

1985 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS

SESSION 7

TESTING FOR HOW MUCH SURPLUS

A COMPANY NEEDS TO COVER THE RISK IT ACCEPTS

MR. STANLEY B. TULIN: I am going to show you practical approaches using some fairly primitive illustrations. The valuation process, in order to be productive at the company level, has to involve teaching — actuaries, investment people, marketing people, management people — how the various parts of the business interact. In the spirit of a teaching session, we will try to develop some common agreement on both the problems and the solutions and also some understanding of what the valuation actuary has to do.

The first item of importance is to define reinvestment risk. This is probably easy to do now, reinvestment risk exists if assets are shorter than liabilities. Second, disintermediation risk exists if assets are longer than liabilities. "Long" and "short" are measured in terms of classic Macaulay duration. Most of us have learned, in the recent past, that interest-sensitive, and maybe some traditional, products have liability durations that shorten as interest rates rise, lengthen as interest rates decline. This is to say that people tend to cash-out when interest rates go down, which would tend to shorten the duration. When interest rates are going up, people tend to stick around if their guarantees, relative to the external market, are favorable. This leads us to the conclusion that classical immunization using duration matching techniques, the kind possible with a fixed liability stream, is not possible for interest-sensitive products. Now, how are we to go about analyzing the risks and understanding the problem?

The first thing the valuation actuary will have to do is collect data in a variety of different forms. Some of it is general and informal, of a conceptual nature, which he must acquire solely by talking to people in his company. Some of it is factual, which he must acquire by digging it out of a morass of facts and figures.

The second thing he will have to do is understand his company's investment strategy, for either a particular line or for the company as a whole. It is my personal belief that the valuation actuary's work is going to be performed on a companywide basis, or probably ought to be. However, for purposes of keeping the valuation process under control analytically, I have found it convenient to deal with blocks of business relating investment strategies to particular asset segments. Even that is not so easy to accomplish though, in today's environment. In years past, most of our industry worked with what I call the "passive" attitude that invested assets were bought and then thrown into a vault to be kept until maturity, that current cash flow would be adequate to fund payments to policyholders and that trading was inherently distasteful. In recent years, companies have taken on what I call an "active" investment management philosophy, one which now sometimes includes the use of options and futures markets. Today, managing a portfolio involves substantial trading, which has become an important element of investment, liability management as well as risk/reward control strategies.

Once investment strategies are related to assets, the actuary can consider the question of duration matching in the classical sense. Are the liabilities in a given block fixed? If not, is it feasible, by either assuming that interest rates remain constant or by using some kind of weighted average duration technique, to calculate the weighted average or real duration of an interest-sensitive

liability flow? Also, can duration matches be achieved using actual cash securities like bonds, or is it necessary to go to the futures market? This is only part of what the valuation actuary will have to understand about his company's investment philosophy.

Third, the valuation actuary needs to understand his company's reinvestment practices. Are there fixed reinvestment percentages? Are there rules? For instance, will all the cash be put into ten-year bonds, regardless of market activity? Or, will the company always put 50 percent of its cash into three-year bonds and 50 percent into seven-years bonds? Will the company try to use a synthetic option approach of an ongoing dynamic duration match?

The next step is building an asset model. This is where yield curves and scenarios become critical in the asset and liability analysis. Other asset information, important to the model, includes book values, market values, the relationship of the market and book values today and in the future, par values of the securities, the maturity dates, the coupon, and call/prepayment provisions. The call provisions are tricky, now that there is heavy investment in GNMA's and other securities with nonfixed maturity dates. These have become significant in understanding valuation risk. Finally, quality of the portfolio should be reflected in the model. Again, it is my personal opinion that actuaries should not be trying to assess that quality, but I do think it must be reflected in the valuation model in order to develop an opinion about solvency. A company with a required surplus of x , given a Treasury portfolio, has very different levels of risks than a company with a required surplus of y , given a Triple B portfolio. So reflecting the quality is important.

I'd now like to discuss scenario and yield curve development in a little more detail, using some simple illustrations. Exhibit 7-1 provides examples of highly simplified yield curves. Typically, those would involve many more securities. Basically, the purpose here is to summarize the viewpoints of management and other people on the short- and long-term markets. One thing about this is that peoples' views vary with time. So, what individuals consider today to be possible interest rates ten years from now may be very different than what they think within the next year or two.

At the time the simplified distribution of yield curves in Exhibit 7-1 was put together, yield curve 3 was thought to reflect the then current reality.

Today, reality is some place between yield curves 1 and 2. Now, though, this distribution allows an infinite variety of interest scenarios to be generated. One of the roles of the valuation actuary is to make sure management does not select positions from this variety that are beyond its means.

Exhibit 7-1 illustrates a position that starts out to be fairly balanced. Assuming you start in the middle, with yield curve 3, you have a 40 percent chance of ending the period right where you started, a 20 percent chance of moving either moderately up or moderately down in interest rates, and a 10 percent chance of moving to either extreme. The position can be made even more dynamic, but it is always keyed off of where you end, or where you begin, each period. This is consistent with Mr. Tilley's discussion of the lattice. The difference here is that there are more than two choices at each node. A probability distribution can be applied to the choices, which is helpful in communicating with managers about the bets they are thinking of making. Obviously, how the probabilities are set in

EXHIBIT 7-1

STRUCTURE OF YIELD CURVE INPUT

<u>YIELD CURVE</u>	<u>SHORT TERM</u>	<u>5-YEAR RATE</u>	<u>10-YEAR RATE</u>	<u>20-YEAR RATE</u>
1	6.85%	8.75%	8.83%	9.09%
2	8.63	10.20	10.40	10.60
3	10.75	12.15	12.25	12.35
4	12.40	13.42	13.46	13.50
5	16.33	16.13	16.01	15.95

STRUCTURE OF PROBABILITY INPUT

<u>ENDING YIELD CURVE</u>	<u>BEGINNING YIELD CURVE</u>				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
1	60%	30%	10%	--	--
2	25	40	20	10%	--
3	15	20	40	20	15%
4	--	10	20	40	25
5	--	--	10	30	60
	100%	100%	100%	100%	100%

this grid determines how volatile the model of the future is. Several different sets, or volatilities, should be examined.

On the liability side, I will talk about the credited rate, since the crediting strategy is a critical part of any valuation analysis. I will go as far as to say that the relationship between crediting strategy and investments is as important in the valuation process as is the relationship between investment strategy and the actual investments. In developing generic optimal models of investment strategy, the model that produces the best expected results (optimal), even for the same universe and the same probability grid, depends on the stated objectives over the liability management.

Four examples of such strategies are: "follow the market," which simply means that one always ties the credited rate to what the market is doing; hold the initial rate; follow the market only as it goes down; follow the market only as it goes up. A number of companies like to credit what they earn less some number of basis points. In other words, they will make their spread no matter what. Typically, if you try to model that situation, you find out that lapse rates vary all over the place.

The lapse rate is the next important liability cash flow feature I will discuss. In general it ought to vary with credited rates, surrender charges, market sophistication, agent sophistication and agent loyalty. The idea that lapse rates are a function of the credited rate and the external environment is, I think, a new idea. In conducting analyses of lapse rates ten years ago, they were rarely, if ever, compared to replacements. Today I think we're all highly sensitized to lapse behavior and to using different market strategies to control it. So choosing

the lapse model to incorporate into the liability model is a very important part of the valuation process.

Now Exhibit 7-2 provides an example of what can be called the "dynamic" withdrawal rate. This formula is probably no different from others presented at this symposium. What is important about it is that the lapse rate used to be viewed as a vector, and now we are going to view it as a matrix. It is critical to understand the sensitivity of results to the inherent risks and to the accuracy of assumptions. No one claims to know the right formula, but everyone has an idea. Typically if you talk to product people and marketing people (I've done a fair amount of this and found that it can be a worthwhile exercise in itself), you find out that they have a lot of insight.

Again, the essential elements that ought to go into the lapse rate model are the credited rate, the surrender charge and factors for the sophistication of the market, the sophistication of agents and the loyalty of agents.

A sample lapse rate formula (for an SPDA product, just as an example) is that the withdrawal rate would be 15 percent plus two times the difference between the market rate and the square of the credited rate (with those rates taken as percentages, a hundred times the actual rate), minus three times the surrender charge, but in no event allow the lapse rate to be less than 3 percent. That defines the market rate in both the A and B parts of Exhibit 7-2. So this is just an example of the kind of formula you could develop.

The bottom half of Exhibit 7-2 contains a sample of the rates this formula develops. What is clear is that if the market rate minus the credited rate is 500

EXHIBIT 7-2

SAMPLE DYNAMIC WITHDRAWAL ASSUMPTION

$$\begin{aligned} \text{WITHDRAWAL RATE} = & 15\% + 2 \cdot (\text{MARKET RATE} - \text{CREDITED RATE})^2 \\ & - 3 \cdot (\text{SURRENDER CHARGE}); \\ & \text{BUT NOT LESS THAN } 3\% \end{aligned}$$

WHERE "MARKET RATE" IS THE GREATEST OF:

(A) 1 TO 15 YEAR BOND RATE LESS 1.65%

OR

(B) SHORT-TERM RATE LESS 1.15%

SAMPLE RATES

<u>(MR - CR)</u>	<u>SC</u>	<u>WITHDRAWAL RATE</u>
-1.00%	7.0%	3%
1.00	7.0	3
3.00	7.0	12
5.00	7.0	44
-1.00%	0	13%
1.00	0	17
3.00	0	35
5.00	0	65

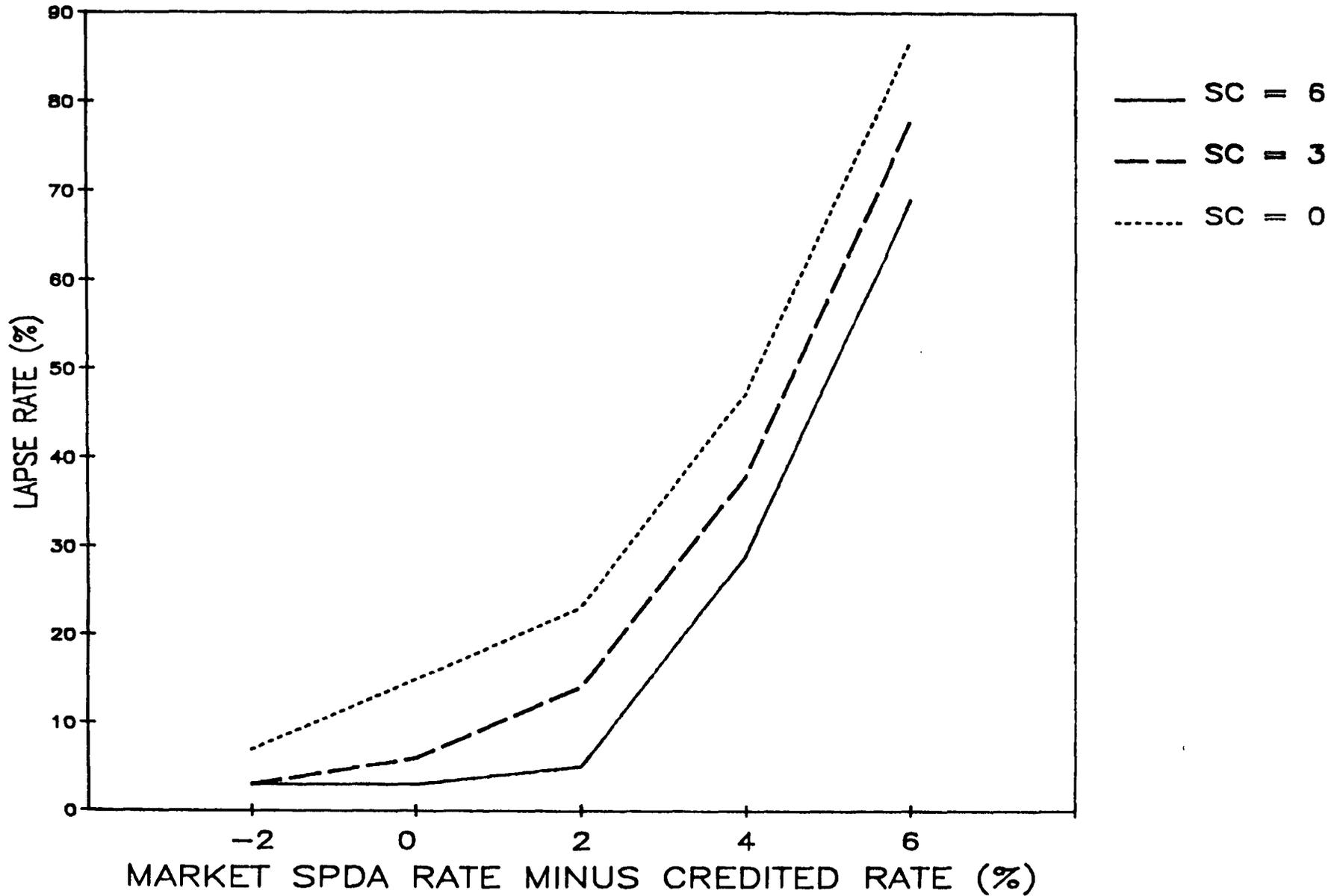
basis points, a 44 percent lapse rate results at the point of a 7 percent surrender charge. If the market rate minus the credited rate is 500 basis points, a 65 percent lapse rate results at the point of no surrender charge. Parenthetically, on one big block of annuity business I worked with several years ago, it was determined that lapse rate with a 500 basis point difference were in excess of 65 percent on an annualized basis. Fortunately, rates were changing fast enough that 65 percent rate was not suffered for a long period.

In Exhibit 7-3 is a graph of the impact on lapse rates from the surrender charge and the credited rate. This is again an SPDA case. The solid line represents surrender charges of 6 percent. The dashed line represents surrender charges of 3 percent. The dotted line represents surrender charges of 0 percent.

Another example, shown in Exhibit 7-4, is based on a case that I have been working on over the last couple months. It's disguised in some ways. It is based on \$700 million of SPDA liabilities. The definition of the credited rate basically describes this company's set of rules for credited-rate management. The lapse definition is given in the formula shown, which is a base rate plus two times the difference between market rate and the square of the credited rate. There is a cap on the lapse rate. Some premium income would be coming in. Surrender charges are policy oriented in the manner shown. The average policy face amount is \$8,000, with an expense of \$25 per policy. The commission is 4.2 percent, and no new issues are assumed.

The definition of the investment universe is given in Treasury yield curves, Exhibit 7-5, with the initial curve being yield curve 6. So, in this view of the universe, interest rates are bottoming out. Only five yield curves were chosen in

IMPACT OF SURRENDER CHARGE AND CREDITED RATE ON LAPSES



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EXHIBIT 7-4

ANNUITY ASSUMPTIONS

BEGINNING RESERVE	\$2.1 BILLION FPDA \$0.7 BILLION SPDA
CREDITED RATE	MARKET RATE; IF MR BELOW CR $11 + .5 \cdot (MR - 11)$; IF MARKET RATE GREATER THAN 11% MR = MARKET RATE CR = CREDITED RATE
LAPSES	GREATER OF 3% AND L $L = \text{BASE RATE} + 2x (MR - CR)^2$; BUT NOT GREATER THAN 35% BASE RATE VARIES BY POLICY YEAR
PREMIUM	INITIALLY \$180 MILLION PER YEAR
SURRENDER CHARGE	7, 6, 5, 4, 3, 2, 1, 0%
AVERAGE SIZE	\$8,000
EXPENSES	\$25 PER POLICY INFLATED 4% ANNUALLY
COMMISSION	4.2%
NEW ISSUES	NONE

EXHIBIT 7-5

TREASURY YIELD CURVES

BOND MATURITY

<u>CURVE NUMBER</u>	<u>SHORT TERM NUMBER</u>	<u>2-YEAR BOND NUMBER</u>	<u>5-YEAR BOND NUMBER</u>	<u>10-YEAR BOND NUMBER</u>	<u>20-YEAR BOND NUMBER</u>
1	4.40	5.20	5.95	6.10	6.00
6*	7.47	9.03	10.04	10.56	10.88
12	9.31	10.10	10.50	10.85	11.10
18	11.95	11.35	10.45	10.35	10.10
24	16.25	16.75	16.60	16.50	16.50
30	27.00	26.25	25.00	24.50	24.25

*INITIAL YIELD CURVE

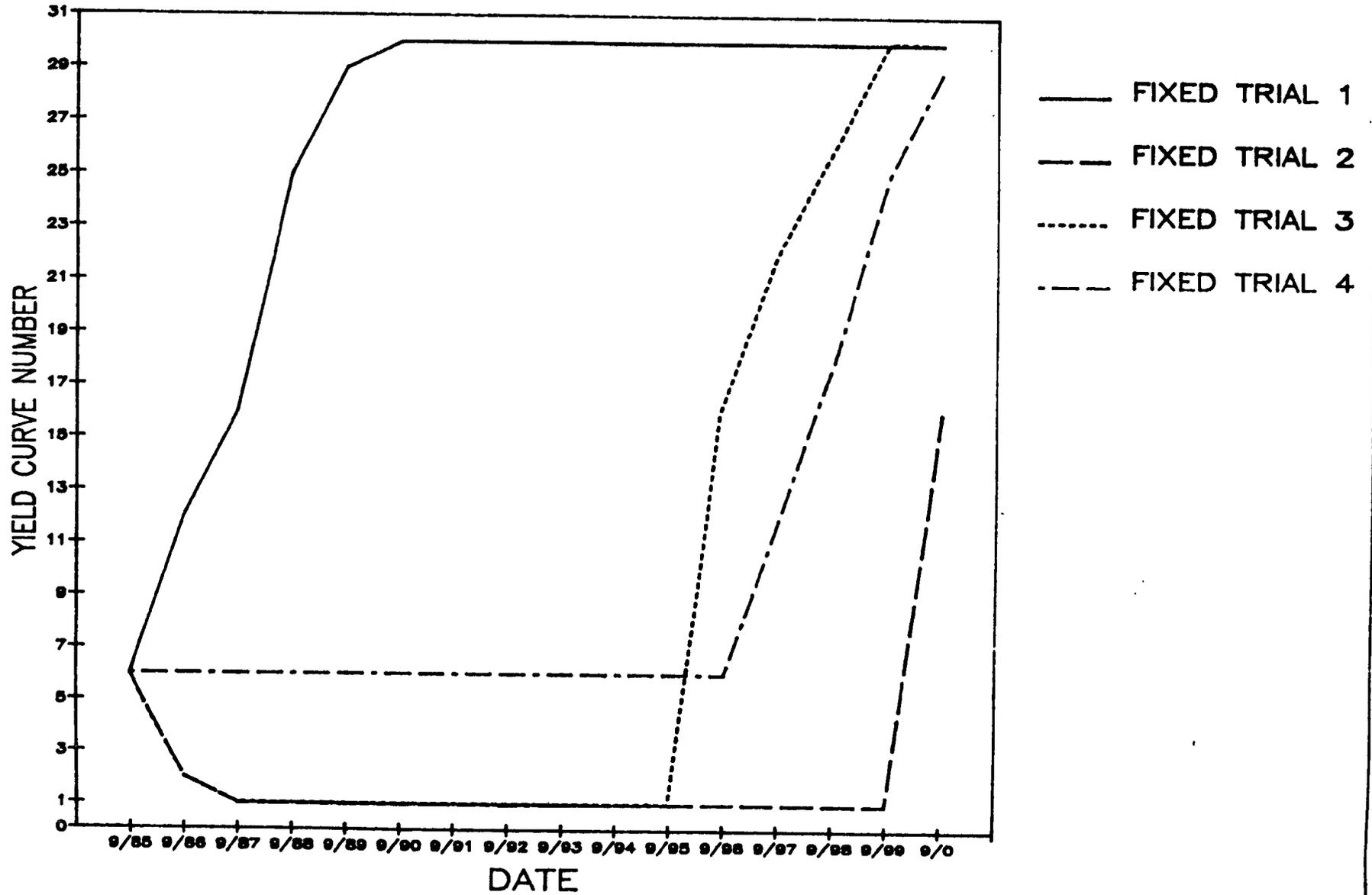
addition to today's. The example in Exhibit 7-6 shows that the user has picked four fixed trials, and what happens to interest rates during those. In other words, you see yield curves running from 1 all the way out to 30.

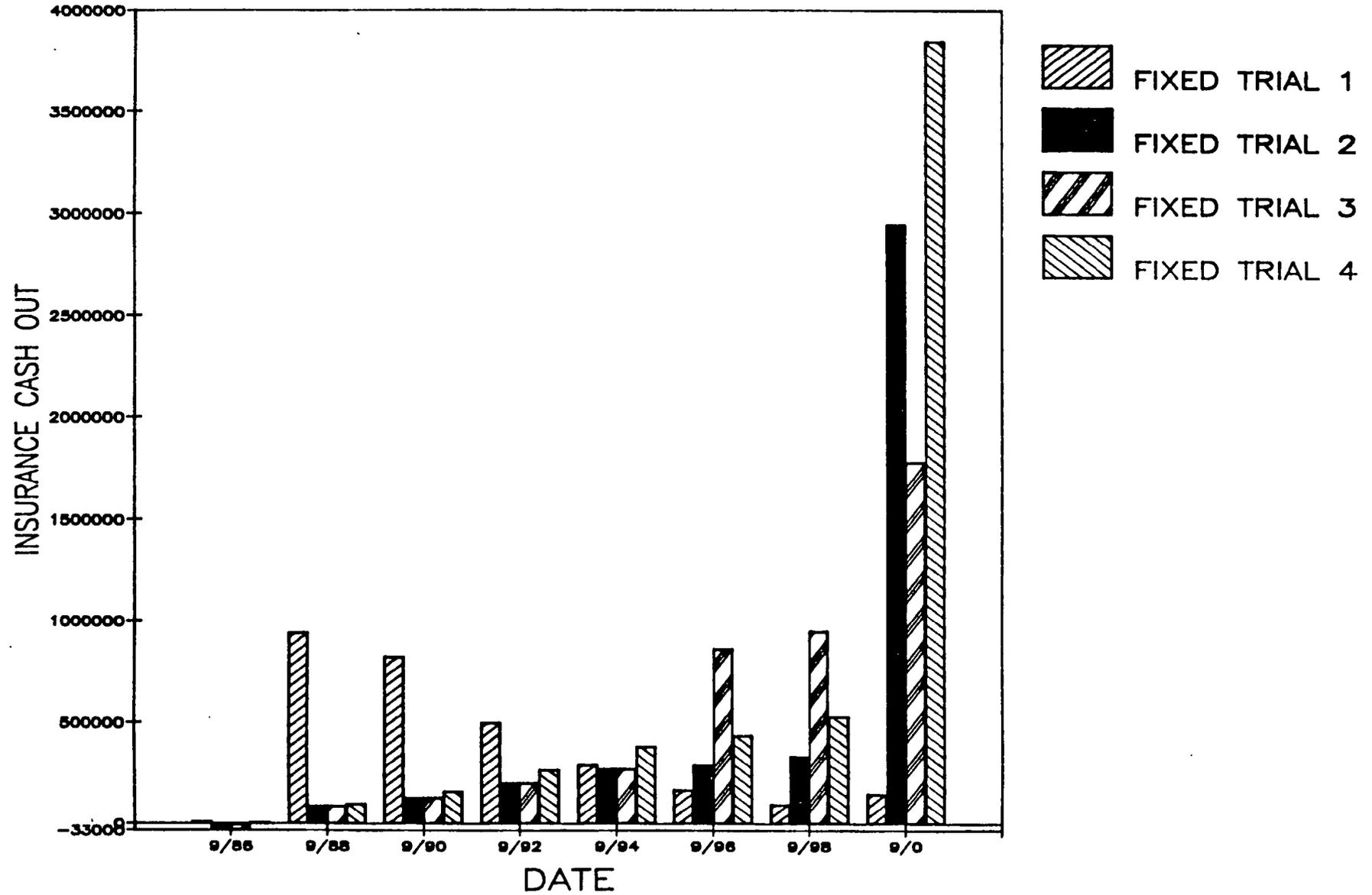
These trials were picked by the company, as opposed to being picked by the regulators or picked by anyone in my firm. The company selected these as they were thought to produce an extremely bad impact on the company. Something I think the valuation actuary ought to be thinking about is that if you make Armageddon assumptions, you typically get very bad results. If you predict disaster, you get disaster, and you don't really prove very much. That is at the heart of scenario selection, thus I think that the valuation actuary should not select them. The point of the whole process is to get some balance, some relative comparison. It is not to have someone step way out on a limb and make an absolute statement about solvency. Understanding and quantifying risks become very important parts of the actuary's job of explaining risk to management. It does not surprise me to end up with some very bad results almost anytime I end up at the top of my yield curve, starting with a contract with guarantees, and interest rates that drop and stay there forever. We are in a risk business. What we have to do is get managers to understand those risks, accept that they are in a risk business, and then move on from there. So, again, I think it ought to be the actuary who increases knowledge throughout the whole system.

Now the graph in Exhibit 7-7 contains, for those four fixed trials, the pattern of the insurance liabilities cashing out. You can see the impact that the different

EXHIBIT 7-6

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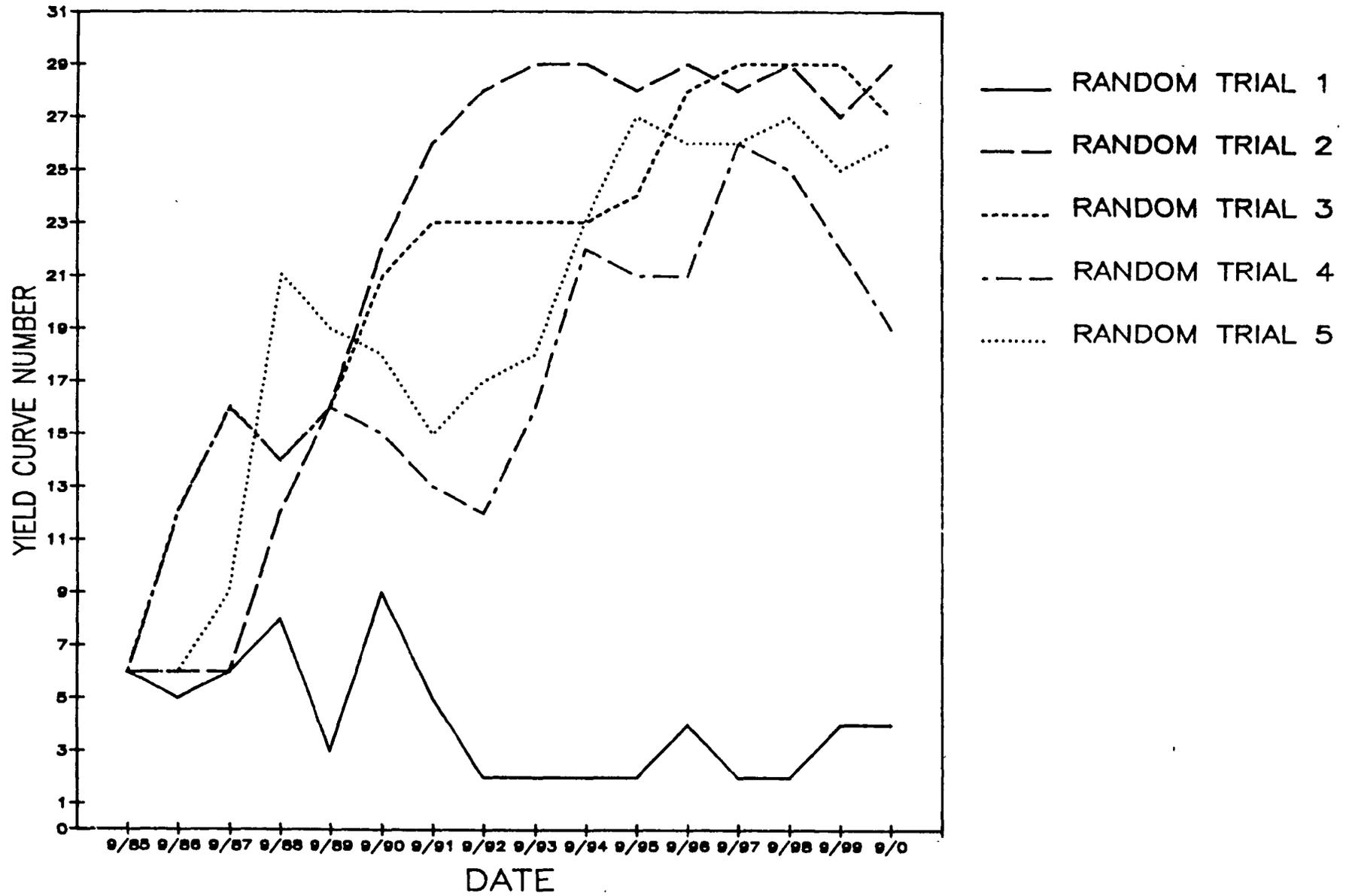


trials have on the amount of cash out. You can see that fixed trial 4 has a huge spike relative to the others; and fixed trial 4, just for perspective, probably generates cash outs of roughly twice the smallest produced by the other trials.

Exhibit 7-8 contains a graph of all five random trials that were generated. In Exhibit 7-9 is a graph of their impact on the insurance cash out, or the liability cash flows, of random fluctuations in interest rates. You can see the impact of interest-rate changes on liability cash flows. It gives you some idea of the problems in this whole process. This company, by the way, was just trying to understand its insurance cash flows. It hadn't gotten to the point where it was looking at the investment cash flows or how the two were related.

The company's investment people found the actual presentation fascinating, I think because they had not had an appreciation that they were dealing with random fluctuations. For instance, potential swings of 10 to 1 in pay outs from one period to the next, and the kinds of nonmatchable situations they actually did have. Now, this was a big company where the investment people were relatively insulated. I think that's been true for a lot of us. The point of this is that there are things we do that will be very interesting to the investment people and vice-versa. The ultimate end of this whole process is to bring things together.

Now, Exhibit 7-10 introduces a different example. It contains a set of GIC assumptions and the deposit. The idea here is a fixed liability stream. The initial deposit grows to \$1.4 billion by June 30, 1985. There are book value withdrawals, but only for death benefits. Some annuitizations are assumed. There is \$1 billion in bullet GICs having one payment at one point in the future,



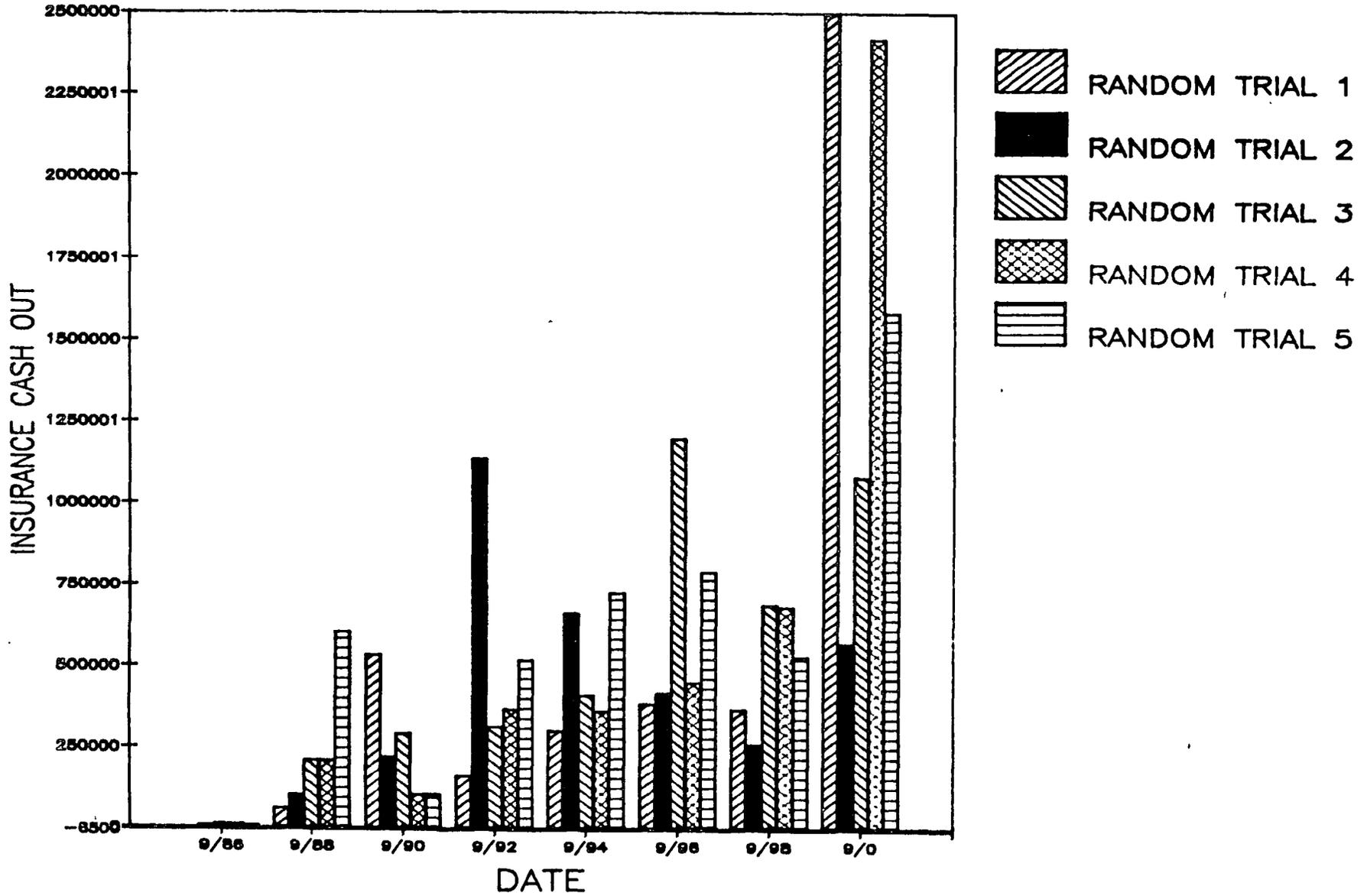


EXHIBIT 7-10

GIC ASSUMPTIONS

DEPOSIT	INITIAL DEPOSIT OF \$1.2 BILLION HAS GROWN TO \$1.4 BILLION BY 6/30/85
BOOK VALUE WITHDRAWALS	DEATH BENEFITS
ANNUITIZATION	\$100 MILLION
BULLET GICs	\$1.0 BILLION
COMPOUND GICs	\$300 MILLION

but interest or a principal prepayment in the future as well as interest in between. There is also \$300 million in compound GICs having one huge payment at the end, interest accumulates.

This example is based on a real life portfolio that is immunized. What was done was to look at the sensitivity of the financial results, under this immunized portfolio, to interest-rate changes. Included were changes in the values of spot interest rates and in the relationship of those spot interest rates to each other. So, there are yield curve twists as well as changes in the values of interest rates. Twelve scenarios were analyzed. Again, this is an immunized situation where the duration of the assets exactly equal, at the point in time of the analysis, the duration of the liabilities. The model assumed that, on a quarterly basis, the assets and liabilities would be rematched on duration. The model then allowed consideration of the risk in this duration-matched portfolio with the company's current situation.

The twelve scenarios are listed in Exhibit 7-11. In the first, we assume that interest rates remain constant; remain equal to where they are today over the entire projection period.

In the second, we assume for instance, that the ten-year rate remains constant, but the twenty-year rate goes up while the short-term rate goes down. In other words, the so-called yield curve steepens. You'll see that some others have been described in common terminology; "valley" means it goes down and then goes up. A "mountain" is something that goes up and then comes down. In both of those (3 and 4) we are keeping the yield curve steep. We keep it getting steeper, in fact. In scenario 5, we have rates that rise in an absolute sense, and the yield curve

EXHIBIT 7-11

**SCENARIO DESCRIPTIONS FOR PROJECTIONS OF
"IMMUNIZED" GIC PORTFOLIO**

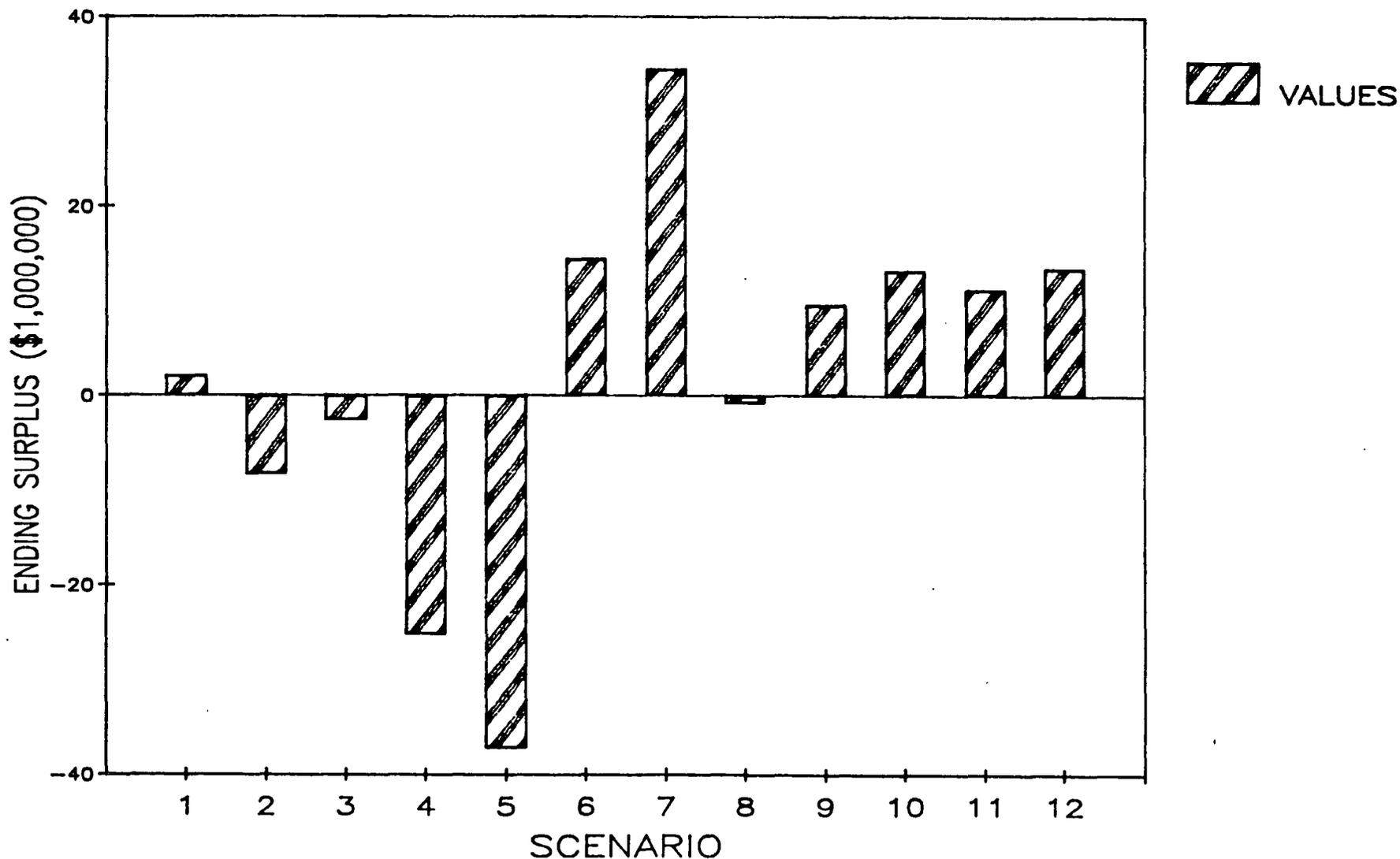
1. LEVEL.
2. LEVEL. YIELD CURVE STEEPENS.
3. VALLEY - RATES FALL THEN RETURN TO ORIGINAL LEVEL.
YIELD CURVE STEEPENS.
4. MOUNTAIN - RATES RISE THEN FALL BACK TO ORIGINAL
LEVEL. YIELD CURVE STEEPENS.
5. RISING. YIELD CURVE STEEPENS.
6. FALLING. YIELD CURVE STEEPENS.
7. FALLING. YIELD CURVE BECOMES LESS STEEP.
8. RISING. YIELD CURVE INVERTS.
9. MOUNTAIN - RATES RISE THEN FALL BACK TO ORIGINAL
LEVEL. YIELD CURVE BECOMES LESS STEEP.
10. VALLEY - RATES FALL THEN RETURN TO ORIGINAL LEVEL.
YIELD CURVE BECOMES LESS STEEP.
11. DEEP VALLEY - RATES FALL FURTHER THAN IN SCENARIO 10.
YIELD CURVE BECOMES LESS STEEP.
12. LEVEL. YIELD CURVE BECOMES LESS STEEP.

steepens, with the long rates going up and the short rates going up more slowly. In the 6th, we again have interest rates falling and the yield curve steepening, which is not inconsistent, by the way, with what has been happening the last few months. I won't describe the next five, but want to point out that the 12th scenario is again level, which means that the rates stay more or less where they are, or at least you could pick a rate that would remain constant. I don't believe that you would have perceived substantial interest rate changes if you'd have experienced either scenario 1, scenario 2 or scenario 12, and I want to make that point before we look at the results.

The results are not exactly consistent, as evident in Exhibit 7-12. What happens to the ending surplus — and it shows that in a worse case, which was scenario 5 where interest rates kept going up, — is a loss of about \$37 million on this \$1.4 billion portfolio. What that is saying is that in an environment where you have increasing steepness and increasing rates, you have substantial risk at least with respect to this immunized portfolio. Given the size (the \$1.4 billion size) as an entire portfolio, that result is not all that bad, but \$37 million is serious money to almost anybody. So, you have to be aware of these risks.

What I'd like you to look at for the moment is the relationship of scenarios 1, 2 and 12. We characterized all three of them as level. Scenario 1 results in a very small gain, which is the basis of the concept of duration matching. Typically, if interest rates do not change, you would expect your duration match to work as it does in scenario 1. We end up with a slight profit. In scenario 2, where we kept the rates more or less the same, but had short rates go down a little bit and the long rates go up a little bit, we end up with a loss. The loss there is about \$8 million. In the 12th scenario, we end up with a substantial gain. The yield curve,

TWELVE PROJECTIONS OF A \$1.4 BILLION "IMMUNIZED" GIC PORTFOLIO



CAPITAL REQUIREMENT = \$37.2 MILLION

instead of steepening, contracts over the period. This is intended to illustrate that there is risk in immunized portfolios and probably in cash-matched portfolios, although in the latter the critical risk is more from defaults. There is also the risk of having your cash flow projections turn out to be wrong, but there is work for the valuation actuary at all points in this process. There are no simple solutions.

FROM THE FLOOR: The \$37 million is the amount required at the end of the period. It does not reflect federal income tax, nor is it a present value. It is a market value surplus number. You could discount it back at appropriate rates, and you could tax it. One thing that scares me about taxation in some of these analysis is that you really have to know the company very well.

MR. TULIN: Probably half of you already know about my involvement as the regulators' actuary in the Baldwin-United situation. When Baldwin-United, among other things, was caught spending tax credits that weren't there, management convinced people that the best way to make money was to lose money, and the company did a good job losing money. It was just that simple. There were IRS questions about whether or not numerous tax benefits could have ever been realized, but the company's scheme was to create taxable losses in order to apply the marginal rate to those losses and treat the results as income. That was the way it could have an extremely short investment strategy, with no disintermediation risk and higher credited rates than anybody else in the market. It sounds silly today, but apparently \$4 billion went into the company before the market ruled on the worthiness of this scheme. So, I worry about tax adjusting. Regarding the present value, the valuation actuary has to find an appropriate basis for discounting those shortfalls.

Next, Exhibit 7-13 contains the assumptions for an annuity example with \$500 million in beginning reserves and a \$500 million beginning book value of assets. The market value of the assets — and this is not atypical for companies in this industry — is below the book value which raises all kinds of statutory problems. The average policy size is relatively small. There's a premium suspension assumption, which is something we are all used to making at this point. What we are saying here is that the average premium per policy in force would continually decrease. There's an assumption setting the credited rate equal to the earned rate minus 2 percent. So, this company will make a set spread. Additionally, you would have to make assumptions about surrender charge, lapse rate, the market rates for these annuities, the average duration of in-force business, expenses and commissions and new issues. One of the reasons I keep listing all the assumptions is to emphasize that the valuation process involves getting many people together. Unless they accept the assumptions together, the process has about one-tenth the value it potentially has. So, what you want to do is start the process by calling people in to discuss all the technical things needed to understand the business and select assumptions. If someone does not like an assumption, it can be talked about, sooner or later, but it must be talked about. The valuation actuary should not go off into a closet and come back with results destined to be discarded because others do not like his assumptions.

Worst of all, if we get ourselves into situations where we work on the assumptions until we get some desired answers, then all we will be doing is creating problems for the future — a system with decreasing margins that doesn't have a whole lot of credibility. The valuation process gives us an opportunity to do a lot that will be good for the industry. And I'd like to see us do that.

EXHIBIT 7-13A

ANNUITY ASSUMPTIONS

BEGINNING RESERVES	\$500 MILLION
BEGINNING BOOK VALUE OF ASSETS	\$500 MILLION
BEGINNING MARKET VALUE OF ASSETS	\$450 MILLION
AVERAGE SIZE	\$3,500
PREMIUM	\$1,000 PER LIFE
PREMIUM SUSPENSION	\$50 PER LIFE PER YEAR
CREDITED RATE	EARNED RATE - 2%
SURRENDER CHARGE	5% FOR 5 YEARS, THEN 4,3,2,1,0%
LAPSES	$12\% + 5 \cdot (MR - CR) - 2 \cdot SC$ MR = MARKET RATE CR = CREDITED RATE SC = SURRENDER RATE
MARKET RATE	GREATER OF: 1 - 15 YEAR BOND RATE LESS 2.0%; OR SHORT TERM RATE LESS 1.25%
AVERAGE DURATION	YEAR 3
EXPENSES AND COMMISSIONS	\$70 PER LIFE PER YEAR; 4% INFLATION
NEW ISSUES	NONE

EXHIBIT 7-13B

POSSIBLE YIELD CURVES FOR
PROJECTION OF ANNUITY BLOCK

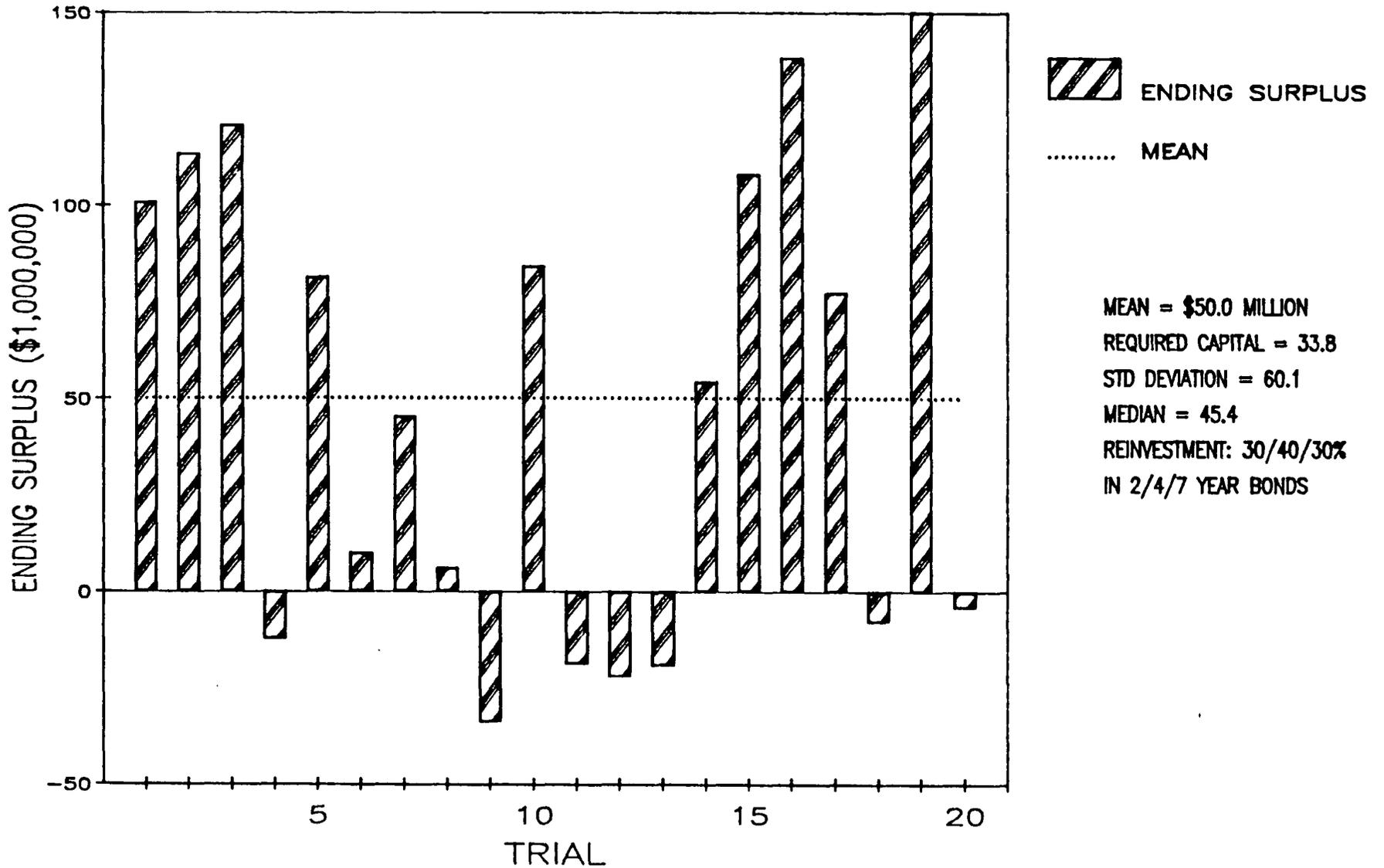
<u>CURVE NUMBER</u>	<u>SHORT TERM NUMBER</u>	<u>2-YEAR BOND NUMBER</u>	<u>5-YEAR BOND NUMBER</u>	<u>10-YEAR BOND NUMBER</u>	<u>20-YEAR BOND NUMBER</u>
1	4.05	5.32	6.94	7.68	8.32
2	6.05	7.32	8.94	9.68	10.32
3	6.82	7.97	9.51	10.21	10.64
4	7.41	8.47	9.95	10.54	10.96
5	7.89	8.89	10.28	10.90	11.28
6	8.59	9.47	10.81	11.31	11.65
7	9.41	10.32	12.00	12.50	13.79
8	10.43	11.33	13.04	13.54	13.99
9	11.49	12.14	13.53	13.99	14.36
10	12.64	13.36	14.59	14.71	14.68
11	13.82	14.59	15.97	15.65	15.20
12	14.85	15.36	16.66	16.30	15.53
13	16.85	17.36	18.66	18.30	17.53

What you see in Exhibit 7-14 are the results of twenty fixed-investment-strategy simulations on that previous \$500 million annuity portfolio. You can see that the mean ending surplus is \$50 million. The worst position is a \$34 million loss. The standard deviation is \$60 million. The median is \$45 million.

Now, not all of what is shown in Exhibit 7-14 is required or necessary for the valuation. But, this kind of fuller analysis, submitted to management, does two things. First, it presents expected profit - as an estimate, not as an absolute. Second, it can be used to set up the risk reward equation, critical to the work of valuation actuary. One of the things I will develop in the next example is the idea that the amount of risk you take ought to be related to the amount of reward you are expecting to get. Some companies take more risk than necessary to achieve a better profit margin. To understand this business is to understand that there are optimal investment positions and optimal risk management positions, with diminishing returns beyond those. The risk/reward equation varies by product and by assumptions, but it does relate the amount of capital you're willing to invest (in the sense of required surplus) and the rate of return that you should expect to get when you take risk. This is illustrated in an SPDA example, Exhibits 7-15 and 7-16. This example involves new issues. What we have is a \$100 million premium, acquisition expenses of 4 percent, and a market rate equal to the seven-year bond rate less 220 basis points.

Here again I will emphasize the importance of involving a wide variety of people in the selection of assumptions. It is fascinating to ask the product people and the marketing people what the market is going to be. Also, the people running the company often think something different than the people selling the business. But again, it's critical to the process.

TWENTY YEAR PROJECTION OF \$500 MILLION ANNUITY PORTFOLIO



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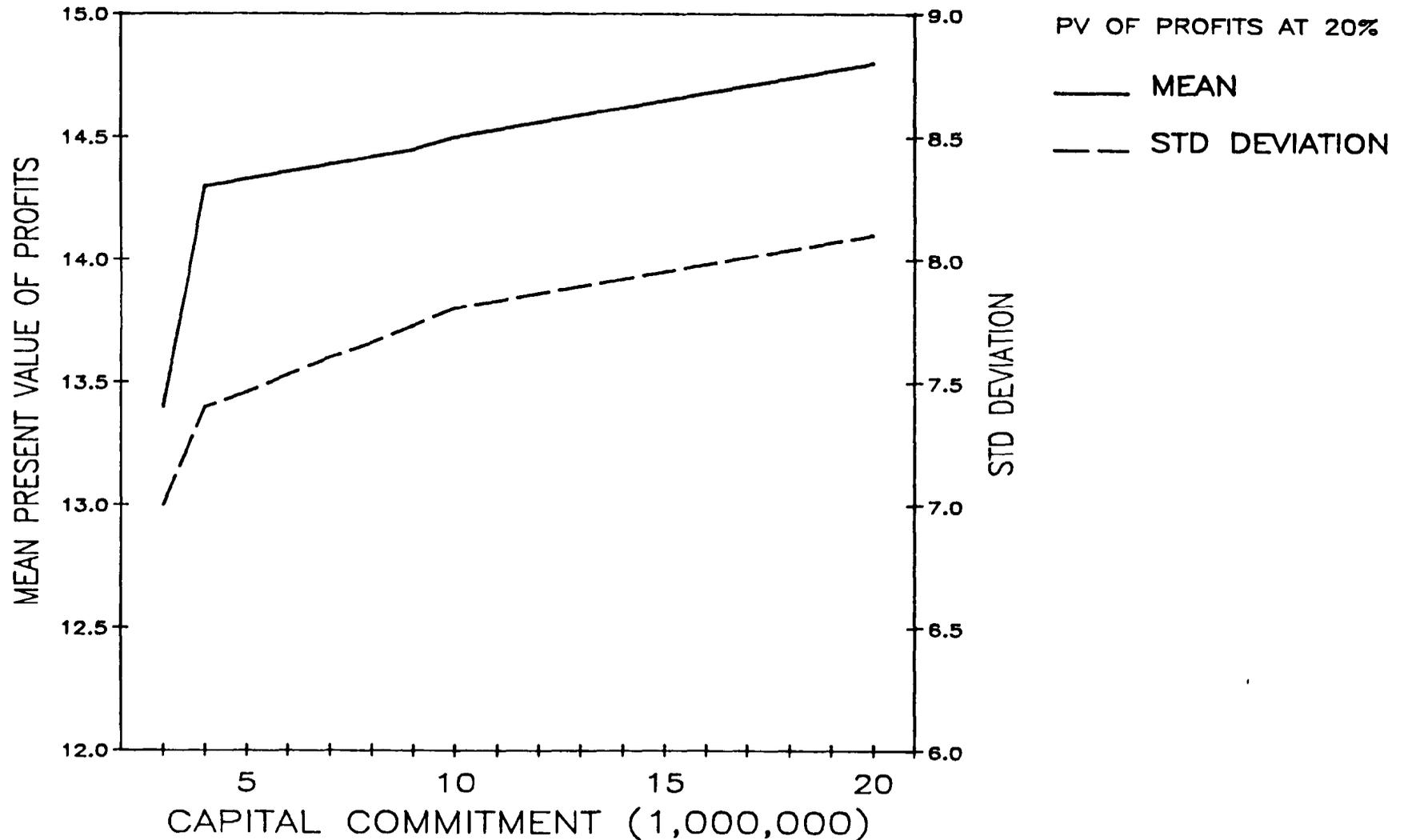
EXHIBIT 7-15

SPDA NEW ISSUE ASSUMPTIONS

PREMIUM	\$100 MILLION
ACQUISITION EXPENSE	4%
CREDITED RATE	MARKET RATE MARKET RATE = 7-YEAR BOND RATE LESS 2.20%
PROJECTION PERIOD BAIL-OUT	15 YEARS CR _{T-1} - 1.5%; NOT GREATER THAN CR ₀ .
SURRENDER CHARGE	5% OF PREMIUM FOR FIVE YEARS
LAPSES	GREATER OF 5% AND L L = 9 + 6 · (MR - CR - 1.0) - SC LAPSES INCREASED 5% IN YEAR 6
OTHER	NO MORE THAN 25% OF ASSETS IN 15-20 YEAR BONDS

<u>CAPITAL COMMITMENT</u>	<u>INITIAL INVESTMENT STRATEGY</u>		
	<u>3 YEAR</u>	<u>5 YEAR</u>	<u>20 YEAR</u>
\$ 3 MILLION	13.1%	61.9%	25%
4 MILLION	12.9	62.1	25
10 MILLION	11.7	63.3	25
20 MILLION	9.6	65.4	25

IMPACT OF RISK POSTURE ON PROFITABILITY SPDA NEW ISSUES: \$100 MILLION



Few companies have, for their interest-rate sensitive products, a defined (in the sense that they could articulate it clearly enough to use in cash flow projections) crediting or liability management strategy. It is very difficult for the valuation actuary to start work without management telling him what it plans to do with the liabilities as interest rates change. Otherwise, management won't like the results, for whatever reason. Sometimes, management very carefully articulates a crediting strategy and then still does not like the answers. It will want to change the strategy after seeing the results. If managers learn something from the process and therefore change their rules, that's good. However, if they simply instruct the actuary to keep working, that's bad. That's bad because one is not dealing with the way the company is going to operate.

The other assumptions in Exhibit 7-15 are things you're used to seeing. There is a fifteen-year projection period on the product at the bail-out rate. There is a surrender charge, and a lapse formula that is nothing new. Then you'll see a rule governing the mix of assets. This is used because the computer chooses the distribution of assets given some external constraints. The investment people didn't like the idea that the computer would tell them what it thought, given all the assumptions, or what the optimal generic portfolio was. So a rule stating that no more than 25 percent of the assets would be fifteen- to twenty-year bonds was included. A lot of companies use this type of rule. Many were hurt badly by having assets that were too long, and are now going to deal with it by keeping everything in cash.

Another assumption is about the initial investment strategy. This gets into the consideration of capital commitment as the amount of cumulative surplus losses or as the cumulative capital commitment, a company's willing to make in terms

of statutory impact. Many companies think about their investments in lines of business just this way. Somebody acquires a block of business and says: "Well, I know I might have to lose money on it because of an interest-rate risk, but I don't want to lose any more than x ." That x is the capital commitment number. It's a highly practical concept, not a theoretical one.

In Exhibit 7-16, we see that the standard deviation and the present value of profits depend on the line (the bottom axis represents the capital commitment). This is an aid to understanding the same product using the same formula, varying only the investment strategy as it relates to capital commitment. What you can do then, as you analyze randomly generated scenarios, is measure the mean present value of profits (the top line) and the standard deviation. Not surprisingly, the standard deviation increases as the risk increases, and the present value of profits increases as the risk increases. In fact, you wouldn't take additional risk or put additional capital into something unless you had an expectation of greater return.

The concept here assumes an investment strategy that pushes profits to their maximum, but never allows the loss of more than the capital commitment. To put it another way, it is a very important job of the valuation actuary. He's got to watch surplus and where it is spent, whether it's required surplus to support risks already taken or whether it's expansion or vitality surplus. When I say that, I don't want to suggest that that's a valuation actuary's public responsibility, because I don't think it is. But I think the valuation actuary is the perfect person to do it internally, he's the perfect person to get management to understand this diminishing return.

If you start trying to turn valuation (statistical) expectations into target internal rates of return, you will find the company making decisions about whether or not it wants to sell more business at a certain return. If it does that, capital may not be available to support the risks in the investment strategy and in the existing block of business. It is a noncontroversial fact that capital is limited. In recent years, many companies have developed problems by operating on an expected value pricing basis coupled with a philosophy that capital is unlimited.

Another SPDA example is given in Exhibits 7-17 through 7-19. Let me skip to the tricky part in Exhibit 7-17, the definition of the investment strategy. There are six different investment and reinvestment strategies, some of which are active and some passive as I previously defined those terms. In constructing these strategies, I started with an initial strategy of a 100 percent seven-year bond, to deal with the fact that there is a seven-year maturity on this contract. Notice that the initial strategy, identified as A, is different. The reinvestment strategies A-E are active in one way or another, with limitations on how much of the portfolio could be traded at the end of an analysis period. Here an analysis period was one year. Finally, reinvestment strategy F is the traditional "buy it and throw it in the vault" concept that I call "buy and hold." Here, 100 percent of the money is put into a seven-year bond, liquidating only as necessary to fund cash needs and reinvesting in instruments maturing at the end of the original maturity period.

Exhibit 7-18 contains the results. What you see is the present value of profits, discounted at a fixed rate and presented in terms of the mean, the low and the standard deviation. Again, this kind of analysis emphasizes the relationship of investment strategy, pricing and the use of capital in the work of the valuation

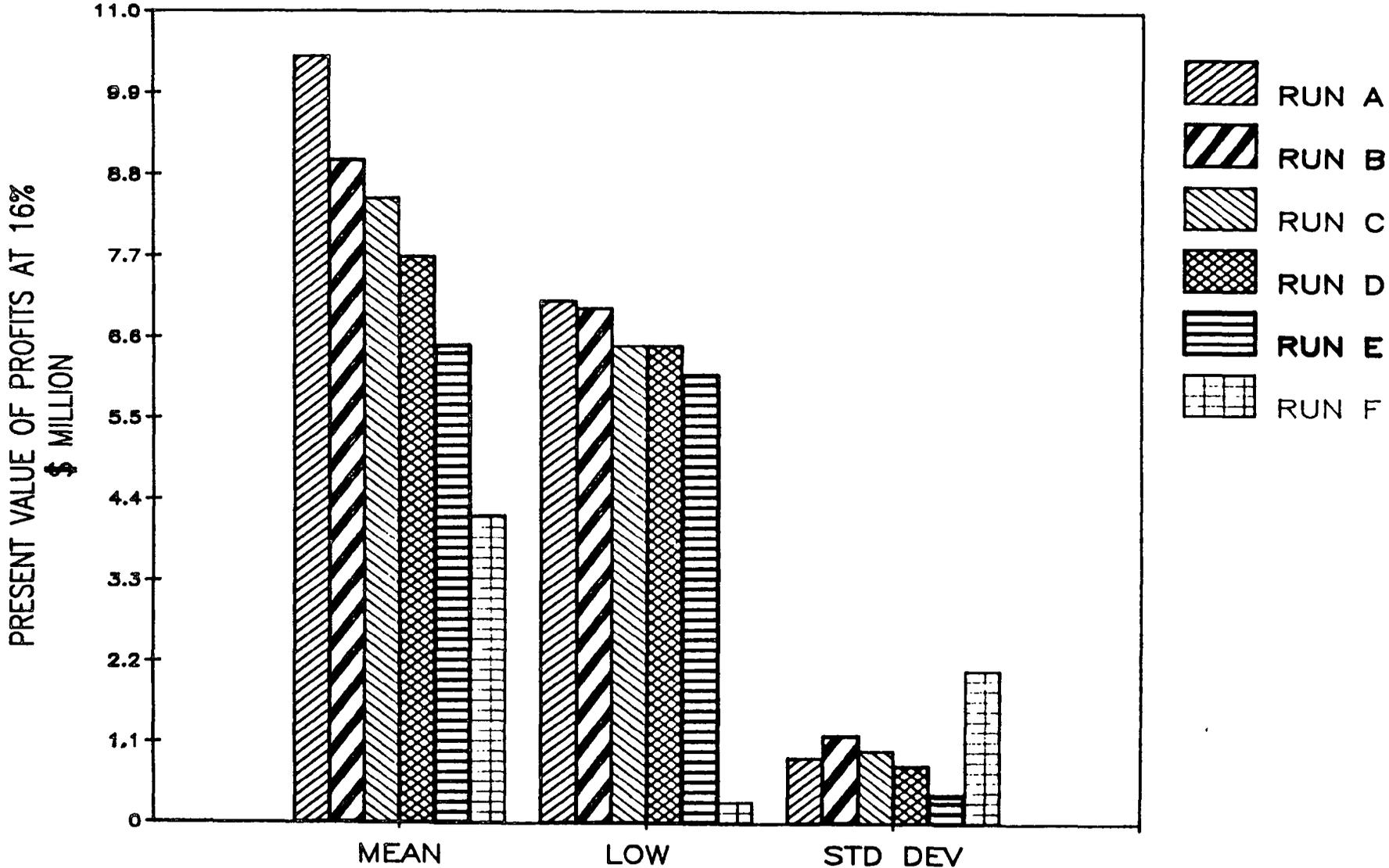
EXHIBIT 7-17

SPDA NEW ISSUE ASSUMPTIONS

PREMIUM	\$100 MILLION
MATURITY	7 YEARS
LAPSES	GREATER of 5% AND L L=14% + 4 · (MR - CR) 1.6 · SIGN (MR - CR) - MAX (1.5 · SC; 1.96 · SC · 7 · (MR - CR) MR = MARKET RATE = 7 YEAR BOND RATE - 2.65%
AVERAGE SIZE	\$25,000
BAIL-OUT	12.1%
CREDITED RATE	12.1% THROUGHOUT
SURRENDER CHARGE	7, 7, 6, 6, 3, 0%
ACQUISITION COST	5%
CAPITAL COMMITMENT	\$5 MILLION

	<u>INITIAL STRATEGY</u>	<u>REINVESTMENT STRATEGY</u>
A	27% 4-YEAR BONDS 73% 15-YEAR BONDS	ACTIVE
B	100% 7-YEAR BONDS	ACTIVE
C	100% 7-YEAR BONDS	ACTIVE - TRADE NO MORE THAN 75% OF PORTFOLIO
D	100% 7-YEAR BONDS	ACTIVE - TRADE NO MORE THAN 50% OF PORTFOLIO
E	100% 7-YEAR BONDS	ACTIVE - TRADE NO MORE THAN 25% OF PORTFOLIO
F	100% 7-YEAR BONDS	BUY AND HOLD

\$100 MILLION NEW SPDA IMPACT OF INVESTMENT STRATEGY



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actuary. And that's what we're trying to do in these examples. It's just this kind of analysis that can help you communicate with your managements.

The example shown in Exhibits 7-19 and 7-20 encompasses different crediting strategies. The basic strategies are crediting the greater of the market rate and bail-out rate and crediting the whole market rate. In this example, the capital commitments were derived from the crediting strategies and initial investments, which were treated as management decisions. Strategy B, the greater of market and bail-out rates, requires much more capital to support than almost any other strategy anyone could think up. This result is again consistent with the kinds of deeper understanding you can reach by going through this process. Exhibit 7-20 shows the results of the present value of profits, in the same format as the previous example.

In the example shown in Exhibits 7-21 through 7-22, we are trying to understand how long-term profitability is affected by management's interim goals. This goes to the point that the valuation actuary, in terms of forming his opinion (and this is something that worries me), can't be responsible for anything other than what his management tells him. This means that the actuary has to understand management's underlying assumptions. You may find out that you are dealing with a company that will not ever allow itself to take a capital loss. This means that there can be situations where it's absolutely right to take a loss given the overall protection of the company from an economic point of view, but the company is unwilling to do so. Some people have the idea that what they want to have is at least \$3 million or X percent of gain every year, no matter what.

EXHIBIT 7-19

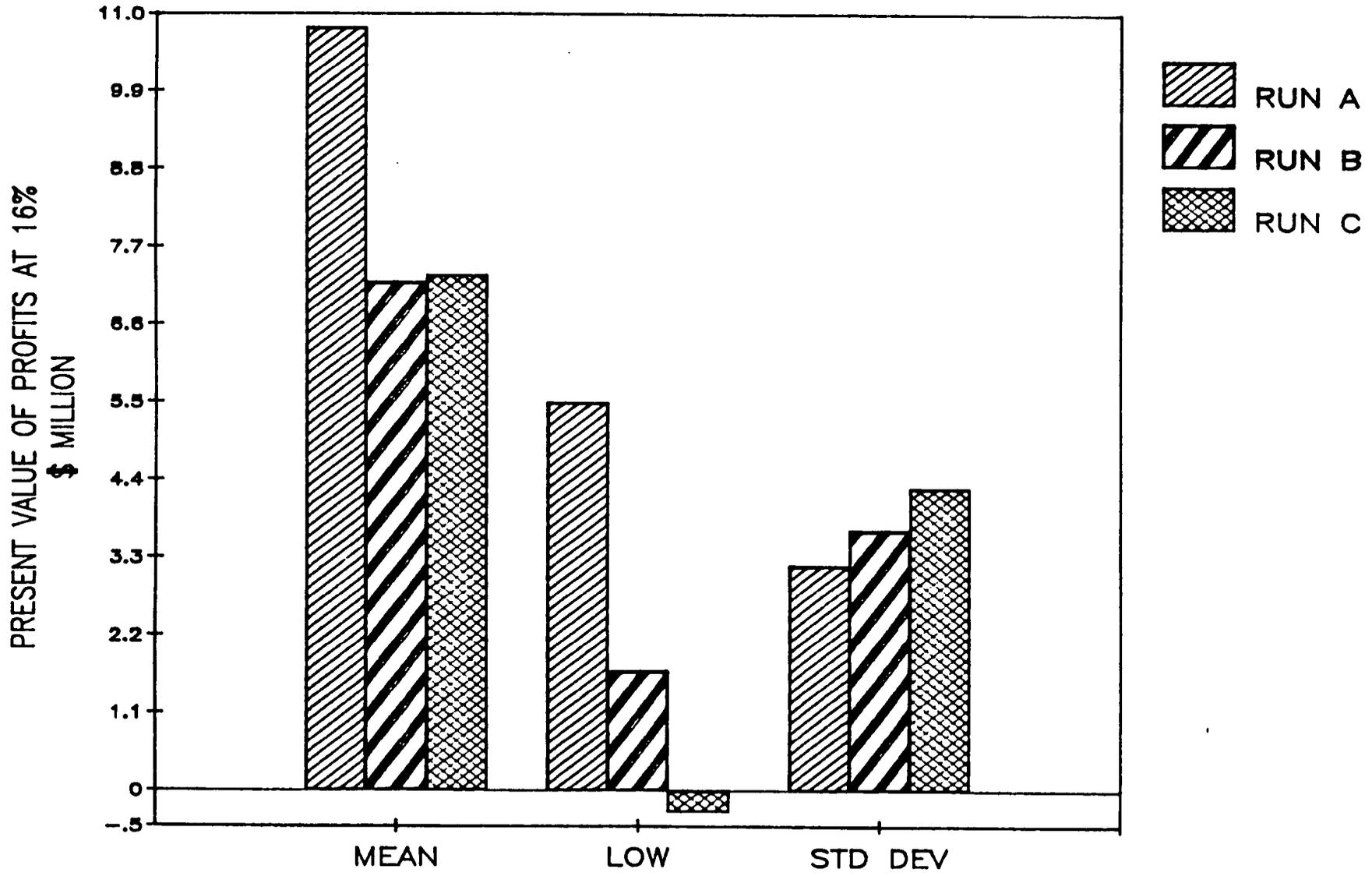
SPDA NEW ISSUE ASSUMPTIONS

PREMIUM	\$100 MILLION
MATURITY	7 YEARS
LAPSES	GREATER of 3.75% AND L L = 11.25% + 3.75 · (MR - CR) 1.5 · SC MR = MARKET RATE = 7-YEAR BOND RATE LESS 2.65%
AVERAGE SIZE	\$25,000
SURRENDER CHARGE	7, 7, 6, 6, 3, 0%
ACQUISITION COST	5%

	<u>CREDITED STRATEGY</u>	<u>INITIAL INVESTMENT</u>	<u>CAPITAL COMMITMENT</u>
A	HOLD INITIAL RATE	27% 4-YEAR BONDS 73% 5-YEAR BONDS	\$5 MILLION
B	CREDIT GREATER OF MARKET RATE AND BAIL-OUT	23% 4-YEAR; 75% 5 YEAR; 2% 15-YEAR	\$20 MILLION*
C	CREDIT MARKET RATE	29% 2-YEAR BONDS 71% 15-YEAR BONDS	\$5 MILLION

*MINIMUM CAPITAL COMMITMENT TO SUPPORT STRATEGY B IS \$20 MILLION.

\$100 MILLION NEW SPDA IMPACT OF CREDITED STRATEGY



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EXHIBIT 7-21

SPDA ASSUMPTIONS

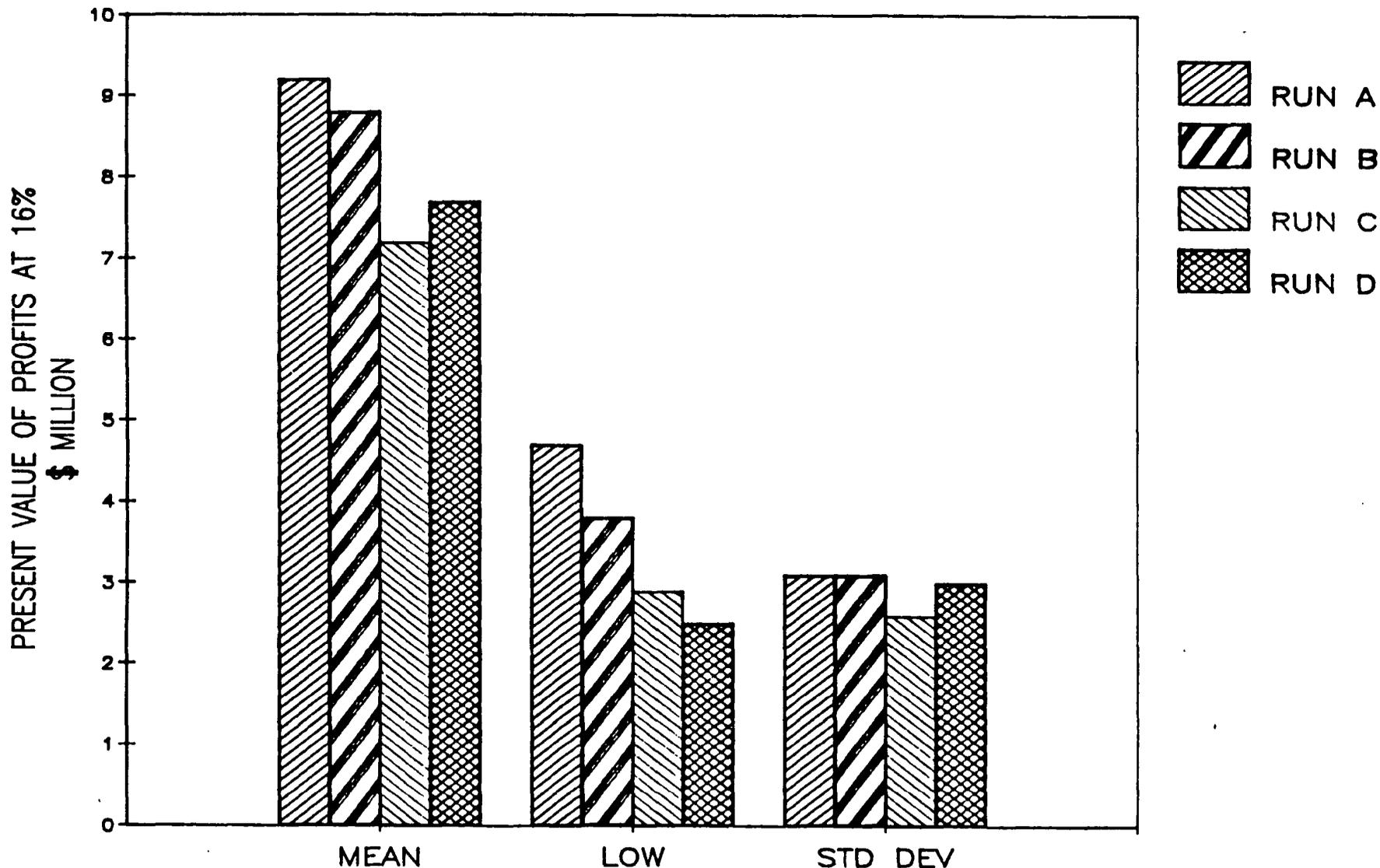
PREMIUM	\$100 MILLION
PROJECTION PERIOD	7 YEARS
AVERAGE SIZE	\$25,000
ACQUISITION EXPENSE	5%
CREDITED RATE	12.1% THROUGHOUT
LAPSES	GREATER of 3.75% AND L L = 11.25% + 5 · (MR - CR) - 2 · SC MR = MARKET RATE = 7-YEAR BOND RATE LESS 2.75%
INITIAL INVESTMENTS	39.4 MILLION 4-YEAR BONDS 60.6 MILLION 4-YEAR BONDS

RUN

INTERIM PROFIT GOAL

A	MAXIMIZE LONG-TERM PROFITABILITY
B	AVOID LOSSES
C	\$3 MILLION PER YEAR
D	\$2-4 MILLION PER YEAR

IMPACT OF PROFIT STABILIZATION ON OVERALL PROFITABILITY



Conceivably, that can be managed through the control of capital gains and losses, but only if you know that that is the primary objective as opposed to the one of maximizing long-term profitability.

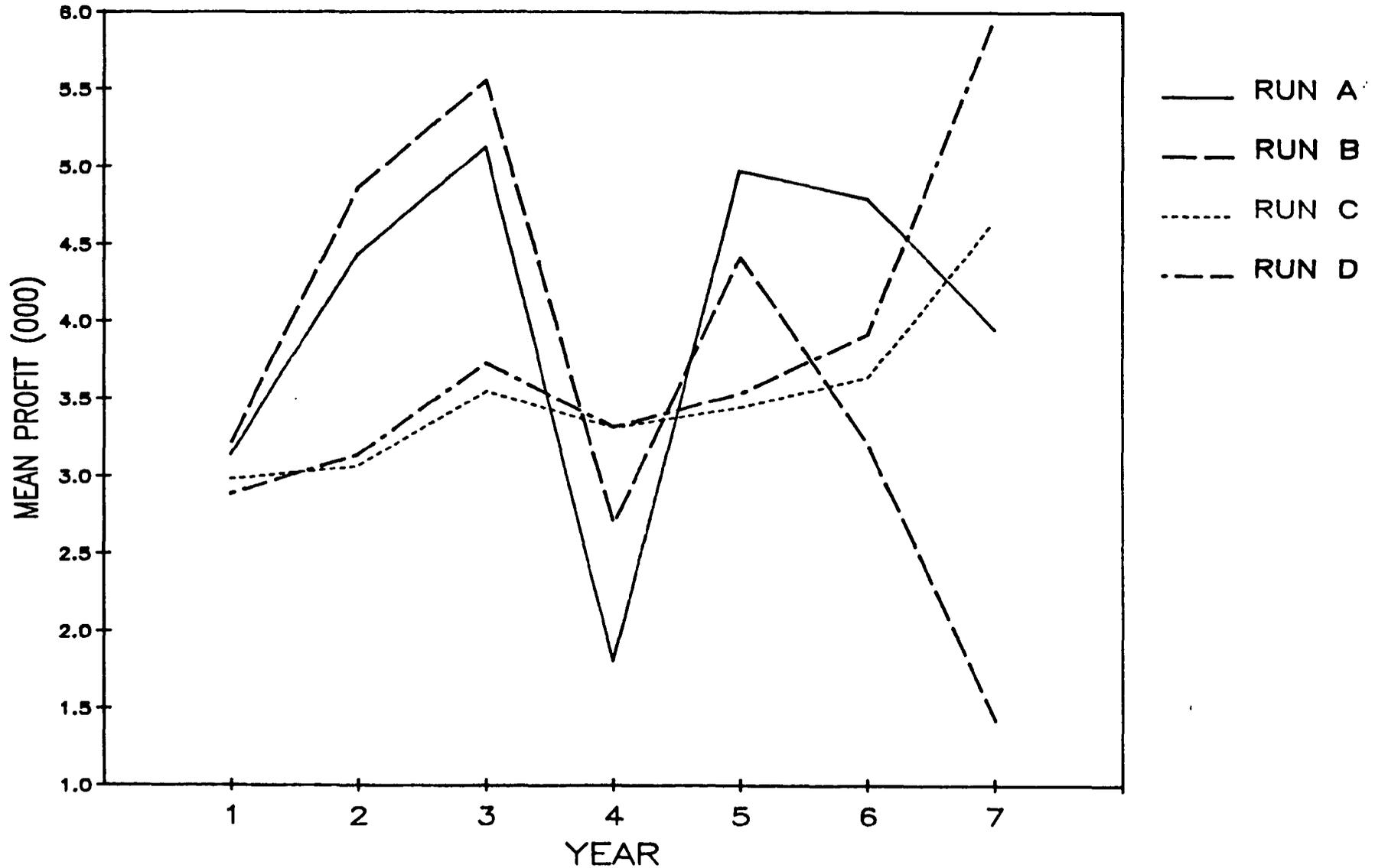
Exhibit 7-22 contains the profitability results. As you can see, in the case where the objectives are to level profits, the lowest present value of profits is produced. It is in a fairly low position, but also has a fairly low standard deviation.

In Exhibit 7-23 is a graph of mean profit by year. In other words, it's showing the impact of the objective of maximizing long-term profit versus the profit-stabilization goal. In Exhibit 7-24 is a graph of the standard deviations. You can see that trade offs are indicated.

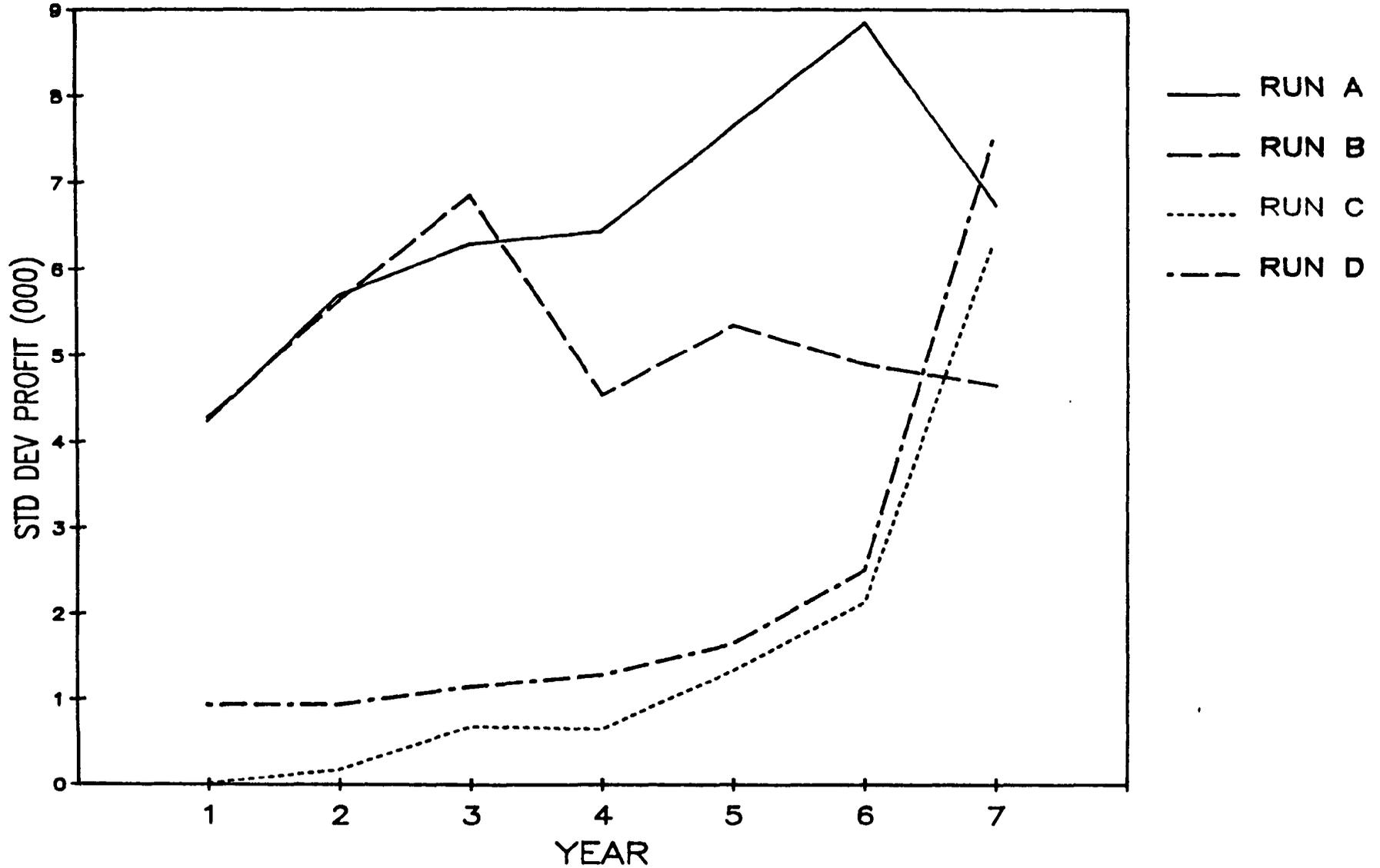
I'm not trying to suggest that one position is appropriate versus another. What I'm trying to suggest is that the actuary needs to be aware of management's broader strategy and operating rules. And the rules are almost as important as the strategy. How will the company manage its earnings? Is the only focus to control product risk and maximize profits, getting the "right" valuation actuary results?

I'd like to close by saying that I think the learning process we actuaries are going through is of great value to us, regardless of what the regulators do. We do have to take steps in communicating to our public (basically the regulators, and in communicating to our employers (basically the life insurance industry).

IMPACT OF PROFIT STABILIZATION ON ANNUAL PROFITS



IMPACT OF PROFIT STABILIZATION ON ANNUAL PROFITS



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We are not necessarily ready to take on the whole of the valuation actuary role, but there's no one else to do that. We can't wait until we're ready because if we try to wait, we might wake up and find out that we don't have a profession. I used to say that we'd wake up and find out we didn't have an industry, but I am also concerned about the profession. No one can better deal with this problem than actuaries, no one has better basic training or breadth of knowledge of the insurance industry from products to asset and liability relationships. No, we are not yet prepared to write the opinions as those are currently drafted, but we have to help redraft them. We have to help the companies we work for understand that we are also going to help the regulators regulate this industry.

