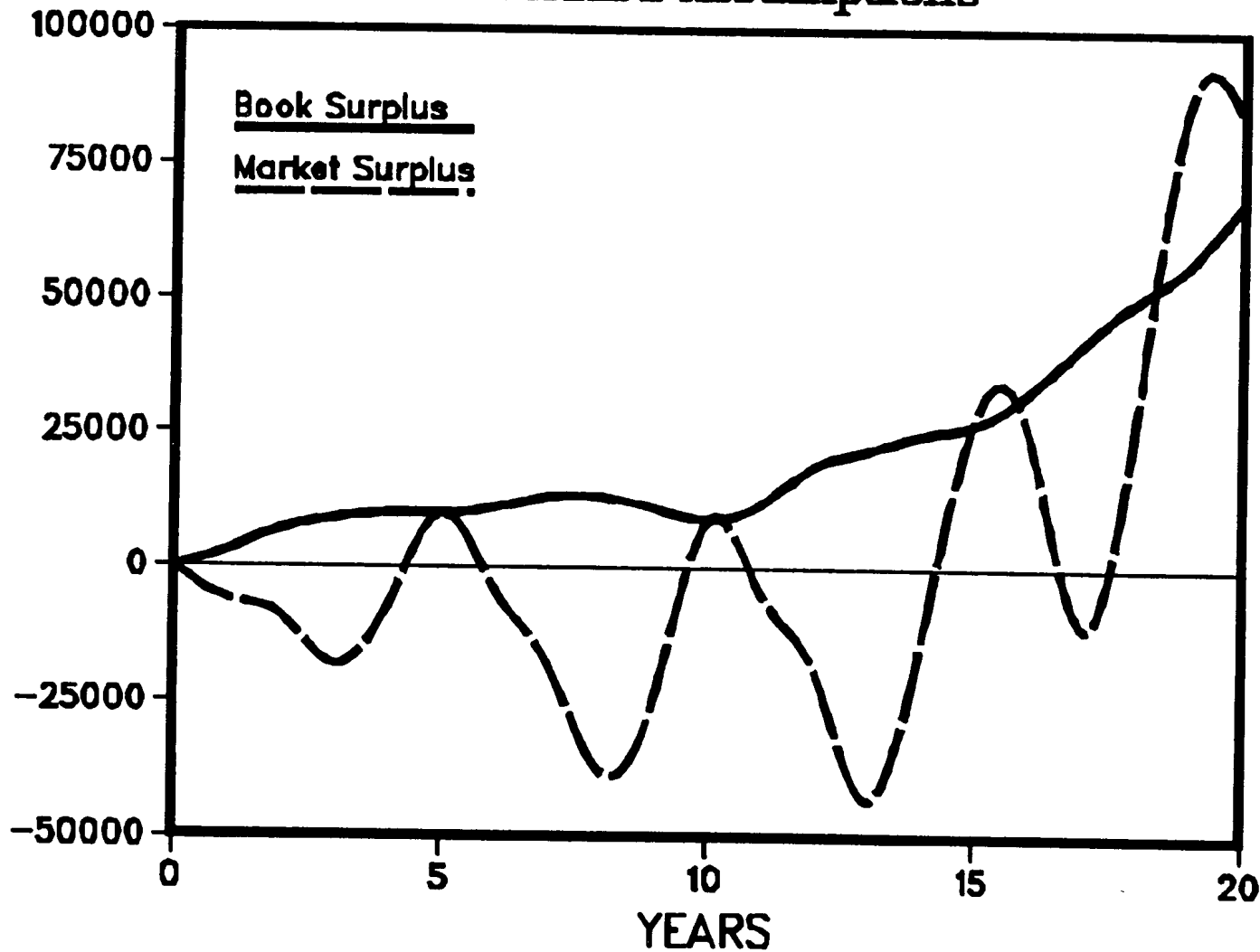
- o the reserve year by year;
- o the surplus with assets valued at book value, which is referred to as book surplus;
- o the surplus where assets are valued at market value, which is referred to as market surplus.

As you look at some of the scenarios, you notice the wide variations between market surplus and book surplus. Graph 4-1 illustrates this. The solid line represents the book surplus and the dotted line the market surplus for a cyclical-up-2 percent scenario (which is one of our reasonable scenarios). As you can see, market surplus has much wider variation than book surplus.

In addition to the results shown in the Case Study Actuarial Management Report, some additional summaries and analyses of the results were performed. These are outside the scope of a normal management report; however, whenever you do this sort of cash flow projection, you should summarize the data as many ways as possible so that the results can be used to influence future management actions.

Let's consider some of the various measures of profit which might be used in analyzing the results of cash flow projections. First there is the present value of book profits. This is the traditional Anderson book profit. For the Mismatch Life study, a 12 percent level discount rate was used. Using a level discount rate over a set of widely varying interest scenarios does not necessarily produce a

Market and Book Value Surplus Cyclical Up 2% Scenario Standard Assumptions



-119-

meaningful result. However, I think it is useful to look at results in various ways in order to draw conclusions. Another measure is the profit margin, which is equal to the present value of book profits divided by the present value of premiums. Again a level 12 percent discount rate was used. Our next measure is business remaining in force. This is not traditional profit measure, but it is a way to measure the results of scenario testing. One place it comes into play is in determining the interest-crediting strategy. If you run the interest-crediting strategy through various increasing scenarios and find that all of the business is lapsed off the books, you need to go back and question whether you are using a realistic interest-crediting strategy. Does the interest-crediting strategy produce meaningful results?

Another way to measure results is to look at the figures described earlier: both the market and book surpluses. These measures can be viewed both in terms of absolute dollar value at the end of the projection period and also as a percentage of the ending reserve. Sometimes different conclusions are drawn from looking at dollars and percentage of reserve. The market value of assets divided by the book value of assets is another meaningful gage. This allows a look at the volatility of the portfolio. The key indicator is the lowest value that occurs under a scenario. For example, if there is a ratio of 80 percent, that means the portfolio becomes 20 percent "under water." Last but not least, the maximum amount borrowed is considered. If an unrealistic amount of borrowing is occurring in a given scenario, this is a "red flag" measure.

Please turn now to Exhibit 4.C.3 of the Case Study, Financial Data Section. This contains a summary of all of the various profit measure values for all of the various scenario tests which were used in developing the Case Study, Section on

Actuarial Report for Universal Life. In other words, it contains the results for the five reasonable scenarios plus the six plausible scenarios. I'm not going to go through each of these results in detail; however, I would like you to note that, of the reasonable scenarios, the cyclical-up-2 percent scenario seems to produce the most difficult, or poorest, results. Some additional sensitivity analyses were completed based on this particular scenario. In real life, the sensitivity analyses would be performed in order to avoid drawing a bad conclusion. For example, the result in an upward scenario may be just the opposite of the result in a downward scenario. You should not draw conclusions from looking at results of one scenario.

If you turn now to Exhibit 4.C.4 of the Case Study, Financial Data Section, you'll find the summary of results of some of these sensitivity tests. In the first line are the standard results.

This is a repeat from the prior page for the cyclical-up-2 percent scenario. Next are results for some variations in interest-crediting strategy. Again, these sensitivity tests are outside the scope of a usual management report. We considered strategies of a portfolio less a 1.25 percent spread and a portfolio less a .75 percent spread. Also considered was a follow-the-competition strategy. As you'll note, we ended up with some rather alarming numbers under the follow-the-competition strategy.

Three variations in investment strategy were also tested. This wouldn't be realistic, since you would be using specific assets and hopefully have some statement from your investment officer as to future investment strategy. The variations in strategy were performed to demonstrate how the results might vary

by investing in longer or shorter assets. Under the longer strategy, a couple of different interest-rate spreads were used: 1.75 percent and 1.25 percent. For the shorter strategy, we had to narrow the spread so that the initial credited rate would be competitive. On the final line on this page are results based on selling assets rather than borrowing. This gets a little tricky in that it is necessary to compare this line of results with the first line of results under the variations in crediting strategy — the portfolio less 1.25 percent. That scenario generates a significant borrowing amount. Enough assets were sold at the appropriate times so that the \$59,000 plus of borrowing, which occurred under the portfolio less a 1.25 percent spread scenario, was avoided. The market value of surplus at the end of the projection period dropped from \$118,000 under the borrowing assumption to \$107,000 under the selling-assets assumption. When we were forced to sell assets, capital losses occurred which exceeded the borrowing costs involved under our standard borrowing assumption.

In my experience, these summaries are quite helpful; however, when it comes to presenting results, graphics are very effective. Before looking at some graphs, let me explain that I will be discussing some conclusions that might be drawn from them, but these conclusions may not be viable in a real situation. I'm going to draw these conclusions for illustrative purposes. One weakness is that we have simplified the graphs by looking at only our cyclical-up-2 percent scenario. In real life, you probably wouldn't want to look at results from just one scenario. You'd want to look at some declining interest-rate scenario results also.

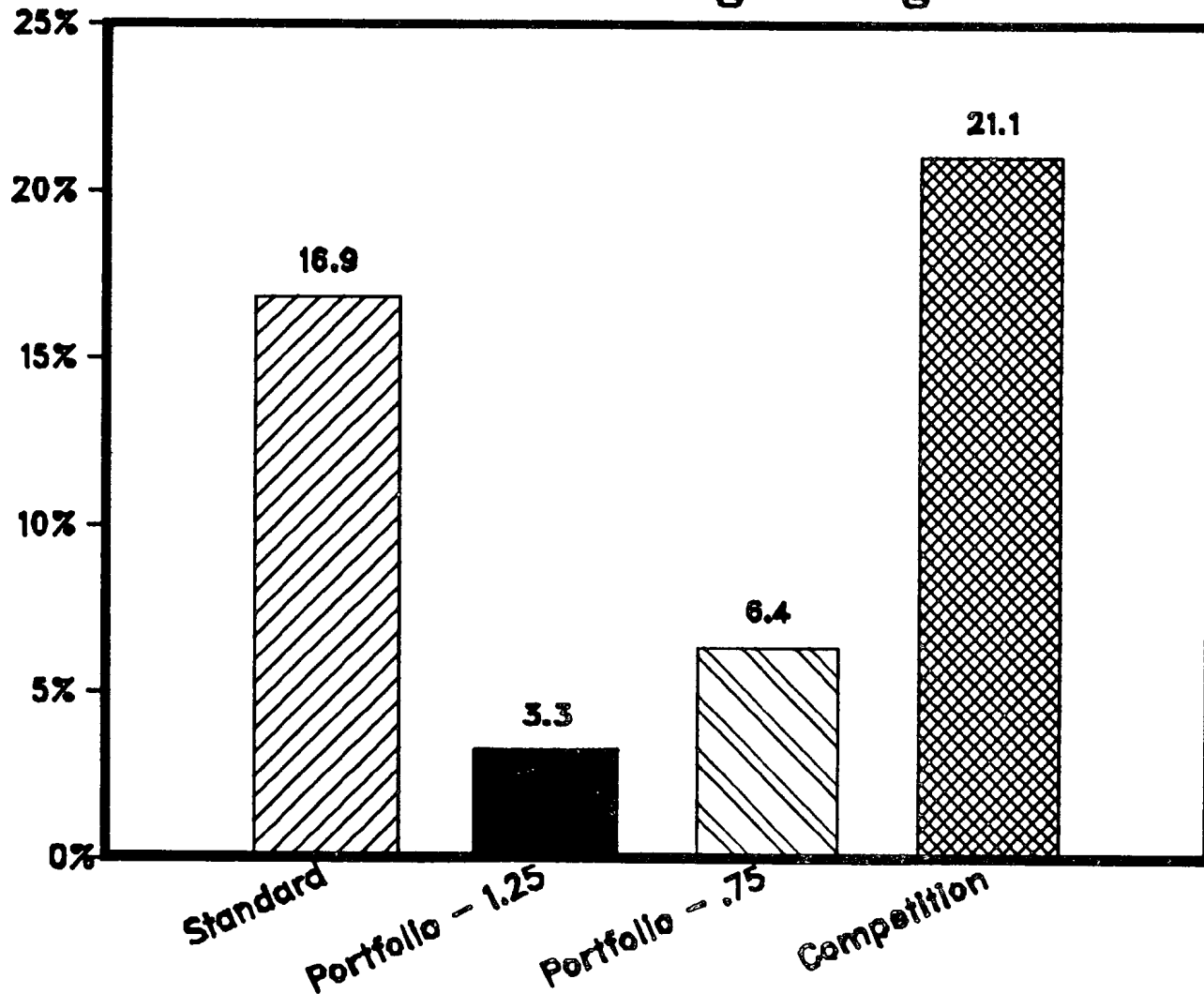
With those cautions in mind, let's look at a set of five graphs. The first three illustrate results based on the variations in interest-crediting strategy we looked

at in Exhibit 4.C.4. In Graph 4-2 the in-force business at the end of the twenty-year projection period for the four interest-crediting strategies tested is shown. The standard strategy followed the portfolio less 1.25 percent, but never got more than 1 percent away from the competition rate. Next, there are the two portfolio strategies — portfolio less a 1.25 percent and portfolio less a .75 percent. Finally there is the competition strategy that maintains the credited rate at the competition rate. The competition strategy maintains 21 percent plus of the in-force business over the scenario. The major point is that under the cyclical-up scenario, which is defined as a reasonable one for Mismatch Life, the business really rolls off the books under the portfolio crediting strategies.

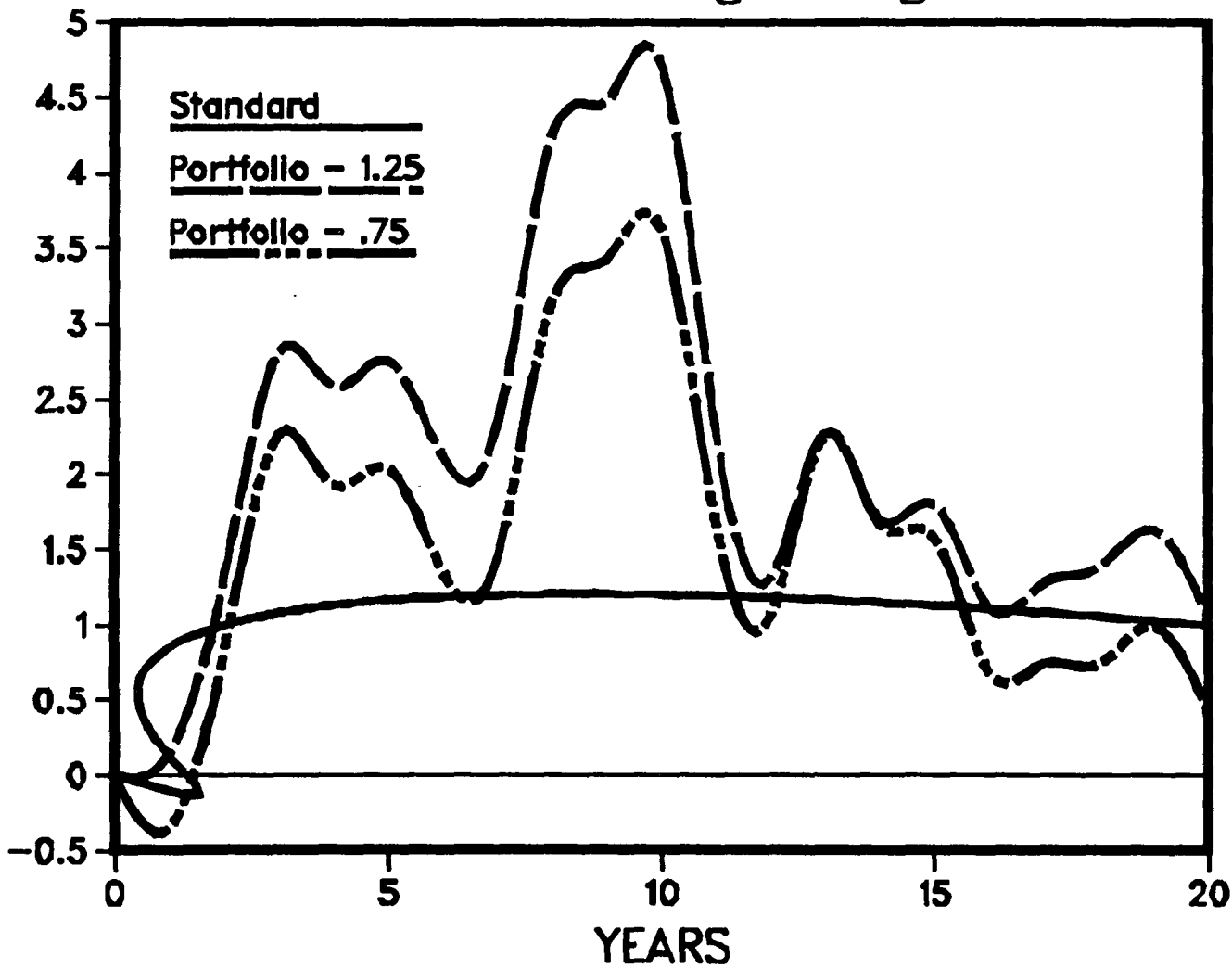
Illustrated in Graph 4-3 are the results of the competition rate less the credited rate under the various crediting strategies. The formula for additional lapses is based on this difference between the competition rate and credited rate. To the extent this difference becomes large, a large amount of additional withdrawals occur. The competition crediting strategy is not shown on the graph because it basically follows the zero line straight across since the credited rate never strays from the competition rate. Under the standard crediting strategy the difference moves to the 1 percent threshold line and stays there. The credited rate bumps along at 1 percent less than the competition rate. The portfolio strategies are certainly the most interesting. The portfolio less 1.25 percent generates a 4.5 percent-5 percent difference between the competition rate and the credited rates. With that large a difference, significant additional withdrawals occur; that is, the business blows off the books.

GRAPH 4-2

**Business In Force – End of 20 Yrs.
Cyclical Up 2% Scenario
Various Crediting Strategies**



Competition Rate Less Credited Rate Cyclical Up 2% Scenario Various Crediting Strategies



In Graph 4-4 the portfolio rate less the credited rate, or the traditional interest spread, is illustrated. This graph would be rather boring for the portfolio strategies. They are not shown, but would be straight lines across at the spread amounts. The interesting strategies are the standard strategy, which never allows us to be more than 1 percent away from the competition, and the competition strategy, where we follow the competition rate. The zero line is in the middle of the graph. Under the standard interest-crediting strategy there are times of negative spread; however, overall there seems to be a few more positive spreads than negatives, so it appears that overall there may be a positive interest spread. The follow-the-competition strategy, on the other hand, doesn't look so good. It follows along below the line and is probably going to be in a loss situation overall.

The next two graphs depict some variations in investment strategy. Two hypothetical investment strategies were chosen — a longer and a shorter. The standard strategy results are also shown for comparison purposes. The three investment strategies are shown in Table 4-9. The standard strategy has an average maturity, not average duration, of 9.1 percent. It has an initial yield based on today's yield curve of 12 percent. The longer strategy has an average maturity of over seventeen years — a significant lengthening. In addition, the initial yield increased to 12.5 percent for the longer strategy. Two different interest spreads were tested on the longer strategy. The 1.75 percent spread assumes that we credit the same 10.75 percent that was credited under the standard strategy. The portfolio was lengthened and the spread widened. The second spread was the 1.25 percent that was used in the standard assumption. With the 1.25 percent spread, the initial credited rate is 11.25 percent. In this case, we passed an additional .5 percent on to the policyholder. The average

Portfolio Rate Less Credited Rate Cyclical Up 2% Scenario Various Crediting Strategies

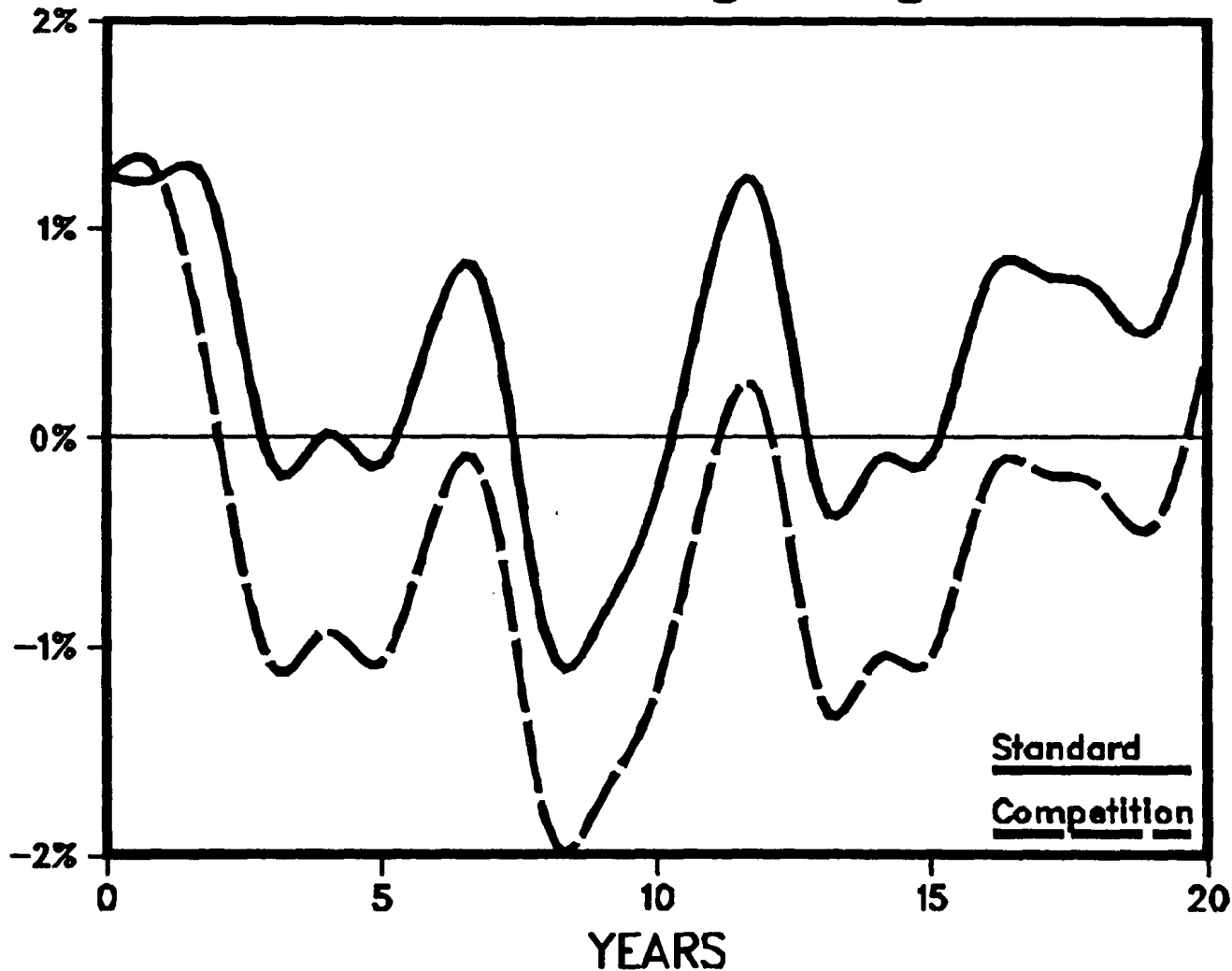


TABLE 4-9**VARIOUS INVESTMENT STRATEGIES**

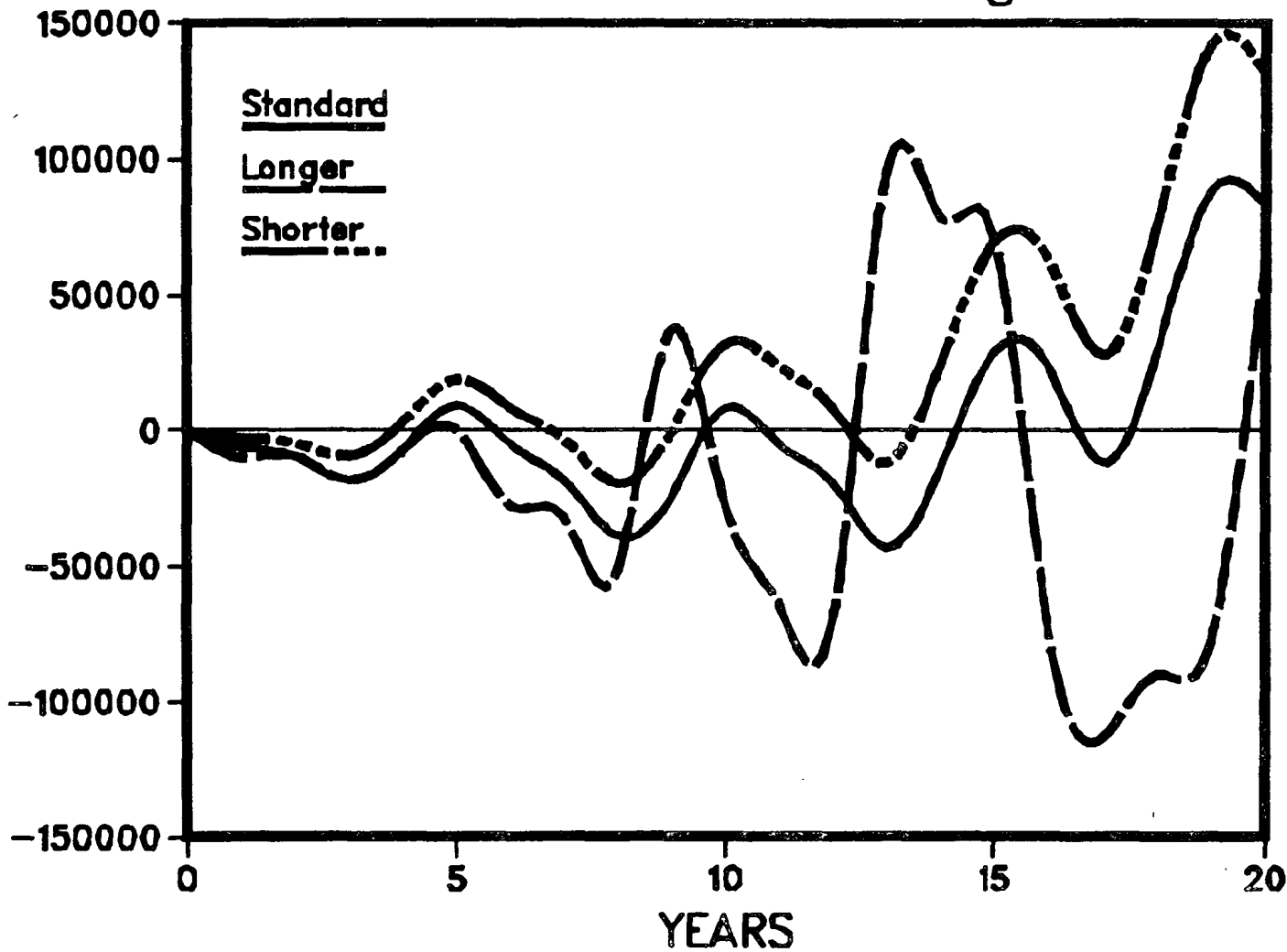
	<u>Standard</u>	<u>Longer</u>	<u>Shorter</u>
90-Day	2.0%	2.0%	2.0%
3-Year	10.0	--	52.0
10-Year	88.0	23.0	46.0
20-Year	---	75.0	---
Average			
Maturity	9.1	17.3	6.1
Initial			
Yield	12.0	12.5	11.5

maturity shortens up from over nine years on the standard strategy to about six years on the shorter strategy. The initial yield rate drops to 11.5 percent. For the shorter strategy, the spread was reduced to .75 percent so that the initial credited rate is 10.75 percent. In testing combinations of crediting strategies and spreads, one needs to be careful to use a realistic spread for shorter investment strategies. You need to have a reasonable credited rate. If you assume that you can get the same spread and go shorter, you're going to come out with the result that you want to be shorter.

In Graph 4-5 the market surplus as it emerges over the twenty-year time period is displayed. If you look at the longer strategy line, you will see much wider variations and it appears that the bottom point on this cycle is at least as far below the zero line as the high point is above the zero line. It appears that as it cycles into the future, there may in fact be a loss under the longer investment strategy. The other two strategies, standard and shorter, tend to not wave as much as the longer strategy. They tend to have shorter variations between peaks and valleys. The shorter strategy ends up on top at the end, mainly because of the particular scenario being tested. Since it is an upward scenario, under the shorter strategy we're able to adjust to a higher credited rate; thus, it comes out a winner. Keep in mind that under a decreasing scenario, longer investments would ensure today's high-yield rates, creating a better result for the longer strategy. You need to be careful in interpreting results of only one scenario.

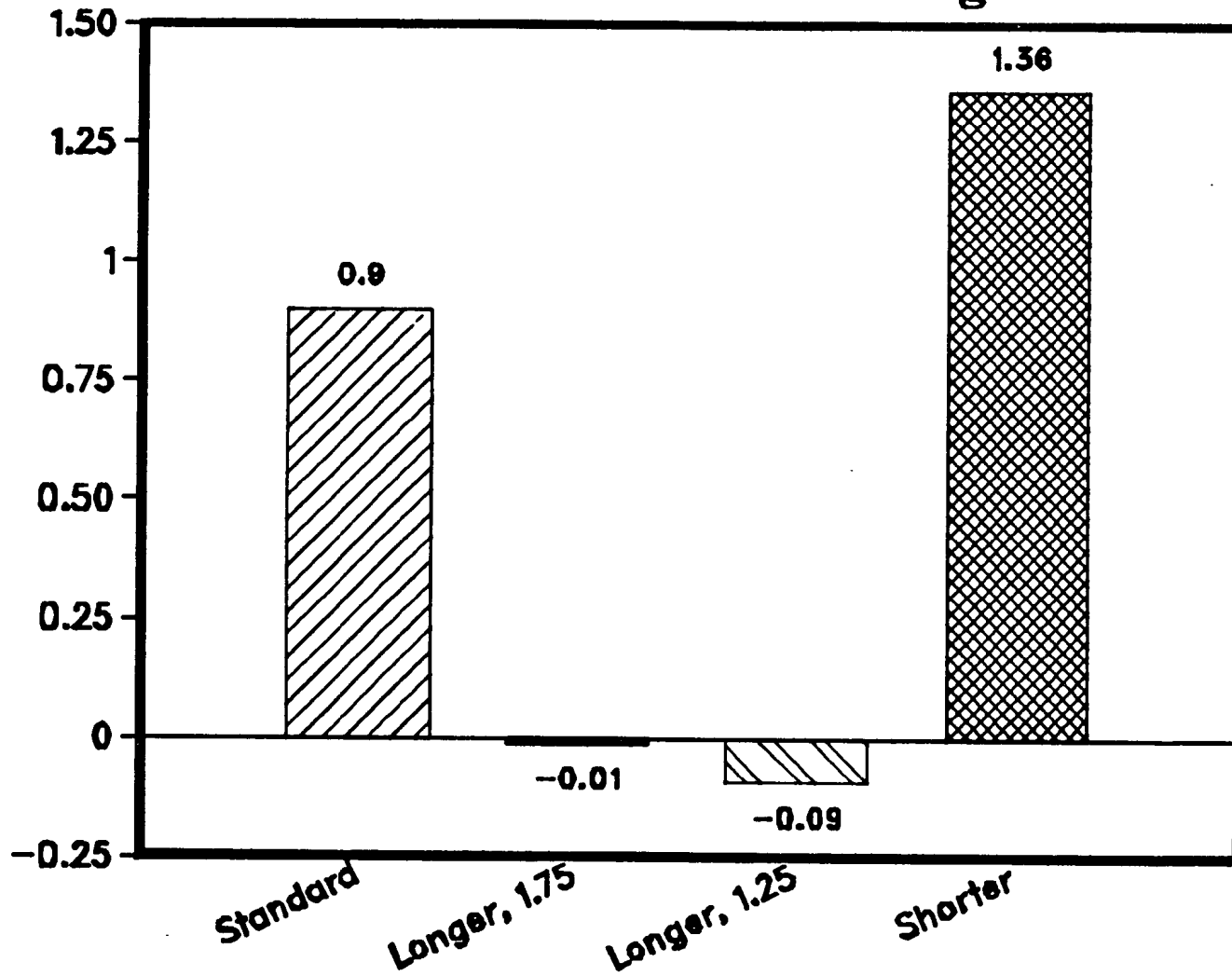
Another way of measuring the results from various investment strategies is to look at the present value of book profits generated under the various strategies. This is what is shown in Graph 4-6. A level 12 percent discount rate was used in calculating the present value. The standard strategy produces \$1.36. The longer

Market Value Surplus Cyclical Up 2% Scenario Various Investment Strategies



-130-

**Present Value of Book Profits 12%
Cyclical Up 2% Scenario
Various Investment Strategies**



strategies, whether we go with the 1.75 percent or the 1.25 percent spread, end up in a loss position.

As you can see, the presentation and interpretation of results are two of the biggest challenges in completing cash flow projections.

MR. MICHAEL TUOHY: A big danger you have to watch out for is becoming swamped in paper. We'll return to that later, I will conclude the presentation with some further thoughts on the role of the valuation actuary.

This whole exercise of cash flow projections and determining suitable reserves is a test of cooperation between the chief executive of a life company and his senior actuarial, investment and sales personnel. It is worth spending time taking the nonactuarial people through the sort of numbers Mr. Carr has just illustrated. The graphics Mr. Carr used are very helpful in this presentation. It is very important for all members of senior management to have an understanding of the implications of a particular investment policy or a particular interest-crediting strategy. If the actuary can communicate this to his colleagues, then he has solved 75 percent of the problem of being a valuation actuary.

If the valuation actuary's eventual responsibilities are similar to those currently proposed, he will effectively have a veto on investment strategy and on new products, as certain investment strategies and certain new products could necessitate the establishment of huge reserves beyond the scope of the company's capital and surplus. Incidentally, it is essential that the reserving implications of any investment strategy or new product are investigated prior to

being implemented rather than at each year end. It could be very embarrassing if a new product was introduced in June, sales were very successful, and then at the end of the year the valuation actuary had to establish such large reserves as to cause the company to be statutorily insolvent.

We must recognize that there will be situations when the valuation actuary sees a problem in a slightly different light from his colleagues. Communication with colleagues may be less than ideal, and he may come to the end of a year and find that he has to establish substantial reserves which his colleagues consider totally unnecessary. What does he do? I believe we have to look to either the Academy or Society to give the valuation actuary some comfort.

This problem has been addressed in the U.K where the valuation actuary is referred to as the Appointed Actuary. The concept of the Appointed Actuary came into effect in the early 1970s after the U.K.'s equivalent of the SPDA debacle. In that country the product was the income bond. The product was very similar to the SPDA and, as in this country, companies failed because of irresponsible investments. Instead of investing in mortgage guarantee companies, they invested in real estate development. The position of Appointed Actuary was introduced shortly after these insolvencies and was readily accepted by the industry.

However, there is a big difference between the U.K and the U.S. in that actuaries have traditionally been heavily involved in the investment area. The majority of chief investment officers of the big life companies are actuaries. Even with this ready acceptance, there have been conflicts between Appointed Actuaries and the rest of the life company management. In these circumstances,

the appointed actuary may approach a subcommittee of the Professional Guidance Committee of the Institute of Actuaries on a confidential basis to discuss his problems. If the actuary is being unduly conservative, he will receive comfort from the subcommittee members while they weaken his basis. However, even if the subcommittee agrees with the actuary's opinion, the actuary is still in danger of being without a job, although he has the satisfaction of knowing he was professionally correct.

These instances are very rare, and companies try to avoid conflicts with their actuaries, as regulators do not look kindly upon a company that does not take its actuary's advice. I would hope that the Academy or the Society would be able to establish something similar for the valuation actuary in this country.

Hopefully, as a result of better communication between the actuary and his colleagues, companies will decide to adopt a formal statement of investment strategy — not purely to facilitate the work of the valuation actuary, but as basic, good business practice. The statement need not be very specific, but should include guidelines as to type of asset, quality of asset and term of asset.

Similarly, an interest-crediting strategy should be formulated. Sitting down once a month and squabbling over what interest rate to credit really is a waste of management time. A strategy need not be set in stone, and should be reviewed periodically, possibly every six months.

Some of the assumptions that must be made to complete the cash flow projections are new to most actuaries. The Academy or Society should provide some guidance in setting assumptions on such elements as additional withdrawal

rates and interest scenarios. In respect of the former, companies should improve their monitoring techniques so that in the longer term, they have some justification for the formulas used.

The concept of cash flow projections is useful not only in establishing reserves and testing the solvency of the company, but also in the pricing aspect of developing interest-sensitive products. Sensitivity tests should be run using various future interest scenarios and assumptions. However, don't get too carried away. It might seem reasonable to test a new product using five investment scenarios, three investment strategies, a couple of competition rate formulas, three crediting strategies, two formulas for additional withdrawals and perhaps an assumption as to future taxation that is different from the continuance of current law. All this seems pretty reasonable, but if you try to test all the possible combinations of the assumptions just cited, you will end up with 360 sets of output.

To make the project manageable, test individual assumptions separately, then test those assumptions having significant individual impacts in combinations. In any event, the volume of results from the test will be quite significant, and then comes the problem of interpretation.

Since the product can be tested with assumptions about future investment scenarios, future investment strategies and so on, the profit results will fall on either side of those derived from the level interest assumption. A set of profit measures can be set, below which it is unacceptable for the results to fall. The runs can be inspected and the investment strategies and crediting strategies that cause the results to fall below this threshold can be eliminated.

Examples of some threshold profit measures, including some that do not apply for a level interest scenario, are the following:

- o 2 Percent Average Annual Profit
- o Twentieth-Year Surplus \leq 2 Percent Reserve
- o 10 Percent Return on Investment
- o 8 Percent Return on Equity
- o 20 Percent of Issued Business In-Force After Twenty Years
- o Market Value of Assets \leq 85 Percent Book Value
- o Annual Earnings Fluctuation \geq .5 Percent Reserves
- o Borrowing \geq 5 Percent Reserves

Interestingly, most of the published literature on scenario testing and cash flow projections has dealt with SPDAs. However, there is a significant difference between SPDA results and universal life results. This is not too surprising, as a young block of UL business can expect to receive significant future premiums that are not available to a block of SPDA business.

The question was raised earlier as to whether all the work involved with projecting cash flows will result in establishing reserves any higher than the ones already held. I believe that in many cases the existing reserves will be found to be sufficient. However, I think most people would agree that for a block of SPDA business matched by thirty-year bonds, it is prudent to hold an additional reserve for the C-3 risk over and above the cash surrender value of the annuities. You have to decide where the break point is for existing reserves to be sufficient. To find this break point, it is necessary to go through the complications of cash flow projections.

I'm hopeful that research will, over time, reduce the complexity of the procedures and that, for those companies with strong reserves, the valuation practices may be no more onerous than at the present time. Considerably more research is required to get to that situation.

Mr. James Geyer, in his earlier presentation at this symposium, stated that each individual product line should have sufficient reserves and that deficiencies in one product line could not be offset against sufficiencies in the other. One of his arguments related to the practicality of testing two lines together. The practicality issue aside, I take issue with this proposal and suggest that the company should show sufficient reserves in aggregate. For example, deferred and immediate annuities have offsetting risks. If one of these lines was deficient and the other sufficient, I believe some offsetting of the two is appropriate. This procedure must not be taken too far, as the product line with the sufficiencies may not be a good value to the consumer, and therefore may disappear much faster than the line showing deficiencies.

I definitely concur with Mr. Geyer's point that a reserve is not sufficient if negative statutory earnings are projected in any future year. Reserve levels should always be such that projected statutory earnings are at least zero.

What are measures of sufficiency? The Academy guidelines suggest that reserves are sufficient if they do not lead to long-term market value deficits using reasonable assumptions. Clearly this is a useful measurement, but as you saw in Mr. Carr's presentation, the twenty-year projection was not sufficiently long. Results were still bouncing around in the twentieth year. Mismatch Life would probably have to project its results for thirty or thirty-five years before

the market surplus figure would settle down. But projections that far into the future seem somewhat unreal. Can an intermediate-term projection produce meaningful results?

If the future interest scenarios continue to oscillate, market surplus will vary significantly with the peaks and valleys of an interest-rate cycle. Perhaps scenarios allowing the interest rates to fluctuate for a period and then flatten out could produce meaningful intermediate term tests. More research is required in this area.

In the tests discussed today, negative cash flow was always handled by borrowing. This is a satisfactory solution unless the borrowing becomes too great. Perhaps some limit should be placed on the acceptable amount of borrowing in the projection. This is another area for further research.

In closing, I would like to say that I view the role of the valuation actuary as a big opportunity for the profession. It presents challenges in new and interesting areas, but I believe we are well equipped to handle them. And as our expertise improves, this could lead to actuarial opportunities outside the insurance industry. The problem of matching assets and liabilities is one facing all financial institutions, not just insurance companies. We should eagerly accept the challenge this poses us.

FROM THE FLOOR: If we have \$5,851 of needed additional internally designated surplus, should the opinion not state that this amount should be set up?

MR. CARR: Although it was not specifically stated in the management report, it is my understanding that the \$5,851 would be set up separately in the statutory statement.

FROM THE FLOOR: Will it be necessary to do all of the valuation work between December 31 and March 1?

MR. CARR: Based on the work that Mr. Tuohy and I have done, I believe there will be an extension for this part of the opinion, maybe until mid-year. It is a lot of work, at least the way I envision it.

MR. TUOHY: I'm not that pessimistic. If you remember the first time the stock companies tried to do GAAP earnings, it took a long time; however, now that work is completed by the second week in January. I agree that the first time around, it's going to take an awful lot of time, but I suspect that once you get a feel for the numbers, you'll be getting it done by March 1.

FROM THE FLOOR: In regard to the withdrawal assumption, the Mismatch Life study assumed that anyone who withdrew took a total surrender. Should you be looking at partial surrenders or nonpayment of premiums separately?

MR. CARR: I think that is something you should look at. We did not for Mismatch Life, but definitely you should look to see if your numbers are going to be distorted by heavy partial surrenders or paid-ups.

FROM THE FLOOR: If we have to put up with this additional reserve, can we deduct it for tax purposes? Are we, as an industry, making any effort to get it deductible?

MR. TUOHY: I am afraid I can't answer that. Clearly, that would be desirable.

FROM THE FLOOR: Ernie D. Spread went out only twenty years in his projections. Was this long enough?

MR. TUOHY: If you look at the earnings year-by-year or the market surplus year-by-year, it's still swinging around late in the projection. To satisfy the requirements, Ernie should have gone out further.

**CASE STUDY
MISMATCH LIFE INSURANCE COMPANY
FINANCIAL DATA SECTION - EXHIBIT 4.C.1**

**TULAS
TILLINGHAST UNIVERSAL LIFE ANALYTIC STUDY
INTEREST TRENDS ANALYSIS**

Analysis of *INDEXED AND NONINDEXED* Products

Total Number of INDEXED AND NONINDEXED Products in CIBD: 313

	<u>Effective Dates</u>						
	<u>4/85</u>	<u>5/85</u>	<u>6/85</u>	<u>7/85</u>	<u>8/85</u>	<u>9/85</u>	<u>10/85</u>
<u>Credited-Interest Rates</u>							
Number of Products Analyzed: (1)	223	233	244	254	274	279	287
Highs:	13.00%	13.00%	13.00%	12.50%	12.50%	12.50%	12.50%
Lows:	8.07	7.71	6.98	6.90	6.90	7.07	7.06
Means:	10.91	10.88	10.86	10.68	10.62	10.58	10.53
Medians:	11.00	11.00	11.00	11.00	10.70	10.60	10.50
<u>Reference Interest Rates</u>							
	(Weekly Averages)						
90-Day T-Bill (2)	8.18%	7.87%	7.03%	7.00%	7.23%	7.12%	7.07%
1-Year Treas. (3)	9.54	8.92	7.80	7.66	8.14	8.04	7.96
5-Year Treas. (3)	11.33	10.85	9.45	9.53	10.01	9.76	9.71
20-Year Treas. (3)	11.92	11.62	10.46	10.53	10.93	10.71	10.75
Corporates (Moody's Seasoned AAA)	12.44	12.15	10.93	10.91	11.21	10.94	11.07

<u>Changes From Previous Period</u>							
Number of Products Analyzed: (1)	208	220	224	241	250	271	269
<u>Decreases</u>							
Number:	37	29	25	83	48	31	41
Highs:	1.13%	1.00%	1.13%	2.50%	1.25%	1.00%	1.50%
Lows:	.18	.02	.10	.03	.13	.02	.06
Means:	.49	.42	.49	.59	.45	.37	.43
Medians:	.50	.41	.50	.50	.50	.25	.40
<u>Increases</u>							
Number:	24	8	5	11	7	11	14
Highs:	2.00%	.50%	1.00%	1.00%	.50%	.50%	1.00%
Lows:	.08	.05	.13	.03	.03	.04	.03
Means:	.59	.27	.38	.44	.25	.24	.33
Medians:	.50	.20	.25	.37	.23	.13	.25

- (1) Products analyzed are those which have sufficient information available. Therefore, in order to be included in the "changes" section, information must have been available in both the current and the immediate prior period.
- (2) Quoted at bank discount rate as of the first Friday of each month.
- (3) Yields on actively-traded issues adjusted to constant maturities effective as of the first Friday of each month.

CASE STUDY (CONTINUED)
FINANCIAL DATA SECTION - EXHIBIT 4.C.2

TULAS
TILLINGHAST UNIVERSAL LIFE ANALYTIC STUDY
NEWSLETTER
OCTOBER, 1985

I. Interest Rate Trends

Credited-interest rates have shown a steadily declining pattern since May, 1985. Over the last six months, there have been 257 decreases in the credited rate and only 56 increases. Over this same time period, the reference interest rates tracked by TULAS have remained relatively stable. It would appear insurers are beginning to recoup some of the interest margins which have been severely tested over the past year.

II. Interest Rate Analysis Technique

As reported in last month's TULAS Newsletter, the December edition of TULAS will incorporate some new analytic techniques. One such technique is described in the following paragraphs.

As funds come in-house, an insurer will invest in various instruments of varying duration. Unless each investment dollar is earmarked to the specific premium dollars which gave rise to it, the company will have a pool of invested funds which include differing instruments each with its own duration to maturity and yield available for allocation to the policyholders by way of the credited-interest rate.

One method of gaining some insight into the potential yield contained within the pool of investments is to analyze a moving average of yields available in the investment environment over a stated number of months. For example, a 24-month moving average of 5-Year Treasuries as of January 1, 1985 would be the average yield of the monthly returns on this instrument between February 1, 1983 and January 1, 1985. The corresponding average as of February 1, 1985 would include the monthly yields from March 1, 1983 to February 1, 1985.

The 24-month and 60-month moving averages for the 5-Year and 20-Year Treasuries and AAA Moody's Corporate Bonds are shown in the following table, along with the single month yield rate.

	Moving Averages								
	5-Year Treasuries			20-Year Treasuries			AAA Bonds		
	1 Mo.	24	60	1 Mo.	24	60	1 Mo.	24	60
1/1/85	11.47%	11.92%	12.78%	12.15%	12.33%	12.82%	12.58%	12.80%	13.39%
2/1/85	11.05	11.93	12.78	11.63	12.33	12.82	12.20	12.78	13.40
3/1/85	11.80	12.01	12.74	12.42	12.39	12.81	12.86	12.82	13.39
4/1/85	11.65	12.05	12.71	12.28	12.44	12.80	12.83	12.85	13.38
5/1/85	11.14	12.10	12.71	11.96	12.50	12.82	12.52	12.89	13.40
6/1/85	9.67	12.05	12.71	10.73	12.47	12.82	11.23	12.85	13.40
7/1/85	9.76	12.00	12.71	10.81	12.43	12.83	11.21	12.81	13.40
8/1/85	10.26	11.92	12.71	11.23	12.38	12.83	11.52	12.74	13.40
9/1/85	10.00	11.83	12.68	11.00	12.32	12.82	11.24	12.68	13.38
10/1/85	9.95	11.77	12.64	11.04	12.29	12.80	11.38	12.63	13.36

These moving averages inherently assume that the total dollar amount invested in the instrument is the same for each month. If a product has experienced rapidly increasing sales over recent months, the lower yields available over past months will play a more prominent role in the average yield of the pooled funds.

As is evident from the preceding table, the moving averages are of a greater magnitude and of a more stable nature than the yields available for the individual months. The differences have become most dramatic as current investment yields have declined. Meanwhile, the moving averages still contain the higher yields available in prior years. This comparison may help shed some light on how some insurers are able to credit seemingly high interest rates.

The yields reported here are effective annual rates as opposed to the nominal annualized rates reported in the TULAS and Federal Reserve Publications. Most universal life products' credited-interest rates are quoted as effective annual rates. To compare universal life credits to potential yields for the preceding table, we have converted the Federal Reserve numbers from the coupon equivalent yield or nominal yield to effective yield. Nominal is a more conservative measure. For example, a 10% coupon equivalent yield (that is, a nominal rate of 10 percent) has an effective yield of 10.25 percent.

III. Simplified Interest Rate Survey

We have received several requests encouraging us to take steps to provide interest information earlier each month. Our first step towards the solution is to begin an experiment with you, our TULAS subscribers. If the experiment is successful, we intend to branch out to all companies in our credited-interest rate data base. We have purchased the use of a sophisticated telephone message service. The service allows you to call toll free (at your convenience) and leave us the pertinent information via a recording. Each month, we request you dial an 800 number and leave your company's interest rate information.

It is anticipated that this service will expedite the publication process so that the TULAS will be in your hands sooner. Please use it and tell us what you think; serving your needs is our prime goal. Full details of this service will be sent to you soon under separate cover.

IV. Updates, Corrections and Additions

The following subscribers have provided TULAS with additional and updated product information this month which has been incorporated in Sections B and D:

Alexander Hamilton	-	Irresistible Life
	-	Irresistible New Life
	-	Irresistible New Life II
Midwestern United	-	ExtraLife
	-	Superflex
Travelers	-	ULXP (Executive UL Plus)

The source information for USAAs UL product was incorrect. The product credited 11.2 percent in February, 1985 instead of 11.5 percent. All the projections in Sections B and D now reflect the corrected information.

The information contained herein is a compilation of information and data which has been published elsewhere or which has been made available to Tillinghast, Nelson & Warren, Inc. for inclusion in this issue. Tillinghast makes no representation regarding the accuracy of the information contained herein and assumes no responsibility for any erroneous information. In the event any erroneous information is discovered, please notify Tillinghast in writing at 3900 North Causeway Boulevard, Suite 1470, Metairie, Louisiana 70002. Tillinghast is an actuarial consulting firm which is not engaged in the business of selling insurance, and nothing contained in this volume should be construed as a positive or negative recommendation regarding any insurance policy or as a representation that any policy has been approved for use in any particular state.

Copyright 1985 Tillinghast, Nelson & Warren, Inc.

CASE STUDY (CONTINUED)
FINANCIAL DATA SECTION
EXHIBIT 4.C.3

MISMATCH LIFE INSURANCE COMPANY
SUMMARY OF RESULTS
Standard Assumptions

	@ 12%		% In-Force End of 20 Years	Market Surplus Yr. 20 ³		Ratio of MV/BV ⁴		Maximum Year	Borrowing Amount
	Present Value of Bk. Profits ¹	Profit Margin ²		\$	% of Reserve	Min.	Max.		
Reasonable Scenarios									
Level	\$3.13	7.85%	21.07%	\$217,096	29.72%	100%	100%	—	—
Cyclical Up 2.0%	.90	2.35	16.88	83,679	6.31	90	103	—	—
Slow Up and Level	1.39	3.59	18.40	176,749	10.27	90	103	—	—
Slow Down and Level	3.27	8.19	21.06	167,595	40.60	100	110	—	—
Cyclical Down	3.14	7.87	20.96	162,802	36.59	99	112	—	—
Plausible Scenarios									
Cyclical Up 2.5%	(.16)	(.43)	16.80	(4,493)	(.27)	87	104	—	—
Fast Up and Level	.49	1.26	18.87	123,936	5.33	83	104	—	—
Further Up and Level	(.60)	(1.58)	18.76	(5,159)	(.13)	78	104	—	—
Fast Down and Level	3.47	8.70	20.98	165,740	48.26	100	120	—	—
Cycle About 11%-A	.96	2.48	18.01	127,281	18.72	80	119	—	—
Cycle About 11%-B	1.77	4.48	18.90	(18,736)	(3.11)	85	125	—	—

1. Present value of statutory book profits after provision for federal income tax with a 12% discount rate.
2. Present value of statutory book profits divided by present value of premiums, with both values discounted at 12%.
3. Surplus based on assets valued at their market value.
4. Ratio of the market value of assets to the book value of assets.

CASE STUDY (CONTINUED)
FINANCIAL DATA SECTION
EXHIBIT 4.C.4

MISMATCH LIFE INSURANCE COMPANY
SUMMARY OF RESULTS-ADDITIONAL SENSITIVITY TESTS
Cyclical Up 2.0% Scenario

	<u>@ 12%</u>		<u>% In-Force End of 20 Years</u>	<u>Market Surplus Yr. 20³</u>		<u>Ratio of MV/BV⁴</u>		<u>Maximum Year</u>	<u>Borrowing Amount</u>
	<u>Present Value of Bk. Profits¹</u>	<u>Profit Margin²</u>		<u>\$</u>	<u>% of Reserve</u>	<u>Min.</u>	<u>Max.</u>		
Standard	.90	2.35	16.88	83,679	6.31	90	103	—	—
<u>Variations in Interest Crediting Strategy</u>									
Portfolio less 1.25% Spread	1.53	5.16	3.27	118,229	55.19	89	104	10	59,991
Portfolio less .75% Spread	1.36	4.11	6.43	110,724	24.00	89	104	10	49,445
Follow Competition Rate	(1.12)	(2.82)	21.07	(86,003)	(4.49)	90	103	—	—
<u>Variations in Investment Strategy</u>									
Longer, 1.75% Spread	(.01)	(.04)	16.87	(62,822)	(4.74)	85	100	--	--
Longer, 1.25% Spread	(.09)	(.22)	16.94	(67,856)	(5.08)	85	100	--	--
Shorter, .75% Spread	1.36	3.53	17.62	132,253	9.39	93	104	—	—
<u>Selling Assets</u> (Rather than borrowing) ⁵	1.43	4.80	2.83	107,273	59.06	89	103	—	—

1. Present value of statutory book profits after provision for federal income tax with a 12% discount rate.
2. Present value of statutory book profits divided by present value of premiums, with both values discounted at 12%.
3. Surplus based on assets valued at their market value.
4. Ratio of the market value of assets to the book value of assets.

**CASE STUDY - SECTION ON STATEMENT OF ACTUARIAL OPINION
STATUTORY ANNUAL STATEMENT OF THE
MISMATCH LIFE INSURANCE COMPANY
FOR THE YEAR ENDED DECEMBER 31, 1987**

I, Ernie D. Spread, am Vice President and Actuary for Mismatch Life Insurance Company in the state of Domicile, and am a member of the American Academy of Actuaries and meet its qualifications to act as Valuation Actuary.

I have examined the actuarial assumptions and actuarial methods used in determining policy reserves and related actuarial items, as listed below, as shown in the Annual Statement of the Company, as prepared for filing with state regulatory officials, as of December 31, 1987.

(i)	Aggregate Reserve for Life Policies and Contracts (Exhibit 8)	\$109,300
(ii)	Aggregate Reserve for Accident and Health Policies (Exhibit 9)	0
(iii)	Net Deferred and Uncollected Premiums (Page 2, Line 17)	0
(iv)	Policy and Contract Claims - Liability End of Current Year Incurred but Unreported (Exhibit 11, Part 1, Line 3)	0

I have considered the provisions of the Company's in-force policies and the related administrative expenses. I have considered any reinsurance agreements pertaining to the policies, the characteristics of the Company's assets, and the investment policy adopted by the Company as they might affect future insurance and investment cash flows under the policies and invested assets. My

examination included such tests and calculations as I considered necessary to form the opinion stated below.

The cash flow tests were conducted on a going-concern basis under consistent sets of assumptions with reasonable margins for adverse deviations for certain paths of future interest rates. Particular attention was given to those provisions and characteristics that might cause future insurance and investment cash flows to vary with changes in the level of prevailing interest rates.

In other respects, my examination included such review of the actuarial assumptions and methods, as well as such tests of the actuarial calculations, as I considered necessary under the circumstances.

In making my examination, I have relied upon listings and summaries of policies in-force and other associated data prepared by E. Z. Earnings, Controller. I relied on the stated investment policy of the Company, including listings and summaries of assets, as provided by Max M. Yield, Chief Investment Officer of the Company. I performed no verification as to the accuracy of these data.

In my opinion, as of December 31, 1987:

1. The policy reserves and other actuarial items shown herein
 - (i) are computed in accordance with commonly accepted actuarial standards consistently applied and are fairly stated in accordance with sound actuarial principles.

**CASE STUDY: STATEMENT OF ACTUARIAL OPINION
(Continued)**

- (ii) are based on actuarial assumptions which produce reserves at least as great as those called for in any policy or contract provision as to reserve basis and method and are in accordance with all other policy or contract provisions.
 - (iii) meet the requirements of the insurance laws of the State of Domicile.
 - (iv) are computed on the basis of assumptions consistent with those used in computing the corresponding items in the Annual Statement of the Mismatch Life Insurance Company for the year ending December 31, 1986.
 - (v) include provision for all actuarial reserves and related actuarial statement items which ought to be established.
2. The anticipated investment cash flows arising from an allocation of assets equal to reserves and other liabilities, plus anticipated considerations to be received from the in-force policies make appropriate provision, according to presently accepted actuarial standards of practice, for the anticipated cash flows required by contractual obligations and the related expenses of the Company.

This opinion is updated annually as required by statute. The impact of unanticipated events subsequent to the date of this opinion is beyond the scope of this opinion. The cash flow portion of this opinion should be viewed recognizing that the Company's future experience will not exactly follow all the assumptions used in the cash flow projections.

Ernie D. Spread, M.A.A.A.

CASE STUDY: ACTUARIAL REPORT TO MANAGEMENT

I, Ernie D. Spread, am Vice President and Chief Actuary for Mismatch Life Insurance Company. This report presents the actuarial assumptions and methods employed, the scope of work, and a summary of results of tests performed in connection with the statement of actuarial opinion regarding the statutory annual statement of the Mismatch Life Insurance Company for the year ended December 31, 1987.

Details of the calculations are available for examination.

Ernie D. Spread, M.A.A.A.

(Only a subreport on universal life is presented here. If Mismatch Life had other blocks of business, additional subreports would be made. Also, the results of the various blocks of business would be combined. For example, the internally designated surplus required for universal life under a given scenario might be offset by sufficiencies in other blocks of business under the same

**CASE STUDY: ACTUARIAL REPORT TO MANAGEMENT
(Continued)**

scenario. Also, any comments on going-concern problems or continuance of stockholder dividends would be covered on a combined company basis.

This report covers a simple block of business and simple assets. The assumptions and approaches would not necessarily be appropriate for more complex situations.)

CASE STUDY (CONTINUED)

SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE

December 31, 1987

CONTRACT PROVISIONS

Mismatch Life Insurance Company offers nonparticipating universal life contracts. The terms of the contracts issued prior to, and in-force on, December 31, 1987 are described below.

Policy Form UL-1983-87

The policy is a flexible premium universal life policy maturing at age 95. Expense loads are 6 percent of premiums plus \$36 per policy each year. Guaranteed cost of insurance rates are based on 1958 CSO mortality, but lower rates are currently being charged. Guaranteed credited interest is 4 percent, and excess interest may be credited. The current credited-interest rate is 10.75 percent. Surrender charges are applicable to cash surrenders during the first fourteen policy years and equal 100 percent of target premium (for example, \$8.00 per \$1,000 at issue age 35) for years 1-5, grading linearly to zero in year 15. Current mortality and interest rates are not guaranteed beyond the current policy month.

POLICIES IN-FORCE

The in-force and reserves as of December 31, 1987, as shown in Exhibit 8 of the Annual Statement of the company, are stated as follows:

**CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)**

<u>Policy Form Number</u>	<u>Issue Year</u>	<u>Face Amount (000's)</u>	<u>Reserves</u>
UL-1983-87	1983	\$ 95	\$ 26,911
	1984	142	29,691
	1985	194	27,306
	1986	252	19,245
	1987	317	6,147
All Other		0	0
TOTAL		\$1,000	\$ 109,300

Reserves are equal to the cash surrender values. In all cases these exceed the CRVM reserves calculated according to the Universal Life Model Regulation. For these figures, I relied upon listings and summaries of policies in-force prepared by E. Z. Earnings, Controller. I reviewed the results for reasonableness but performed no verification as to the accuracy of these data.

ASSETS

For the purposes of cash flow projections, invested assets of \$109,300 were allocated to support universal life reserves as of December 31, 1987. A listing of these assets was provided by Max M. Yield, Chief Investment Officer. This listing includes par value, coupon and maturity date for each security, as well as the book and market values assigned to the security.

I did not verify the calculation of these values or the records of securities held which formed the basis for these calculations. This listing provided the basis for the projections of investment income and asset maturities. The assets are summarized in the following tables.

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

	<u>90-Day Account</u>	<u>3-Year Bond</u>	<u>10-Year Bond</u>	<u>Total</u>
Yield Rate	8.50%	11.00%	12.20%	12.00%
Book Value	\$ 2,186	\$10,930	\$96,184	\$109,300
Market Value	2,186	10,930	96,184	109,300
Maturity Date	4/1/88	1/1/91	1/1/98	

PROJECTION OF INSURANCE CASH FLOWS

A model projection was prepared of the universal life contracts in-force as of December 31, 1987. A description of the policies and of the assumptions used for projections is given in Exhibit 3. The initial model reserves, premiums and face amounts were validated to actual values. The projection values were used to derive plan characteristics for a single policy which duplicated the model results. This single policy was used to project insurance cash flows under various scenarios. While the characteristics of this single policy would not necessarily generate the same values as the aggregate of all the policies in the cell for different projections, in my opinion, the differences are not material.

The projection of insurance cash flows took into account projected excess interest credits, policy terminations from death and surrenders, and maintenance expenses and commissions. It was assumed that level target premiums were received from all in-force policies.

Projected excess interest credits were determined based upon current company practice. The credited rate in each projection quarter is set as the portfolio average earnings rate for the previous quarter less 125 basis points, but not more than 100 basis points different than the "competition rate" (defined as the larger of the three-year rolling average of three-year bond yields less 50 basis points, or the current three-year bond yield less 200 basis points).

Policy terminations from death were projected using the Company's current assumptions for product pricing, increased by 5 percent as a margin to cover reasonable deviations from expected assumptions. No future improvement of mortality was assumed.

Policy surrenders in each projection quarter were a function of the assumed competition rate and the credited rate for that quarter. The lapse rates include a 2 percent margin over expected lapse rates to cover reasonable deviations. It was assumed that the total lapse rate would never exceed 30 percent per year. It is expected that surrender charges would favorably affect lapse rates in the early projection years, but the effect would not have been significant in the projections performed. Note that the Company's current credit-interest rate procedures result in little deviation from standard lapse rates, because the difference between credited-interest rates and competitive interest rates is not permitted to exceed 100 basis points.

Premiums were assumed to be paid quarterly. Level target premiums were assumed to be paid on all in-force policies. Policy loans and partial withdrawals are insignificant and assumed to be zero.

Maintenance expenses of \$37 per policy in-force were assumed. This is \$2 per policy higher than used in product pricing as a reasonable margin for adverse deviation. Maintenance expenses were assumed to inflate at a rate equal to the current three-year bond yield less 5 percent. Percentage of premium expenses were 5 percent for commissions and 2 percent for premium tax.

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

Federal income taxes were assumed payable on gains from operations at a rate of 36.8 percent. Credit was given for negative taxes.

PROJECTION OF INVESTMENT CASH FLOWS

The timing and amounts of coupon income and maturities were projected for the securities held on December 31, 1987 in support of the universal life reserves. It was assumed that these securities would be held until maturity or call. In the event of any negative cash flows, funds were assumed to be borrowed at the current ninety-day rate plus 2 percent.

Investment cash flows, combined with the insurance cash flows, are used first to pay interest on borrowed funds and then to pay off any short-term borrowed balances outstanding. Any net positive cash flow is invested each quarter at the new-money interest rate in order to maintain the following desired mix of in-force assets (in order of priority).

<u>Asset</u>	<u>% Total</u>
90-Day	2%
3-Year Bond	10
10-Year Bond	88

In the projection where market interest rates were less than average coupon rates on the 10-year bonds by more than 150 basis points, it was assumed that a portion of the bonds would be called. A 3 percent premium was recognized. When a call occurred, it was applied on a pro-rata basis to every 10-year bond. It was assumed that no calls occurred until 1993. In 1993 and beyond, the rates of call for various interest differentials are as follows:

<u>Interest Differential</u>	<u>Rate</u>
1.50%	0.0%
2.00	5.7
2.50	11.5
3.00	17.3
3.50	23.3
4.00	29.4

Federal income taxes were assumed payable on investment income at a rate of 36.8 percent.

NEW MONEY INTEREST SCENARIOS

Projections of insurance and investment cash flows were made under several new-money interest scenarios. Two sets of scenarios were tested. The first set was chosen as representative of the extreme paths that interest rates could reasonably be expected to follow. These interest-rate scenarios were promulgated by the NAIC's Interest Rate Scenario Committee as the minimum basis for determining adequacy of reserves for 1987 annual statements.

The second set of interest rates was chosen as representative of the extreme paths that interest rates could plausibly be expected to follow. The relationships of these scenarios to the reasonable scenarios are similar to those used in a paper distributed last year by the Society of Actuaries' Committee on Valuation and Related Problems titled "An Analysis of Reasonable/Plausible Interest Scenarios." These interest-rate scenarios are used for determining whether the company should internally designate surplus so that combined reserves and surplus are adequate to provide sufficient cash flows.

**CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)**

The various scenarios are intended to generate an understanding of the dynamics relating the insurance and investment cash flows.

Details of the interest-rate paths are shown in Exhibits 4.C.5 and 4.C.6.

METHODOLOGY FOR EVALUATING SUFFICIENCY OF RESERVES

Total cash flows, including both insurance and investment cash flows, and allowing for reinvestment of net positive cash flows and borrowing to cover net negative cash flows, were projected to the end of a twenty-year period. The market value of assets, based on the assumption that interest rates after such date would be frozen at the prevailing rate on that date, was then compared to policy reserves. If the market value of assets, less debt, exceeds reserves, then the cash flows would be deemed appropriate to meet the contractual obligations on that interest-rate path. If the reserves exceed the market value of assets, less debt, at the end of the projection period, then the cash flows would be deemed to be not appropriate on that path.

RESULTS OF PROJECTIONS

The results of the projections at the beginning and end of the projection period for all the reasonable interest-rate scenarios are summarized:

	<u>Market Value of Assets</u>	<u>Reserves</u>
December 31, 1987	\$ 109,300	\$ 109,300
December 31, 2007		
Level	969,003	751,907
Cyclical Up 2%	1,445,927	1,362,248
Slow Up and Level	1,939,817	1,763,068
Slow Down and Level	594,757	427,162
Cyclical Down	623,020	460,218

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

EXHIBIT 4.C.5

MISMATCH LIFE INSURANCE COMPANY - UNIVERSAL LIFE
Reasonable Scenarios

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
			<u>Level</u>				
1	8.5%	11.0%	12.2%	12.7%	\$ 109	\$ 0	\$ 0
2	8.5	11.0	12.2	12.7	170	3	4
3	8.5	11.0	12.2	12.7	221	7	9
4	8.5	11.0	12.2	12.7	271	10	15
5	8.5	11.0	12.2	12.7	319	14	20
6	8.5	11.0	12.2	12.7	365	17	26
7	8.5	11.0	12.2	12.7	409	21	31
8	8.5	11.0	12.2	12.7	450	26	38
9	8.5	11.0	12.2	12.7	488	31	45
10	8.5	11.0	12.2	12.7	523	37	52
11	8.5	11.0	12.2	12.7	555	45	59
12	8.5	11.0	12.2	12.7	584	55	70
13	8.5	11.0	12.2	12.7	611	65	81
14	8.5	11.0	12.2	12.7	635	77	94
15	8.5	11.0	12.2	12.7	656	90	109
16	8.5	11.0	12.2	12.7	675	105	124
17	8.5	11.0	12.2	12.7	693	121	142
18	8.5	11.0	12.2	12.7	709	137	160
19	8.5	11.0	12.2	12.7	725	155	178
20	8.5	11.0	12.2	12.7	739	174	199
21	8.5	11.0	12.2	12.7	752	194	217
			<u>Slow Up and Level</u>				
1	8.5	11.0	12.2	12.7	109	0	0
2	9.4	12.0	13.2	13.6	170	3	(7)
3	10.3	13.0	14.2	14.4	222	7	(3)
4	11.2	14.0	15.1	15.3	272	11	(6)
5	12.2	15.0	16.1	16.1	321	14	(9)
6	13.1	16.0	16.8	16.8	369	17	(13)
7	14.3	17.0	17.5	17.5	418	18	(19)
8	15.5	18.0	18.2	18.2	468	19	(25)
9	16.7	19.0	18.8	18.6	522	18	(34)
10	21.6	20.0	19.2	18.8	580	15	(45)

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

EXHIBIT 4.C.5
(Continued)

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
<u>Slow Up and Level</u> (Continued)							
11	17.6%	20.0%	19.8%	19.6%	\$ 643	\$ 12	\$ (34)
12	15.4	20.0	22.2	23.0	711	11	(40)
13	15.4	20.0	22.2	23.0	785	12	(30)
14	15.4	20.0	22.2	23.0	862	17	(11)
15	15.4	20.0	22.2	23.0	944	26	11
16	15.4	20.0	22.2	23.0	1,039	37	33
17	15.4	20.0	22.2	23.0	1,153	49	58
18	15.4	20.0	22.2	23.0	1,282	63	83
19	15.4	20.0	22.2	23.0	1,427	79	110
20	15.4	20.0	22.2	23.0	1,587	97	141
21	15.4	20.0	22.2	23.0	1,763	120	177
<u>Cyclical Up 2%</u>							
1	8.5	11.0	12.2	12.7	109	0	0
2	10.0	13.0	14.4	15.0	170	3	(6)
3	13.2	15.0	14.9	14.7	222	7	(9)
4	18.4	17.0	16.3	16.0	273	9	(18)
5	13.2	15.0	14.9	14.7	325	10	(7)
6	10.0	13.0	14.4	15.0	377	10	10
7	11.6	15.0	16.7	17.3	426	11	(4)
8	15.0	17.0	16.8	16.7	471	13	(18)
9	20.5	19.0	18.2	17.9	520	13	(38)
10	15.0	17.0	16.8	16.7	573	11	(24)
11	11.6	15.0	16.7	17.3	628	9	9
12	13.1	17.0	18.9	19.6	679	12	(5)
13	16.7	19.0	18.8	18.6	730	19	(19)
14	22.7	21.0	20.2	19.7	789	22	(43)
15	16.7	19.0	18.8	18.6	857	25	(13)
16	13.1	17.0	18.9	19.6	931	27	29
17	16.7	19.0	18.8	18.6	1,007	33	25
18	22.7	21.0	20.2	19.7	1,083	42	(11)
19	16.7	19.0	18.8	18.6	1,170	50	28
20	13.1	17.0	18.9	19.6	1,266	57	88
21	16.7	19.0	18.8	18.6	1,362	69	84

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

EXHIBIT 4.C.5
(Continued)

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
<u>Slow Down and Level</u>							
1	8.5%	11.0%	12.2%	12.7%	\$ 109	\$ 0	\$ 0
2	8.1	10.5	11.7	12.1	170	3	7
3	7.7	10.0	11.1	11.5	221	6	17
4	7.3	9.5	10.5	10.9	270	10	28
5	6.9	9.0	10.0	10.4	316	14	39
6	6.5	8.5	9.4	9.8	360	17	51
7	6.2	8.0	8.9	9.2	399	21	60
8	5.8	7.5	8.3	8.6	434	26	71
9	5.4	7.0	7.8	8.1	463	32	82
10	5.0	6.5	7.2	7.5	487	39	93
11	4.6	6.0	6.7	6.9	503	47	96
12	4.6	6.0	6.7	6.9	512	56	101
13	4.6	6.0	6.7	6.9	517	65	102
14	4.6	6.0	6.7	6.9	516	75	107
15	4.6	6.0	6.7	6.9	511	86	114
16	4.6	6.0	6.7	6.9	502	97	122
17	4.6	6.0	6.7	6.9	491	109	130
18	4.6	6.0	6.7	6.9	478	121	138
19	4.6	6.0	6.7	6.9	463	133	147
20	4.6	6.0	6.7	6.9	446	145	157
21	4.6	6.0	6.7	6.9	427	158	168
<u>Cyclical Down</u>							
1	8.5	11.0	12.2	12.7	109	0	0
2	7.7	10.0	11.1	11.5	170	3	10
3	6.9	9.0	10.0	10.4	221	6	24
4	6.2	8.0	8.9	9.2	269	10	41
5	8.1	9.0	9.3	9.4	313	14	41
6	10.8	10.0	9.6	9.4	355	17	33
7	8.1	9.0	9.3	9.4	394	20	41
8	6.2	8.0	8.9	9.2	428	25	57
9	5.4	7.0	7.8	8.1	458	31	8
10	7.2	8.0	8.2	8.3	482	37	72

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

EXHIBIT 4.C.5
(Continued)

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
	<u>Cyclical Down</u> (Continued)						
11	9.7%	9.0%	8.6%	8.5%	\$ 501	\$ 44	\$ 53
12	7.2	8.0	8.2	8.3	514	53	65
13	5.4	7.0	7.8	8.1	522	61	87
14	4.6	6.0	6.7	6.9	524	71	116
15	6.3	7.0	7.2	7.3	523	83	114
16	8.6	8.0	7.7	7.5	518	95	102
17	6.3	7.0	7.2	7.3	511	107	122
18	4.6	6.0	6.7	6.9	501	119	149
19	6.3	7.0	7.2	7.3	490	132	149
20	8.6	8.0	7.7	7.5	476	145	142
21	6.3	7.0	6.7	7.3	460	158	163

**CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)**

EXHIBIT 4.C.6

**MISMATCH LIFE INSURANCE COMPANY - UNIVERSAL LIFE
Plausible Scenarios**

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
<u>Fast Up and Level</u>							
1	8.5%	11.0%	12.2%	12.7%	\$ 109	\$ 0	\$ 0
2	10.0	13.0	14.4	15.0	170	3	(6)
3	15.0	17.0	16.8	16.7	222	6	(20)
4	21.6	20.0	19.2	18.8	278	5	(39)
5	17.6	20.0	19.8	19.6	339	2	(48)
6	15.4	20.0	22.2	23.0	403	(2)	(59)
7	15.4	20.0	22.2	23.0	472	(9)	(63)
8	15.4	20.0	22.2	23.0	543	(15)	(62)
9	15.4	20.0	22.2	23.0	616	(21)	(62)
10	15.4	20.0	22.2	23.0	692	(26)	(61)
11	15.4	20.0	22.2	23.0	771	(29)	(41)
12	15.4	20.0	22.2	23.0	861	(27)	(23)
13	15.4	20.0	22.2	23.0	969	(24)	(8)
14	15.4	20.0	22.2	23.0	1,090	(21)	7
15	15.4	20.0	22.2	23.0	1,224	(16)	20
16	15.4	20.0	22.2	23.0	1,373	(10)	33
17	15.4	20.0	22.2	23.0	1,540	(4)	46
18	15.4	20.0	22.2	23.0	1,723	4	62
19	15.4	20.0	22.2	23.0	1,923	14	81
20	15.4	20.0	22.2	23.0	2,142	27	103
21	15.4	20.0	22.2	23.0	2,379	43	124
<u>Further Up and Level</u>							
1	8.5	11.0	12.2	12.7	109	0	0
2	11.6	15.0	16.7	17.3	171	3	(15)
3	16.7	19.0	18.8	18.6	224	5	(30)
4	25.9	24.0	23.0	22.6	286	1	(58)
5	21.1	24.0	23.8	23.5	359	(7)	(74)
6	18.5	24.0	26.6	27.6	437	(16)	(90)
7	18.5	24.0	26.6	27.6	525	(28)	(100)
8	18.5	24.0	26.6	27.6	620	(42)	(106)
9	18.5	24.0	26.6	27.6	724	(55)	(112)
10	18.5	24.0	26.6	27.6	836	(69)	(119)

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

EXHIBIT 4.C.6
(Continued)

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
<u>Further Up and Level</u> (Continued)							
11	18.5%	24.0%	26.6%	27.6%	\$ 960	\$ (82)	\$ (98)
12	18.5	24.0	26.6	27.6	1,107	(87)	(82)
13	18.5	24.0	26.6	27.6	1,288	(95)	(73)
14	18.5	24.0	26.6	27.6	1,498	(103)	(66)
15	18.5	24.0	26.6	27.6	1,742	(112)	(62)
16	18.5	24.0	26.6	27.6	2,020	(119)	(58)
17	18.5	24.0	26.6	27.6	2,335	(126)	(53)
18	18.5	24.0	26.6	27.6	2,693	(132)	(46)
19	18.5	24.0	26.6	27.6	3,099	(137)	(35)
20	18.5	24.0	26.6	27.6	3,559	(139)	(19)
21	18.5	24.0	26.6	27.6	4,080	(138)	(5)
<u>Cyclical Up 2.5%</u>							
1	8.5	11.0	12.2	12.7	109	0	0
2	10.4	13.5	15.0	15.5	170	3	(8)
3	14.1	16.0	15.8	15.7	222	6	(14)
4	20.0	18.5	17.8	17.4	275	7	(28)
5	14.1	16.0	15.8	15.7	330	7	(15)
6	10.4	13.5	15.0	15.5	386	6	5
7	12.3	16.0	17.8	18.4	439	5	(14)
8	16.3	18.5	18.3	18.1	489	6	(34)
9	22.7	21.0	20.2	19.7	547	3	(63)
10	16.3	18.5	18.3	18.1	611	(4)	(49)
11	12.3	16.0	17.8	18.4	677	(9)	(10)
12	14.2	18.5	20.5	21.3	742	(9)	(31)
13	18.5	21.0	20.8	20.6	806	(6)	(56)
14	25.4	23.5	22.6	22.1	887	(9)	(94)
15	18.5	21.0	20.8	20.6	982	(14)	(65)
16	14.2	18.5	20.5	21.3	1,086	(19)	(15)
17	18.5	21.0	20.8	20.6	1,195	(21)	(34)
18	25.4	23.5	22.6	22.1	1,309	(21)	(94)
19	18.5	21.0	20.8	20.6	1,442	(23)	(53)
20	14.2	18.5	20.5	21.3	1,585	(26)	20
21	18.5	21.0	20.8	20.6	1,731	(23)	(4)

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

EXHIBIT 4.C.6
(Continued)

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
<u>Fast Down and Level</u>							
1	8.5%	11.0%	12.2%	12.7%	\$ 109	\$ 0	\$ 0
2	6.9	9.0	10.0	10.4	170	3	16
3	6.2	8.0	8.9	9.2	220	6	33
4	4.6	6.0	6.7	6.9	267	10	61
5	4.6	6.0	6.7	6.9	309	14	71
6	4.6	6.0	6.7	6.9	345	19	73
7	4.6	6.0	6.7	6.9	375	25	70
8	4.6	6.0	6.7	6.9	400	31	72
9	4.6	6.0	6.7	6.9	421	37	75
10	4.6	6.0	6.7	6.9	438	44	78
11	4.6	6.0	6.7	6.9	450	51	71
12	4.6	6.0	6.7	6.9	454	59	73
13	4.6	6.0	6.7	6.9	455	67	78
14	4.6	6.0	6.7	6.9	450	76	86
15	4.6	6.0	6.7	6.9	443	87	97
16	4.6	6.0	6.7	6.9	432	98	108
17	4.6	6.0	6.7	6.9	420	110	120
18	4.6	6.0	6.7	6.9	406	121	131
19	4.6	6.0	6.7	6.9	391	133	142
20	4.6	6.0	6.7	6.9	375	145	154
21	4.6	6.0	6.7	6.9	356	157	166
<u>Cycle About 11% - A</u>							
1	8.5	11.0	12.2	12.7	109	0	0
2	10.0	13.0	14.4	15.0	170	3	(6)
3	13.2	15.0	14.9	14.7	222	7	(9)
4	18.4	17.0	16.3	16.0	273	9	(18)
5	13.2	15.0	14.9	14.7	325	10	(7)
6	10.0	13.0	14.4	15.0	377	10	10
7	8.5	11.0	12.2	12.7	425	11	39
8	6.9	9.0	10.0	10.4	468	16	73
9	5.4	7.0	7.8	8.1	507	22	105
10	3.9	5.0	5.6	5.8	536	29	135

CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)

EXHIBIT 4.C.6
(Continued)

<u>Beginning Of Year</u>	<u>Interest-Rate Scenarios</u>				<u>Summary of Results (000's)</u>		
	<u>90-Day</u>	<u>3-Year</u>	<u>10-Year</u>	<u>20-Year</u>	<u>Reserves</u>	<u>Book Surplus</u>	<u>Market Surplus</u>
<u>Cycle About 11% - A</u> (Continued)							
11	5.4%	7.0%	7.8%	8.1%	\$ 552	\$ 37	\$ 85
12	6.9	9.0	10.0	10.4	561	45	31
13	8.5	11.0	12.2	12.7	566	52	(8)
14	10.0	13.0	14.4	15.0	571	56	(36)
15	13.2	15.0	14.9	14.7	583	54	(56)
16	18.4	17.0	16.3	16.0	604	47	(78)
17	13.2	15.0	14.9	14.7	629	37	(60)
18	10.0	13.0	14.4	15.0	656	25	(36)
19	8.5	11.0	12.2	12.7	680	15	(12)
20	6.9	9.0	10.0	10.4	694	13	44
21	5.4	7.0	7.8	8.1	698	22	127
<u>Cycle About 11% - B</u>							
1	8.5	11.0	12.2	12.7	109	0	0
2	6.9	9.0	10.0	10.4	170	3	16
3	5.4	7.0	7.8	8.1	220	6	42
4	3.9	5.0	5.6	5.8	267	10	74
5	5.4	7.0	7.8	8.1	307	14	58
6	6.9	9.0	10.0	10.4	343	19	29
7	8.5	11.0	12.2	12.7	377	23	6
8	10.0	13.0	14.4	15.0	407	26	(12)
9	13.2	15.0	14.9	14.7	438	27	(26)
10	18.4	17.0	16.3	16.0	475	24	(43)
11	13.2	15.0	14.9	14.7	513	20	(29)
12	10.0	13.0	14.4	15.0	550	18	(11)
13	8.5	11.0	12.2	12.7	584	18	32
14	6.9	9.0	10.0	10.4	606	25	92
15	5.4	7.0	7.8	8.1	627	37	144
16	3.9	5.0	5.6	5.8	638	49	185
17	5.4	7.0	7.8	8.1	637	61	128
18	6.9	9.0	10.0	10.4	632	72	68
19	8.5	11.0	12.2	12.7	625	83	29
20	10.0	13.0	14.4	15.0	618	89	3
21	13.2	15.0	14.9	14.7	620	89	(19)

**CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)**

Under all interest rate paths tested, the market value of assets at the end of the projection period, less the debt outstanding at that time, was found to be in excess of the policy reserves.

The results of the projections at the beginning and end of the projection period for the plausible interest-rate scenarios are summarized:

	<u>Market Value of Assets</u>	<u>Reserves</u>	<u>Additional Internally Designated Surplus Required</u>
December 31, 1987	\$ 109,300	\$ 109,300	
December 31, 2007			
Cyclical Up 2.5%	1,726,683	1,731,175	\$ 633
Fast Up & Level	2,503,184	2,379,247	None
Further Up & Level	4,075,038	4,080,196	447
Fast Down & Level	522,194	356,454	None
Cycle About 11%-A	825,265	697,983	None
Cycle About 11%-B	601,301	620,037	5,851

Three of the scenarios indicated that the market value of assets at the end of the projection period, less the debt outstanding at the time, is less than the policy reserves. The above data also include the amounts of additional internally designated surplus at December 31, 1987 necessary to provide sufficient cash flows to have the market value of assets match the policy reserves at the end of the projection period. The maximum amount needed is \$5,851, or 5.4 percent of the reserves as of December 31, 1987.

Details of the projection results are shown in Exhibits 1 and 2. Note that some of the plausible interest-rate scenarios indicate a negative statutory book value surplus position as early as 1992. Comments about the effect of these scenarios

on the ability of the company to continue as a going concern over the next five through ten years are included in the combined company report.

SUMMARY AND LIMITATIONS

The universal life business is subject to cash flow matching risks in increasing interest-rate environments, both steady increases and increases during the upside portions of interest cycles. When interest rates rise, the portfolio earnings rate will not rise as quickly as competitors' credited-interest rates, and earned rates will not support the credited rates. If credited rates are kept less than market rates to maintain the interest earnings, surrenders may increase forcing the company to borrow or liquidate assets during periods of high interest rates. This is known as market-value risk. When interest rates decline, high-yielding assets may be called, leading to increased investment activity during periods of low interest rates. This is known as reinvestment risk.

The exposure to market-value risk is determined primarily by the interest-crediting strategy, the amount of policy surrenders and the maturity structure of the asset portfolio. The maturity structure of the portfolio and the interest credited to the product are controlled by Mismatch Life. If future investments have maturities different than assumed in these projections, or if the interest-crediting strategy is different than assumed in these projections, then the business would be exposed to market-value risks not anticipated in these projections.

The exposure to market-value risk also is determined primarily by the interest-crediting strategy, the amount of policy surrenders and the interest rate on

**CASE STUDY: SECTION ON ACTUARIAL REPORT FOR UNIVERSAL LIFE
(Continued)**

similar products being offered by competitors. These items cannot be controlled directly by the company. If future surrenders or competitors' interest rates are higher than those assumed in the projections, then the business would be exposed to market-value risks not anticipated in these projections.

In addition to investment risks, the business is exposed to several other risks. Product related risks include the level of death claims and maintenance expenses. Other risks are the risk of asset default and changes in federal income tax. To the extent that these items exceed the assumptions provided in the projections, the business could be exposed to risks not anticipated in these projections.

The opinion expressed as to the adequacy of the assets supporting universal life reserves is based on the projections of asset and liability cash flows described in this report. These are, in turn, based on a variety of future interest-rate assumptions. These future interest-rate assumptions, and the accompanying assumptions as to policy surrenders, represent the extremes to which, in my opinion, the business may be subjected. The opinion is stated in full in the accompanying statement of actuarial opinion.

EXHIBIT 4.C.7

MISMATCH LIFE INSURANCE COMPANY - UNIVERSAL LIFE
SUMMARY OF PRODUCT SPECIFICATIONS AND ASSUMPTIONS

Product Specifications

1. Plan: Policy Form UL-1983-87. Universal life with level net amount at risk.
2. Target Premiums: Used as basis for first-year commissions and surrender charges, annual premium per unit.

<u>Issue Age</u>	<u>Target Premium</u>
35	\$ 8.00

3. Expense Loads: 6 percent of premium, \$36 per policy all years, assessed monthly.
4. Surrender Charges: 100 percent of target premium years 1-5, decreasing 10 percent of target premium each year, to zero in year 15.
5. Cost of Insurance Charges: Guaranteed rates equal to 1958 CSO age last birthday. Current rates per \$1,000 as of 12/31/87:

<u>Attained Age</u>	<u>Annual Cost of Insurance</u>
35	\$ 2.26
40	3.31
45	4.35
50	7.13
55	9.74

6. Interest Crediting: 4% guaranteed. Current interest 10.75% at 12/31/87.

EXHIBIT 4.C.7
(Continued)

7. Current Interest-Crediting Strategy: Portfolio average earnings rate for previous quarter less 1.25%, not more than 1.00% different from competition rate. (Competition rate is larger of three-year rolling average of three-year bond yields less .5%, or current three-year bond yield less 2.00%.)
8. Investment Strategy: Positive net cash flow invested each quarter to maintain desired mix of in-force assets (in order of priority):

<u>Asset</u>	<u>% Total</u>
90-Day	2%
3-Year Bond	10
10-Year Bond	88

Assumptions

1. Model Plan: Issue age 35, male.
2. Premiums: Target premium paid each year in-force, 50% target premium paid in extra at issue as dump-in. Quarterly mode.
3. Withdrawals: No loans or partial withdrawals, except for lapse.
4. Lapse Rates: Base rates as follows:

Policy Year	1 - 20%
	2 - 14
	3 - 10
	4+ - 7

EXHIBIT 4.C.7
(Continued)

Addition to base rates due to competition rate (i') being higher than current rate (i) = $200 (i' - i)^2$, with no addition of less than .5% and with maximum lapse rate of 30%, for example:

<u>$i'-i$</u>	<u>Additional Lapse</u>
.50%	.5%
1.00	2.0
2.00	8.0
3.00	18.0

5. Mortality: A percentage of the 1965-70 Select & Ultimate, Male table, as follows: 105% in duration 1, graded uniformly to 80% durations 16 and later.

6. Expenses:

Maintenance:	\$37 per policy
Commissions:	5% premiums
Premium Tax:	2% premiums
Inflation:	Maintenance expense inflated at rate equal to three-year bond rate less 5%.

7. Federal Income Tax: 36.8% on statutory gain from operations.