

CURRENT RESEARCH AND ALTERNATIVE TECHNOLOGIES

(TEACHING SESSION)

ALTERNATIVE APPROACHES TO C-3 RISK

MR. ARNOLD A. DICKE: Up to this point, we have discussed one particular approach to valuation of interest-sensitive liabilities. Next, we will consider alternative valuation approaches.

Let me begin by restating the purpose of any valuation process:

Determine an amount of assets that will provide sufficient cash to meet future insurance obligations with a pre-determined (if unstated) degree of certainty.

GROSS PREMIUM VALUATIONS, CASH FLOW ANALYSIS AND  
MARKET VALUE ANALYSIS

Joseph J. Buff listed three methods for studying C-3 Risk at the 1986 Valuation Actuary Symposium. They are also three potential methods of valuation:

1. Gross Premium Valuation, the actuary's traditional approach,

2. Cash Flow Analysis, the subject of our discussion heretofore, and
3. Market Value Analysis, otherwise called "Modern Financial Analysis."

### Cash Flow Analysis

The gross premium valuation served actuaries well over long periods of time. It incorporates many of the variables that need consideration and develops a unique value. Unfortunately, gross premium valuation is unstable with respect to interest rate changes -- that is, changes in level or shape of the yield curve cause large changes in the value assigned by this process.

Up to this point, we have concentrated on one generalization of gross premium valuation which allows the actuary to overcome this instability -- namely, cash flow analysis. Under this method, as we have seen, a series of gross premium valuations are made with interest-sensitive assumptions keyed off of interest rate scenarios. Explicit results are available for the various scenarios which enhance understanding of the risks taken. Once a specific degree of certainty is settled upon, a reserve value is obtained which contains the C-3 Risk within that bound. Moreover, we have seen that when a specific degree of certainty is set, a unique value may be extracted by statistical analysis of results.

However, the method is cumbersome, expensive and hard to monitor. Also, it isn't additive -- that is, if two known cash flows are combined, the only way to get the new value is to redo the whole cash flow process.

Finally, there is an irresistible tendency to focus on low probability scenarios. Consider what would happen if scenario analysis were used on mortality. Scenario One might show all deaths in the first policy year; Scenario Two would defer one death to the second year, and so on. Regardless of the improbability of these scenarios, if their extremely negative results were displayed to management or the public, misunderstanding would be likely.

### Market Value Analysis

Market value analysis is a new, partially developed technique that both manages to provide a unique value and is additive. It is, by nature, more of a black box and consequently less explicit than cash flow testing, so that unlikely results are not spotlighted. There hasn't been a lot of discussion of the way this technique can be used for valuation. Instead, it is often demonstrated that this approach works for pricing, or that the "generalized duration" derived from it is useful for managing cash flows.

I don't have a valuation approach worked out in detail, but I'd like to make some comments that might inspire our researchers, and

regulators, hopefully, to stay interested.

What is the market value method? Its definitive features are:

1. The current yield curve is used to discount future cash flows (insurance and asset flows).
2. Interest sensitive cash flows are valued with methods similar to those used in modern financial analysis to price options.

When you are discounting with the current yield curve, it is important that the discount rates are the underlying "spot rate" -- that is, the rates that correspond to 0 coupon bonds of various durations. These can be derived algebraically from the yield curve in Mr. Buff's 1986 Symposium presentation. The result of this discounting process is that both assets and liabilities will be at market value (hence the name of the method).

Interest sensitive cash flows require a special treatment, which turns out to be a variation of option pricing modeling. Few people carry around in their heads the formulas of option pricing theory. Luckily, most of these formulas are unnecessary. All that is used from option pricing theory are a few basics.

The valuation problem involves finding a present value of a set of cash flows that occur at various points in the future. Some

of these cash flows vary depending on the interest rate environment. Option pricing theory is applied to each of the interest-sensitive future cash flows one by one. At each place where there is interest sensitivity, the calculation utilizes a lattice of future interest rates, developed by assuming small upward or downward moves as shown in Slide 1. The probability of these upward and downward moves is not subjective but is usually assigned according to a theory of market behavior called "arbitrage pricing theory." Briefly, this theory assumes no risk-free trading profits will be available in the marketplace. In its pure form, option pricing theory would apply only to cash flow functions that have just two values as options do.

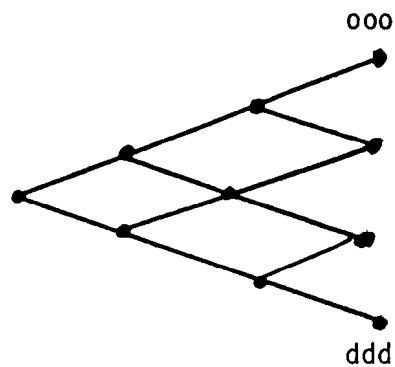
What must we do to apply option models to valuation?

1. All values must be at market to use these models.
2. These models have certain implicit assumptions whose application to the valuation problem must be checked. For example, "friction" -- imperfect response of policyholders -- is not part of these models, usually.

In Slide 2, certain features of market analysis and cash flow analysis are compared.

## OPTION PRICING MODELS

- ASSUMES LATTICE OF INTEREST RATE CHANGES.



- ASSIGNS "PROBABILITIES" ACCORDING TO THEORY OF MARKET BEHAVIOR.
- APPLIES TO INTEREST SENSITIVE FUNCTIONS THAT HAVE JUST TWO VALUES.

MARKET ANALYSIS

CASH FLOW ANALYSIS

ALL VALUES AT MARKET

MOST VALUES AT BOOK

LATTICE OF FUTURES  
APPLIED TO EACH  
INTEREST SENSITIVE  
CASH FLOW SEPARATELY

LATTICE APPLIED TO  
NET CASH FLOW  
FUNCTION ALL AT ONCE

PROBABILITIES  
CONSISTENT WITH  
EFFICIENT MARKET

SUBJECTIVE  
PROBABILITIES

The calculations underlying cash flow analysis and market analysis appear superficially to be quite different. Nevertheless, both involve interest-sensitive functions and variations in future interest rate assumptions. It is natural to ask: Are cash flow analysis and market analysis in any sense equivalent?

Even without detailed analysis we note certain points:

1. The difference between market and book value must disappear in the long run, since both involve the same underlying cash flows.

2. In order to look for a potential equivalence, the market approach must be adapted first to allow for inefficiency of policyholder response.

3. In order to prove equivalence, we have to show that the reserve value indicated by the two methods is equal. In order to do this, we must specify a unique way to select the reserve value when using cash flow analysis. Our analysis of the distribution of results, together with the specification of a degree of certainty, will do this. In fact, if  $p_s$  is the probability of scenario  $s$ ,  $CF(s)_t$  is the cash flow in that scenario at time  $t$ , and  $v(s)^t$  is the discounting function using scenario interest rates, we have for cash flow analysis a reserve value  $V^{CF}$  given by:

$$V^{CF} = \sum_{\substack{\text{Scenarios} \\ s}} p_s \sum_t CF(s)_t v(s)^t$$



Now one way to define an "equivalent" market value would be to use the  $p_s$ 's to define the lattices for the option pricing model. If  $v_0$  represents the discounting value at time 0, we get a reserve value  $V^M$  defined by

$$V^M = \sum_t v_0^t \sum_{\substack{\text{Scenarios} \\ s}} \sum_{t'} p_s CF(s)_{t'} v(s)^{t'-t}$$

In other words, the market reserve value looks suspiciously like the cash flow reserve value with the summations reversed. Can this analysis be carried through to completion, showing the two approaches to be equivalent, in principle at least? I don't know the answer; the above discussion can be viewed as a plea for volunteers to sharpen the questions and, hopefully, provide the proof.

Whether or not it proves to be equivalent to cash flow analysis, market value analysis yields certain advantages, such as: natural perturbation analysis, and additivity.

By "perturbation analysis" I mean an expression of the market value in a way that allows the approximation of changes for small changes in the interest rate structure. The standard approach to this sort of problem begins with the Taylor Series:

$$f(x) = f(x_0) + (x-x_0) f'(x_0) + 1/2 (x-x_0)^2 f''(x_0) + \dots$$

which may be applied to the reserve value V:

$$V(\delta + \Delta\delta) = V(\delta) + \Delta\delta V'(\delta) + 1/2 (\Delta\delta)^2 V''(\delta) + \dots$$

Here,  $\delta$  is the force of interest and  $V(\delta)$  is the market value of the cash flow stream (that is, the reserve value). From this expansion, we see that for small changes in interest rates, the fractional change in the market value is

$$D = -V'(\delta) / V(\delta)$$

This is called the (generalized) duration.

Note that for fixed cash flows, we have

$$\begin{aligned} V(\delta) &= \sum_t CF_t e^{-\delta t} \\ V'(\delta) &= -\sum_t tCF_t e^{-\delta t} \\ D &= \frac{\sum_t tCF_t e^{-\delta t}}{\sum_t CF_t e^{-\delta t}} \end{aligned}$$

which is the Macaulay duration. Interest-sensitive cash flows produce a generalized duration that differs from the Macaulay duration by having terms involving the first derivatives of the cash flow functions.

The (generalized) duration is, in a certain sense, additive: if

$$CF = CF^1 + CF^2$$

$$V = V_1 + V_2$$

and

$$D = \left( \frac{V_1}{V} \right) \cdot D_1 + \left( \frac{V_2}{V} \right) \cdot D_2$$

In other words, the duration of the sum of two cash flows is equal to the market-value-weighted sum of the durations. This fact can be useful in determining the impact of changes. For example, if the actuary knows the reserve value on a market basis, and if a new block of business is added, the impact of this change can be estimated.

The second-order expansion term also conveys useful information.

The quantity

$$C = V''(\delta) / V(\delta)$$

is called the convexity of the cash flow. To second order, the fractional change in market value is

$$\frac{V(\delta + \Delta\delta) - V(\delta)}{V(\delta)} \approx -\Delta\delta \cdot D + \frac{1}{2} (\Delta\delta)^2 \cdot C$$

Convexity plays a role in some ways analogous to the variance of the curve of results in cash flow analysis.

The analogies which we have been drawing lead to two final

research topics: (1) Is there an "implicit duration" in cash flow analysis? In other words, given a scenario structure with probability weighting, could the sensitivity of the resulting reserve to interest rate changes be quantified by a duration-like function? (2) Could market value analysis techniques be used to improve "formula reserves" in a two-track approach to U.S. statutory reserving? In other words, could we agree on an option-pricing formula for implicit options that could be added to statutory formula reserves?

Volunteers are urgently requested.

### C-2 RISK AND COMBINATIONS OF RISK

MR. DOUGLAS C. DOLL: Unlike the C-3 Risk, which has had lots of attention and has dominated cash flow analysis research the past few years, C-2 Risk (claims, expenses) has drawn little attention. More recently, the C-1 Risk has garnered much attention, but not the C-2 Risk. Perhaps this is because it is felt that actuaries have long been addressing C-2 Risk, and we feel comfortable that current statutory reserve methodology adequately covers the C-2 Risk.

In the Final Report of the Joint Committee on the Role of the Valuations Actuary in the United States, the C-2 Risk was described as follows:

[For valuation reserves] Can be large in disability and medical coverages, but smaller "normal" variations will occur in contracts involving mortality, provided appropriate reinsurance is used.

[For contingency surplus] Disability claims associated with C-1 Risk; epidemic; large variation in total death claims in a small company; a quantum jump in medical care claims; very poor underwriting of medical care or disability coverage in association or sponsored group; expenses in C-1 Risk inflation.

In the Valuation Actuary Handbook, which "should represent the latest techniques available in the public domain as of January, 1987," C-3 Risk scenario testing is covered, duration is analyzed, but the only section covering C-2 Risk is in Donald D. Cody's chapter, entitled "A Potential Approach To Valuation of Reserves and Surplus in Statutory Financial Statements."

#### THE C-2 RISK: THREE CATEGORIES

The first category is stochastic deviations in random events, for example, total death claims. Of course, that can be managed by a retention limit for mortality, but there is going to be some statistical fluctuation. If we are talking about reserves that are just barely adequate to cover C-3 Risks, then we also ought to take a look at the additional risk involved with total death claims. It may be a larger fluctuation for, let's say, surplus management than for reserve adequacy, but we ought to take a look at the effect on reserves as well. There is a lot of literature available on the probability distribution of total death claims.

Casualty actuaries are fairly advanced in this area. One of the casualty actuaries in our office has a personal computer program that he uses primarily for evaluating the amount of surplus or reserves a hospital should retain when it self-insures its medical malpractice, but it could also be used for such things as determining the expected fluctuation in mortality claims for a life insurance company. There's a paper in the 1983 Proceedings of the Casualty Actuarial Society, entitled "The Calculation of Aggregate Loss Distributions." There is a lot of other literature as well.

The second category of C-2 Risk is unpredictable single events. Earthquakes or, perhaps, epidemics might fall into that category. The prevailing wisdom seems to be that those are items that should be covered by surplus and not by reserves. There are some rules of thumb that have been developed as to how much target surplus one might hold, say, to protect yourself against something similar to the 1918 flu epidemic.

The third category is called judgment errors, for example, poor underwriting. One of the handouts distributed prior to this Symposium is from Session 4B. It is on CIA provisions for adverse deviation. It was devoted solely to what they called the misestimation of mean and possible deterioration of mean, which is the third category I just defined. It is a discussion draft and is still very preliminary. Even if you think the recommendations in the paper aren't appropriate, it's a very good checklist of some of the considerations that you

should make when trying to quantify the risk from misestimation of the mean.

### THE C-2 RISK TASK FORCE

There is a C-2 Risk Task Force that's part of the Committee on Valuation and Related Areas. They have addressed two issues with regards to C-2 Risk. The first issue involves Acquired Immune Deficiency Syndrome (AIDS), and the second involves group accidental and health coverage. The question came up as to whether the 1980 CSO mortality standard is still adequate in view of the extra mortality expected from AIDS. The Task Force did some analysis, and the conclusion they came up with was that the extra mortality due to AIDS is offset in aggregate by the improvement in mortality that has occurred since the 1980 tables were developed. Furthermore, they noted that if you did update the 1980 CSO tables, what you would do is to increase mortality at the younger ages and decrease it at the older ages. This would actually lower reserves if you use that to calculate reserves for a traditional product. So, the suggestion was that perhaps the 1980 CSO does not need to be changed. Note that the Society of Actuaries has a separate committee doing further analysis as to the impact of AIDS on life insurance company solvency. They have basically taken over from the C-2 Risk task Force on that.

The second issue involves group A&H. The C-2 Risk Task Force has produced an internal discussion paper on this. Daniel J. McCarthy,

who was chairman of the C-2 Risk Task Force, reported on it briefly at the New York Society of Actuaries meeting. The paper is still not finalized.

The Task Force is looking at surplus needs, but perhaps some of the techniques could be applied to reserves. The process that they are taking, first of all, involves breaking the group A&H business into different categories that might be expected to have similar experience, such as different kinds of coverage, LTD versus medical, different kinds of contracts, different experience arrangements, different marketing and different dividend margins.

Next, the Task Force is looking at the current margins that are anticipated in each category and performing an evaluation of the ways that bad experience might get into the future. That means that the Task Force is looking at where they are in the product cycle, since group A&H tends to run in cycles similar to property and casualty. They are considering where they are in the cycle, how bad they expect the next bad part of the cycle to get and looking at antiselection, and perhaps expense shortfalls.

Then, the Task Force looks at the potential that the insurance company would have to recover from the low point in the cycle, and that involves looking at the lag time that the company might have to respond, plus its ability to respond. How much ability will the company have to recoup past losses? Finally, they look at the



minimum amount of surplus that the company will need to have at the worst point in the future cycle (because an insurance company needs a certain amount of surplus to exist at any point in time). You discount all that back to the valuation date, and you can get a required surplus or a target surplus for the current point in time.

Mr. McCarthy also said that the Task Force is looking at an alternative to this particular analysis that would involve the additional constraint of looking at liquidity to make sure that they have the cash flows needed at the worst point in cycle. In other words, if the company has a lot of assets tied up in bricks and mortar and can't pay it out in claims, that's another consideration.

#### COMBINATION OF RISKS TASK FORCE (CORTF)

Let's move on to the next topic, combination of risks. The Combination of Risks Task Force of the Committee on Valuation and Related Problems has been very active during the past few years, although most of their work did not specifically address combination of risks. They began their work in mid-1983, and, consequently, their early work was developing the methodology for analyzing C-1, C-2 and C-3 Risks -- namely, cash flow projections and calculation of cash flow surplus.

The CORTF issued its final report on March 31, 1987. The report consists of a series of papers, most of which had been presented on in

various Society of Actuaries meetings. Two of these papers specifically address combination of risks. One is "Mathematical Concepts Underlying C-1, C-2 and C-3 Risks and Their Combinations" by Mr. Cody. Most of this material is included in Section 4 of Chapter VI of the Valuation Actuary Handbook. The other paper is by Linda Crout Dinius and gives some cash flow analysis of combinations of C-2 and C-3 Risks. A presentation of these results was made by James A. Geyer at the 1985 New Orleans Society of Actuaries meeting, and can be found in pages 1801-1813 of the 1985 Record.

In his paper, Mr. Cody takes his mathematical theory and comes up with a simplified proposal. Here is the formula.

$S_n$  = Required Surplus for "n"

$r_2$  = Correlation Coefficient

$$S_{1+2}^2 = S_1^2 + S_2^2 + (2)(r)(S_1)(S_2)$$

His simplified formula basically says that if we have Risk 1 and Risk 2, then the square of the required surplus for the combination of the risks is equal to the square of the required surplus for each separate risk plus two times the correction coefficient times the surplus required for each risk.

What does Mr. Cody mean by the "correlation coefficient?" Maybe an example would make that a little more clear: The C-2 disability

risk -- that is, the risk that disability claims may be higher than what you anticipated -- might have a fairly high correlation with the C-1 Risk, maybe even close to 1, because if the economy deteriorates, you're going to have a lot of defaults, and at the same time you're going to have a lot of disability claims. The C-1 and C-3 Risks have a correlation coefficient somewhere between 0 and 1. Mr. Cody suggests one-half. If you have a great deal of fluctuation in interest rates, the assumption is that the economy has some strange things going on, and that might give you a fair amount of defaults. Finally, the mortality risk and the C-3 Risk might be considered to have a correlation coefficient of 0.

There are some underlying assumptions that are required to be made before this simplified mathematical formula is appropriate. The first is that risks are additive. The required surplus if each of the two risks happens is the same as the sum of the required surplus for each risk. An example in which that is not so is: Consider a required surplus needed for the C-2 Risk that mortality is going to get worse in the future, plus another required surplus needed for the C-3 interest rate fluctuation risk. If you combine those two risks and you have both fluctuating interest rates and higher mortality, it may happen that because of the interest fluctuation you have excess lapses, and the extra mortality may not be as bad because of less business in force. On the other hand, due to antiselection on lapse, mortality may be worse. So, that's a situation in which the surplus needed for both risks happening at the same time

could be higher or less than the sum of the two surpluses, calculated separately.

The other underlying assumption is that of a normal probability distribution. We've talked a little bit about the distribution of the C-3 Risk, and that some additional research as to just what that distribution is needs to be done, particularly in the tails. The distribution for excess mortality has been shown not to be normally distributed. However, Mr. Cody makes a valid point that the formulas contain an unknown level of error, but that's presumed not to be material relative to the errors of estimation in input to the models. That's something we always need to keep in mind. We've put in certain assumptions to our model. We put in a lapse function that says if the interest rates go up, we're going to get certain excess lapses. There's a lot of subjectivity in those assumptions. So, if that's a very vague assumption, perhaps we shouldn't quibble too much about the absolute precision of these combination of risks formulas.

In the 1985 Record, there were some cash flow analyses performed on a combination of C-2 Risk and C-3 Risk for a single premium life policy. In the writeup they admit or assert that the probability distribution of the C-3 risk results was not normally distributed. They used a student's T distribution for excess mortality. They ran their model, and calculated the required surplus to cover 95% of future scenarios. When they did each risk separately they came up with the

C-2 Risk requiring surplus equal to .6% of the initial reserves, and the C-3 Risk requiring 0% surplus. When they simply summed the two amounts they came up with .6%. When they applied Mr. Cody's formula, they also came up with .6%. However, when they combined the two risks in their model they actually came up with 1.2%. So, the sum, which you would expect to be conservative, and Mr. Cody's formula both understated the required surplus.

There were two reasons given for this. One, which I guess should be pretty evident, was the fact that the product had certain margins in it such that the expected profits of the product were positive. When they tested each risk separately, they were counting those margins for each risk. When they combined the risks, those margins were only available to cover one or the other. They're not available to cover both. So that's why they got a higher required surplus when they combined the risks. The second reason was the fact that the probability distribution was not normal.

When they tried to cover 99% of scenarios, they found that the C-2 Risk had a surplus requirement of 2.2% of reserves, and the C-3 had a requirement of 3.0% of reserves. So, when they sum the two you get 5.2%. Mr. Cody's formula gave a result of 3.7%. The actual result was 4.6% -- that is, higher than what the formula provides. Most of the difference was attributable probably to the fact that the results were not normally distributed.

I believe that further research into combination of risks is probably going to be dependent upon additional knowledge being obtained about the C-3 Risk, since we seem to have fairly good knowledge about the C-2 Risk, at least with regards to mortality.

### MEASURING C-1 RISK

MR. GREGORY D. JACOBS: I'd like to make a few comments about current practices and current research with respect to measuring C-1 Risk, the risk of default.

The first type of current practice I'm aware of is to ignore the C-1 Risk. You might laugh a little bit, but I have a feeling that most of us ignore this risk when we price products or establish reserves. We don't do much with the C-1 Risk. Probably the reason why we don't is because of the Mandatory Securities Valuation Reserve (MSVR).

We probably assume that the MSVR is sufficient to cover this risk. I just don't think that that's a valid assumption anymore. The main purpose the MSVR serves right now is simply as a net worth or a statutory surplus stabilizing account.

First, some of the problems with MSVR are that it is based on a set formula. It's the same for all companies. It doesn't measure at all what each company does in their credit analyses. It doesn't measure

the diversifications of their assets.

Second, there is also a good possibility that it will move in the wrong direction given the risk situation you have just undertaken. For example, look at the situation in which capital gains or losses run directly through MSVR before they hit your surplus account. You can get out of a risk investment by selling it and taking a capital gain. Your risk profile went down, but your MSVR went up. So your MSVR moved the wrong way for the wrong reason.

Third, another problem with MSVR is there is no component for mortgages nor for real estate, and those are heavily invested assets in at least the United States. Finally, the MSVR builds up gradually over time. Reserves are generally required at the time a risk is taken. You generally don't have the luxury of gradually setting a reserve up over time. One final comment about the MSVR, changes in the MSVR are reflected "below the line," so you don't have a profit impact due to changes in your MSVR account. Whereas, if you do something to your reserve, it has a definite profit impact. A very good Transactions Discussion in Vol. 38 was written by Barry Paul on this subject that I would advise you to read. The discussion is of Richard Sega's article, "A Practical C-1."

Another common practice in dealing with the C-1 Risk is reflected in this case study. That is the default holdback from interest earnings. We used a 5 basis point holdback for investment grade

bonds and a 150 basis point holdback on junk bonds or below investment grade bonds. This holdback is basically treated as an expense. It is removed from the cash flow and presumably is deposited into some sort of a C-1 fund. This C-1 fund is the reserve that you have for defaults.

Another approach is the use of a default rate formula. This is more in the area of research than current practice. Historical default rates for certain asset types can be studied and related to different types of economic factors. Through regression analysis, a default rate formula can be developed and used in a cash flow projection.

A final approach that has been worked on by Mr. Buff and his COVARA Committee is what I'll call C-1 Monte Carlo Modeling. Using cash flow analysis techniques and Monte Carlo random trials of default rates (under a level interest rate environment to look solely at the C-1 Risk), cash flow projections with variations in default rates can be used to quantify the C-1 Risk reserve.

Finally, another area where we can get some help in evaluating C-1 Risks is through the credit analysis techniques from the investment profession.

One final editorial comment. The C-1 Risk hasn't been a major problem, except for those of us that lived through the 1930s.



However, my investment friends have consistently warned me about the default risk. They seem to think it's the biggest risk that we are facing in the insurance industry, with the possible exception of AIDS. Their reason is that the last five or so years have been unprecedented as far as economic growth in the United States. With all the leveraged buyouts and with all the newly issued below-investment-grade securities that are in the market, we have no historical perspective of the default risk on that type of issue. If the economic growth slows down or stops, the feeling is that a lot of these issues will not be able to pay their debt. The area of C-1 Risk analysis and quantification is an important one that warrants some good research.

#### SMALL COMPANY APPROXIMATIONS

MR. DOUGLAS C. DOLL: When we first put this on the agenda it was our hope that we would actually be able to give some techniques that small companies could use to alleviate some of the complexities of cash flow projections. I guess that's going to require a more able group than this group. The Small Company Task Force of the NAIC Advisory Committee also was unable to come up with a recommended set of valuation approaches that might apply only to small companies. I guess the key point here is that really there's no special reason why a small company is going to have any less risk than a large company from these various C-1, C-2, C-3 Risks that we are talking about.

## SMALL COMPANY TASK FORCE RECOMMENDATION

What did the Small Company Task Force recommend? They recommended that the new valuation law be constructed so that a company, large or small, would not be subject to doing the elaborate projections that we've been talking about. So the Task Force envisioned a two-level reserve basis with a standard reserve basis that does not involve such projections, but a smaller minimum reserve basis if the company could do the appropriate projection to justify those reserves. They say further that, in the case of contracts which are interest sensitive, the reserve basis be set at a level such that such business would only be affordable to a company if it was insignificant. So, they recognize the fact that these risks do exist, and you have to deal with them. You can't just ignore them. Maybe, for political reasons, something will be done for small companies, but from an actuarial point of view there wasn't much that could be done.

What we thought we might do is perhaps we could each give a few comments as to what small companies could do. Perhaps these could also be done for large companies as well. I had a very short list. One is if you want to simplify things, you just use a less elaborate liability model, especially for non-interest sensitive lines of business. That would be one way of simplifying things. Another way to simplify things is to use "standard assumptions." For a very small company internal experience might not be considered reliable. So, you're not

going to go through the expense of trying to do a particular study. I wrote Mr. Dicke a note and said that standard assumptions are easy for consultants to provide, and he didn't say I couldn't say that here. So, now it's said. Regarding asset projections, in many cases asset projections are probably easier to do seriatum rather than modeling, maybe even more so for a small company. So, I don't think there's any simplifying that you can do on the asset projection.

Another simplifying method that can be done is to limit the number of scenarios. We'll probably see the small companies looking at the research being done by large companies regarding which scenarios are appropriate. I doubt that small companies will do thousands of scenarios. They just can't afford to do that. But some of the big companies may do that and report on their results.

For a small company it probably is more appropriate to buy rather than build a projection program. A large company has the luxury of being able to build a projection program that can include all the special "bells and whistles" that might be unique to that company. A small company perhaps might have such unique features, too, but might be able to find some ways to work with an existing program and force that in.

So, the major point is there's no magic approximate formula for small companies, at least none that we were able to come up with.

APPENDIX C

ACTUARIAL STATEMENT OF OPINION

CASE STUDY LIFE INSURANCE

I, Doug A. Greg, M.A.A.A., F.S.A., Vice President and Actuary, am an officer of the Case Study Life Insurance Company and was appointed by the Board of Directors of Case Study Life as stated in the copy of the Board resolution dated September 14, 1986 submitted with the letter to the Chief, Actuarial Valuation Bureau dated September 20, 1986. I am familiar with current valuation laws and procedures.

I have examined the actuarial assumptions and actuarial methods used in determining policy reserves and related actuarial items listed below, as contained in the Annual Statement of Case Study Life, prepared for filing with State regulatory officials, as of December 31, 1986.

	<u>Amount of Reserves</u>	<u>Annual Statement Location</u>
Single Premium Deferred Annuities	\$643,059,363	Exhibit 8B, Line 8
Supplementary Contracts Including Life Contingency	\$5,000,000*	Exhibit 8E, Line 20
Supplementary Contracts Not Including Life Contingency	\$3,000,000*	Exhibit 8c, Line 25

\*Note: For supplementary contracts extensive testing was not done and the statutory reserves established were 105% of the otherwise minimum reserves that were used.

I have considered the provisions of the Company's in force contracts, the applicable experience rating plans or dividend distribution policies, and the related administrative expenses for the product categories stated above. I have considered any reinsurance agreements pertaining to the contracts, the dividend experience rating plan or interest crediting philosophy, the characteristics of the Company's assets, and the investment policy as they might affect future insurance and investment cash flows under the contracts and invested assets. My examination included such tests and calculations as I considered necessary to form the opinion stated below.

The unit expenses in the cash flow tests were based on a "going-concern basis" for contracts in force on the valuation date, with reasonable margins for adverse deviations, for various paths of future interest rates. Where appropriate, new considerations on lives covered at the valuation date were considered, but no new lives were covered. Where appropriate, insurance and investment cash flows were varied with changes in the level of prevailing interest rates. The assets and reserves are consistent with Annual Statement data. I caused the investment cash flows to be varied with the insurance cash flow and with the various projected interest scenarios.

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 contracts in force and other associated data prepared by Ad. M. Strate, Vice President, and We. R. Ker, Actuary. In addition, I have relied upon listings and summaries of current assets and other associated data prepared by Messrs. Strate and Ker. I have performed no verification as to the accuracy of these data, but have reviewed the results for reasonableness.

I have relied on the stated investment policy of the Company as provided by Per. N. Charge, Senior Vice President, Corporate Investments.

In my opinion, the contract reserves and other actuarial items resulting from the products identified above:

- (i) are computed in accordance with consistently applied, commonly accepted actuarial standards, and are fairly stated, in accordance with sound actuarial principles.
- (ii) are based on actuarial assumptions which produce reserves at least as great as those called for in any contract provision as to reserve basis and method, and are in accordance with all other contract provisions;
- (iii) meet the requirements of the Insurance law of New York;

(iv) are computed on the basis of assumptions consistent with those used in computing the corresponding items in the Annual Statement of the preceding year-end;

(v) along with the assets held by the Company in support of such reserves, make good and sufficient provision, according to presently accepted actuarial standards of practices, for the projected cash flows including those required by the contractual obligations and related expenses of the Company.

This opinion is updated annually as required by statute. The impact of events unanticipated in the projections, and occurring subsequent to the "as of" date of this opinion, is beyond the scope of this opinion. However, events occurring between the "as of" date and the date the report was completed have been reviewed for materiality. Any event materially impacting upon the opinion has been noted. The cash flow portion of this opinion should be viewed recognizing that the Company's future experience cannot follow all the assumptions used in the cash flow projections.

---

Doug A. Greg  
Vice President and Actuary

February 15, 1987

ACTUARIAL MEMORANDUM

Supporting the

ACTUARIAL OPINION

Pursuant to Section 4217 of the

New York State Valuation Law

Case Study Life Insurance Company

Valuation Date: December 31, 1986



## SCOPE

### Products Tested

For SPRDA's extensive testing was done. Because of the small size of the supplementary contract reserves, it was determined that testing would not be done this year and instead additional reserves equaling 5% of the otherwise minimum reserves were set up in the Annual Statement.

#### I. Reserves and Products

##### A. Product Description:

##### 1. Deferred Annuities

The Single Payment Retirement Deferred Annuity (SPRDA) is designed for the non-qualified market. This product guarantees a modest interest rate during the accumulation phase (i.e., 4%). Interest credited to these contracts accumulate on a tax deferred basis. Above the modest guaranteed rates, these products pay current interest rates. Throughout the year the investment climate is reviewed and, as warranted, new rates are declared.

These products do not permit future considerations.  
The minimum contract size is \$10,000.

These contracts provide a level payout of the guaranteed benefits. These contracts are participating, however, we do not anticipate that any dividends will be payable.

There is a charge for early surrender, ranging from 7% in the first contract year, and grading down to zero after 7 years.

B. Sources of Liability In Force

The data for the deferred annuities and supplementary contract liability in force comes from the current administrative file appropriately adjusted to be consistent with the annual statement data. The data includes such items as: number of contracts, accumulation value, issue year, maturity year and amount of annual income benefit.

We've relied on Mr. Ad. M. Strate for the accuracy of the in force data on the deferred annuity and Supplementary Contract Administrative files.

To the best of our knowledge no binding commitments exist as of the valuation date.

## II. Assets

### A. Asset Description

Generally, it is our policy to acquire assets that are consistent with the annuity product sold. Essentially, all assets currently acquired for the products included in this memorandum are done with regard to appropriate liability matching.

Assets held in support of the reserves included in this memorandum consist primarily of high quality bonds, agency mortgage-backed pass through securities, and other liquid assets. Investments backing these products are held in directed asset pools and as investment period assets. All assets included are of investment quality, and none are more than 3 months in default. A list of assets is attached.

### B. Source of the Asset In Force Data

The asset in force primarily comes from the administrative systems that support company's accounting records. The type of data used to determine the cash flow of assets include such items as: book value, market value, par amount, coupon rate, coupon pay dates, yield rate, maturity date, call date and call price.

we have relied on Mr. Per N. Charge of the Investment Department for the accuracy of the asset data. The value of the assets are equal to the value of the reserves. A list of the assets are included in Appendix B.

Investment Income is allocated in manner consistent with the basis filed and approved by New York State; however, it is understood that all of the assets support all of the liabilities.

C. Meetings with Investment Department

Per N. Charge, Chief Officer of the Investment Department, is formally in charge of all investment data and policies. However, meetings are held at least bi-weekly with the actuaries and investment people to discuss current investment strategies and any needed changes.

III. Methods Used to Project Cash Flows

A. General Matters

The insurance and investment cash flows were projected on an annual basis under the assumed interest rate scenarios. Projections extend over a period of 20 years.

The cash flow projections were used as input into a model which, for each year, nets the current year asset and liability cash flows. Any net asset cash flow is then used for reinvestment. Both administrative expenses and federal tax liability have been considered in these projections.

B. Insurance Cash Flow

In projecting the insurance cash flows, we've taken into consideration all of the items previously described above in the Product Description Section (Section I.A.). In addition, we've considered the following items:

1. Two interest crediting philosophies on deferred annuities were tested: (1) Crediting 150 basis points less than the net rate earned on the assets,\* and (2) crediting the greater of the one year T-bill and a 5 year rolling average of 5 year Treasury bonds. We are currently crediting 150 basis points less than our net earned rate,\* but thought it instructive to all examine the results if the alternate interest crediting philosophy were used.

\*Earned rate net of both investment management fees and respective default holdback.

2. Lapse rates, maturity rates, dormancy rates, and additional consideration rates have been considered where applicable. The effect on these rates by the interrelationship between the interest crediting rates, current market rates and surrender charges has also been taken into consideration.
3. While contractually possible, it is not expected that dividends will be paid to deferred annuity contract-holders due to the nature of this business.
4. For details as to the lapse, dormancy, and maturity rates, refer to Appendix A.

C. Investment Cash Flows

In projecting the investment cash flows, we've taken into consideration all of the items previously discussed above in the Asset Description Section (Section IIA). In addition, we've considered the following items.

1. Calls and prepayment provisions have been reflected based on loan provisions and market conditions. The call trigger of 200 basis points was used, which means that if market rates on comparable new securities were 2% below a securities coupons that security was assumed to be called.

2. We've considered scheduled cash flows including expected investment income and repayments of principal.
3. Investment expenses have been considered.
4. Appropriate provisions have been made for the default risk by a reduction in investment income. This reduction is as follows:

<u>Type of Asset</u>	<u>Basis Point Reduction</u>
Government and Government Agency Securities	0
Investment Grade Corporate Bonds and Mortgages	5
Agricultural Mortgages	75
Below Investment Grade Bonds	150

The provisions for the default risk also recognized the availability of the MSVR, although MSVR was not included as part of the reserves.

We relied on Per N. Charge of the Investment Department for investment cash flows and reviewed these results for reasonableness.

#### IV. Scenarios Tested

The interest rate scenarios being tested were stochastically generated. In addition, the seven interest scenarios mentioned in New York Regulation 126 were examined. The assumptions

used to determine the beginning interest rates are consistent with the product.

Several reinvestment philosophies were examined for positive cash flow , These options were as follows:

1. 100% in GNMA's
2. 100% in 5 year A rated corporate bonds
3. Invest in highest yielding asset up to 10 years.

It is anticipated at this time that the investment strategy is dynamic but it is felt that the above philosophies represented possible actual scenarios.

The model invests net positive cash flows in investments consistent with the above investment policies. Negative cash flows are treated as short-term borrowing at a rate equal to the one-year Treasury bill plus one percent.

Our current investment policy is to invest in 5 year Corporate Bonds.

Refer to Appendix C for a description of each scenario and the results.



The lapses assumption is defined as follows: the formula is dynamic, and is equal to a baseline amount plus two times the spread squared. The spread is defined as the difference between the credited rate and the greater of 1) one year treasuries or 2) a 5 year rolling average of 5 year treasuries.

V. Summary of Results

A. Numerical Results

Numerical results are given in Appendix C.

SECTION 1  
VALUATION ACTUARY SYMPOSIUM  
CASE STUDY LIFE  
SPDA PRODUCT

Valuation Date: December 31, 1986

In force:

<u>Issue Year</u>	<u>Policy Count</u>	<u>Account Value</u>	<u>Cash Value</u>	<u>CARVM Reserve</u>	<u>Valuation Interest Rate</u>
1980	3,700	\$ 92,500,000	\$ 92,037,500	\$ 92,037,500	7.75%
1981	4,000	116,500,000	114,752,500	114,752,500	9.00
1982	3,500	92,500,000	90,188,963	90,188,963	10.00
1983	3,000	85,000,000	82,024,035	82,024,035	8.75
1984	3,300	109,200,000	104,286,287	104,286,287	8.50
1985	5,500	128,900,000	121,808,610	121,808,610	8.50
1986	1,500	40,600,000	37,961,468	37,961,468	7.25
<b>Total:</b>	<b>24,500</b>	<b>\$665,200,000</b>	<b>\$643,059,363</b>	<b>\$643,059,363</b>	

Product Design: No loads.

Surrender Charges: 7% in first year, graded to 0% in year 8.

4% guaranteed interest.

Interest Crediting Strategy

- A. Portfolio Earned less 150 Basis Points
- B. Market Rate (Greater of 1 year Treasury or 5 year average of 5 year treasuries).

Taxes: Assumed payable at 34% of net gain per year.

Mortality: 1965-70 Ultimate ANB Male  
 Assume all issues are age 50.

Lapses: Baseline Lapse Rate  
 5% per year up to Age 60, increasing 2% per year up to maximum of 25%.

Dynamic Lapse Formula

$$\text{Lapse Rate} = \text{Baseline} + 2 \cdot \text{Spread}^2$$

**Expenses:** 5% Commissions  
 \$125 per policy - Acquisition  
 \$ 30 per policy - Maintenance  
 Inflated at 4% less than the 5 year Treasury rate  
 .25% Investment Expense

**Assets:** Attached

**Investment Strategy:**  
 A. Invest all positive cash flows in GNMA's  
 B. Invest all positive cash flows in 5 year A-Rated Corporate Bonds.  
 C. Invest all positive cash flows in highest yielding security (up to 10 years).

Negative cash flows are treated as borrowing at a rate of the 1 year treasury rate plus 1%.

**New Securities:** GNMA - 30 year, purchased at Par Coupon = 10 year A-Rated prepayment - 5 + 3 (spread) + 2 (Spread)<sup>2</sup>

Corporate Bond - Terms 1 - 10 years, purchased at Par Coupon = (1.05 Treasury) - 25 Basis Points Non-Callable

**Default Holdback:** 5 Basis-point holdback for investment grade security. 150 Basis-point holdback for junk bonds (See investment ratings chart.)

**12/31/86 Treasury**

Yield Curve: Nominal	<u>Term</u>	<u>Rate</u>	<u>Term</u>	<u>Rate</u>
	Cash	6.29%	7	6.63%
	1	6.30	10	6.96
	2	6.33	15	7.56
	3	6.36	20	8.17
	5	6.47		

**Yield Curve Universe:** Attached

**Yield Curve Movement Probabilities:** Attached

Investment Ratings

<u>S&amp;P's</u>	<u>Moody's</u>	
AAA	AAA	I
.	.	N
.	.	V
BBB+	BAA1	G
.	.	R
.	.	D
BBB-	BAA4	
<hr/>		
BB+	BA1	J
.	.	U
.	.	N
.	.	K

(3107r)

**CASE STUDY LIFE INSURANCE COMPANY**  
**YIELD CURVE UNIVERSE**  
**12/31/86**

CURVE #	SHORT TERM	MATURITY																				CURVE #	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		21
1	0.64	0.65	0.66	0.69	0.73	0.77	0.83	0.89	0.96	1.04	1.13	1.23	1.34	1.46	1.59	1.72	1.87	2.02	2.18	2.35	2.54	2.72	1
2	1.01	1.02	1.04	1.07	1.10	1.15	1.20	1.27	1.34	1.42	1.51	1.61	1.72	1.84	1.96	2.10	2.24	2.40	2.56	2.73	2.91	3.09	2
3	1.39	1.40	1.42	1.45	1.48	1.53	1.58	1.64	1.72	1.80	1.89	1.99	2.10	2.21	2.34	2.47	2.62	2.77	2.93	3.11	3.29	3.47	3
4	1.77	1.78	1.80	1.82	1.86	1.90	1.96	2.02	2.09	2.17	2.26	2.36	2.47	2.59	2.72	2.85	2.99	3.15	3.31	3.48	3.66	3.84	4
5	2.14	2.15	2.17	2.20	2.23	2.28	2.33	2.40	2.47	2.55	2.64	2.74	2.85	2.97	3.09	3.23	3.37	3.52	3.69	3.86	4.04	4.22	5
6	2.52	2.53	2.55	2.58	2.61	2.66	2.71	2.77	2.85	2.93	3.02	3.12	3.22	3.34	3.47	3.60	3.75	3.90	4.06	4.23	4.41	4.59	6
7	2.90	2.91	2.93	2.95	2.99	3.03	3.09	3.15	3.22	3.30	3.39	3.49	3.60	3.72	3.84	3.98	4.12	4.28	4.44	4.61	4.79	4.97	7
8	3.28	3.28	3.30	3.33	3.37	3.41	3.46	3.53	3.60	3.68	3.77	3.87	3.98	4.09	4.22	4.36	4.50	4.65	4.81	4.98	5.16	5.34	8
9	3.65	3.66	3.69	3.73	3.77	3.83	3.91	3.99	4.09	4.20	4.32	4.44	4.57	4.69	4.81	4.93	5.05	5.18	5.30	5.42	5.54	5.66	9
10	4.03	4.04	4.07	4.10	4.15	4.21	4.28	4.37	4.47	4.58	4.70	4.82	4.94	5.06	5.19	5.31	5.43	5.55	5.67	5.79	5.92	6.04	10
11	4.41	4.42	4.44	4.48	4.53	4.59	4.66	4.75	4.84	4.95	5.08	5.20	5.32	5.44	5.56	5.68	5.81	5.93	6.05	6.17	6.29	6.41	11
12	4.78	4.79	4.82	4.86	4.90	4.97	5.04	5.12	5.22	5.33	5.45	5.57	5.69	5.82	5.94	6.06	6.18	6.30	6.42	6.55	6.67	6.79	12
13	5.16	5.17	5.20	5.23	5.28	5.34	5.41	5.50	5.60	5.71	5.83	5.95	6.07	6.19	6.31	6.44	6.56	6.68	6.80	6.92	7.04	7.16	13
14	5.54	5.55	5.57	5.61	5.66	5.72	5.79	5.88	5.97	6.08	6.20	6.33	6.45	6.57	6.69	6.81	6.93	7.05	7.18	7.30	7.42	7.54	14
15	5.91	5.93	5.95	5.99	6.03	6.10	6.17	6.25	6.35	6.46	6.58	6.70	6.82	6.94	7.07	7.19	7.31	7.43	7.55	7.67	7.79	7.92	15
16	6.29	6.30	6.33	6.36	6.41	6.47	6.54	6.63	6.73	6.84	6.96	7.08	7.20	7.32	7.44	7.56	7.68	7.81	7.93	8.05	8.17	8.29	16
17	6.72	6.73	6.76	6.79	6.84	6.90	6.97	7.05	7.15	7.25	7.37	7.49	7.61	7.72	7.84	7.96	8.08	8.20	8.31	8.43	8.55	8.67	17
18	7.26	7.27	7.29	7.32	7.37	7.42	7.49	7.57	7.66	7.75	7.87	7.98	8.09	8.20	8.31	8.42	8.53	8.64	8.75	8.86	8.97	9.08	18
19	7.90	7.91	7.93	7.96	8.00	8.05	8.11	8.18	8.26	8.34	8.44	8.54	8.64	8.74	8.84	8.94	9.04	9.14	9.24	9.34	9.44	9.54	19
20	8.64	8.65	8.67	8.69	8.73	8.77	8.82	8.88	8.95	9.02	9.11	9.19	9.27	9.36	9.44	9.53	9.61	9.69	9.78	9.86	9.94	10.03	20
21	9.49	9.50	9.51	9.53	9.56	9.59	9.63	9.68	9.73	9.78	9.85	9.91	9.98	10.04	10.11	10.17	10.24	10.30	10.37	10.43	10.49	10.56	21
22	10.45	10.45	10.46	10.48	10.49	10.51	10.54	10.57	10.60	10.64	10.68	10.72	10.76	10.80	10.84	10.88	10.92	10.96	11.00	11.04	11.09	11.13	22
23	11.51	11.51	11.52	11.52	11.53	11.53	11.54	11.55	11.56	11.57	11.59	11.60	11.61	11.63	11.64	11.65	11.67	11.68	11.69	11.71	11.72	11.73	23
24	12.68	12.68	12.67	12.67	12.67	12.66	12.65	12.64	12.63	12.62	12.60	12.59	12.57	12.56	12.54	12.52	12.50	12.47	12.45	12.42	12.40	12.37	24
25	13.95	13.95	13.94	13.93	13.91	13.89	13.87	13.84	13.81	13.77	13.73	13.69	13.64	13.59	13.53	13.47	13.41	13.34	13.27	13.19	13.11	13.03	25
26	15.33	15.32	15.31	15.29	15.26	15.22	15.18	15.13	15.08	15.02	14.95	14.87	14.79	14.70	14.60	14.50	14.39	14.27	14.14	14.01	13.87	13.74	26
27	16.81	16.80	16.78	16.75	16.71	16.66	16.60	16.52	16.44	16.35	16.25	16.14	16.02	15.89	15.74	15.59	15.43	15.26	15.07	14.88	14.68	14.47	27
28	18.40	18.38	18.36	18.31	18.26	18.19	18.11	18.01	17.90	17.78	17.64	17.49	17.33	17.15	16.96	16.75	16.54	16.30	16.06	15.80	15.52	15.25	28
29	20.09	20.07	20.04	19.98	19.91	19.83	19.72	19.60	19.46	19.30	19.12	18.93	18.72	18.49	18.25	17.99	17.71	17.41	17.09	16.76	16.41	16.06	29
30	21.89	21.86	21.82	21.76	21.67	21.56	21.43	21.28	21.11	20.91	20.70	20.46	20.20	19.92	19.61	19.29	18.94	18.57	18.18	17.77	17.34	16.91	30
31	23.79	23.76	23.71	23.63	23.53	23.40	23.24	23.06	22.85	22.61	22.35	22.07	21.75	21.42	21.05	20.66	20.24	19.80	19.33	18.83	18.31	17.79	31

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BEGINNING YIELD CURVE = 16

CASE STUDY LIFE INSURANCE COMPANY

YIELD CURVE PROBABILITIES

ENDING	-----BEGINNING CURVE-----																																
CURVE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
1	20.0	12.5	6.3	5.0	2.5																												
2	20.0	12.5	12.5	10.0	5.0	2.5																											
3	20.0	25.0	18.8	15.0	10.0	5.0	2.5																										
4	20.0	25.0	25.0	20.0	17.5	10.0	5.0	2.5																									
5	20.0	12.5	18.8	20.0	30.0	17.5	10.0	5.0	2.5																								
6		12.5	12.5	15.0	17.5	30.0	17.5	10.0	5.0	2.5																							
7			6.3	10.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5																						
8				5.0	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5																					
9					2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5																				
10						2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5																			
11							2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5																		
12								2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5																	
13									2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5																
14										2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5															
15											2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5														
16												2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5													
17													2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5												
18														2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5											
19															2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5										
20																2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5									
21																	2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5								
22																		2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5							
23																			2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5						
24																				2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5					
25																					2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5				
26																						2.5	5.0	10.0	17.5	30.0	17.5	10.0	5.0	2.5			
27																							2.5	5.0	10.0	17.5	30.0	17.5	15.0	12.5	12.5		
28																								2.5	5.0	10.0	17.5	20.0	18.8	12.5	20.0		
29																									2.5	5.0	10.0	17.5	20.0	25.0	25.0	20.0	
30																										2.5	5.0	10.0	15.0	18.8	25.0	20.0	
31																											2.5	5.0	5.0	6.3	12.5	20.0	

BEGINNING YIELD CURVE = 16

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**CASE STUDY LIFE INSURANCE COMPANY  
RISK ANALYSIS SYSTEM**

PRODUCT: SPDA - NEW YORK SCENARIOS - REG 126

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YIELD CURVE NUMBERS FOR EACH PERIOD  
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TRIAL	12/86	12/87	12/88	12/89	12/90	12/91	12/92	12/93	12/94	12/95	12/96	12/97	12/98	12/99	12/00	12/01	12/02	12/03	12/04	12/05	12/06
1	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
2	16	17	18	19	20	21	22	23	24	25	25	25	25	25	25	25	25	25	25	25	25
3	16	17	18	19	20	21	20	19	18	17	16	16	16	16	16	16	16	16	16	16	16
4	16	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
5	16	15	14	13	12	11	10	9	8	7	7	7	7	7	7	7	7	7	7	7	7
6	16	15	14	13	12	11	12	13	14	15	16	16	16	16	16	16	16	16	16	16	16
7	16	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
MEAN:	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
HIGH:	16	22	22	22	22	22	22	23	24	25	25	25	25	25	25	25	25	25	25	25	25
LOW:	16	10	10	10	10	10	10	9	8	7	7	7	7	7	7	7	7	7	7	7	7
STANDARD DEVIATION:	0	3	4	4	4	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6

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SECTION 2

CASE STUDY LIFE INSURANCE COMPANY

DESCRIPTION OF ASSETS

The total book value of assets as of December 31, 1986, is \$643,059,363.

These assets are summarized below and on the following pages:

Breakdown by Type (000's omitted)

Bonds	\$609,476	11.79% Nominal Yield
GNMA	33,583	9.39% Nominal Yield

Breakdown by Call Provision (000's omitted)

Callable	\$348,415	12.41% Nominal Yield
Non-Callable	294,645	10.79% Nominal Yield

Breakdown by Quality (000's omitted)

BBB or Better	\$581,758	11.48% Nominal Yield
Below BBB	61,301	13.48% Nominal Yield

Also attached is a completed detailed listing of assets as supplied by the Investment Department.



CASE STUDY LIFE INSURANCE COMPANY

SUMMARY OF BOOK VALUE OF EXISTING ASSETS - 12/31/86  
(IN THOUSANDS)

GNMAS

	0+ TO 10 PERCENT CBE COUPON	10+ TO 16 PERCENT CBE COUPON	16+ TO 21 PERCENT CBE COUPON	21+ TO 29 PERCENT CBE COUPON	TOTAL
ATC					
0+ TO 2 YEAR	0	0	0	0	0
2+ TO 5 YEAR	0	0	0	0	0
5+ TO 10 YEAR	0	0	0	0	0
10+ TO 25 YEAR	33,583	0	0	0	33,583
25+ TO 30 YEAR	0	0	0	0	0
TOTAL:	33,583	0	0	0	33,583

NOMINAL YIELD (CBE): 9.39

BONDS

	0+ TO 10 PERCENT CBE COUPON	10+ TO 16 PERCENT CBE COUPON	16+ TO 21 PERCENT CBE COUPON	21+ TO 29 PERCENT CBE COUPON	TOTAL
0+ TO 2 YEAR	13,135	6,478	0	0	19,613
2+ TO 5 YEAR	21,742	119,287	8,192	0	149,221
5+ TO 10 YEAR	75,682	279,841	0	3,753	359,276
10+ TO 25 YEAR	41,322	13,672	0	0	54,994
25+ TO 30 YEAR	19,867	6,505	0	0	26,372
TOTAL:	171,749	425,782	8,192	3,753	609,476

NOMINAL YIELD (CBE): 11.79

CASE STUDY LIFE INSURANCE COMPANY

SUMMARY OF BOOK VALUE OF EXISTING ASSETS - 12/31/86  
(IN THOUSANDS)

CALLABLE BONDS

	0+ TO 10 PERCENT CBE COUPON	10+ TO 16 PERCENT CBE COUPON	16+ TO 21 PERCENT CBE COUPON	21+ TO 29 PERCENT CBE COUPON	TOTAL
0+ TO 2 YEAR	0	0	0	0	0
2+ TO 5 YEAR	0	36,699	0	0	36,699
5+ TO 10 YEAR	47,470	249,063	0	0	296,533
10+ TO 25 YEAR	8,678	0	0	0	8,678
25+ TO 30 YEAR	0	6,505	0	0	6,505
TOTAL:	56,148	292,266	0	0	348,415

AVERAGE CALL PRICE (PCT OF PAR): 101.59  
NOMINAL YIELD (CBE): 12.41

NON-CALLABLE BONDS

	0+ TO 10 PERCENT CBE COUPON	10+ TO 16 PERCENT CBE COUPON	16+ TO 21 PERCENT CBE COUPON	21+ TO 29 PERCENT CBE COUPON	TOTAL
0+ TO 2 YEAR	13,135	6,478	0	0	19,613
2+ TO 5 YEAR	21,742	82,589	8,192	0	112,522
5+ TO 10 YEAR	28,212	30,778	0	3,753	62,743
10+ TO 25 YEAR	66,227	13,672	0	0	79,899
25+ TO 30 YEAR	19,867	0	0	0	19,867
TOTAL:	149,184	133,516	8,192	3,753	294,645

NOMINAL YIELD (CBE): 10.79

CASE STUDY LIFE INSURANCE COMPANY

SUMMARY OF BOOK VALUE OF EXISTING ASSETS - 12/31/86  
(IN THOUSANDS)

INVESTMENT GRADE SECURITIES

	0+ TO 10 PERCENT CBE COUPON	10+ TO 16 PERCENT CBE COUPON	16+ TO 21 PERCENT CBE COUPON	21+ TO 29 PERCENT CBE COUPON	TOTAL
0+ TO 2 YEAR	13,135	6,478	0	0	19,613
2+ TO 5 YEAR	21,742	105,460	8,192	0	135,394
5+ TO 10 YEAR	59,599	249,578	0	3,753	312,930
10+ TO 25 YEAR	73,778	13,672	0	0	87,450
25+ TO 30 YEAR	19,867	6,505	0	0	26,372
TOTAL:	188,121	381,692	8,192	3,753	581,758
NOMINAL YIELD (CBE):		11.48			

BELOW INVESTMENT GRADE SECURITIES

	0+ TO 10 PERCENT CBE COUPON	10+ TO 16 PERCENT CBE COUPON	16+ TO 21 PERCENT CBE COUPON	21+ TO 29 PERCENT CBE COUPON	TOTAL
0+ TO 2 YEAR	0	0	0	0	0
2+ TO 5 YEAR	0	13,827	0	0	13,827
5+ TO 10 YEAR	16,084	30,262	0	0	46,346
10+ TO 25 YEAR	1,128	0	0	0	1,128
25+ TO 30 YEAR	0	0	0	0	0
TOTAL:	17,211	44,090	0	0	61,301
NOMINAL YIELD (CBE):		13.48			

CASE STUDY LIFE INSURANCE COMPANY

ASSETS BACKING SPDA LINE

GROUP	RATING	BOOK VALUE	MARKET VALUE	COUPON RATE	PAY DATES	MATURITY DATE	PAR VALUE	BOOK YIELD	CALL DATE	CALL PRICE
1	3A	2,173,605.75	92.375	8.100	010731	07312003	2,130,834.32	7.881		0.000
1	3A	79,296.31	92.375	8.100	010731	07312003	78,504.42	7.989		0.000
1	3A	2,211,011.02	91.750	8.000	010201	09152001	2,249,942.91	8.203		0.000
1	3A	1,149,484.72	101.125	8.500	051115	05151999	1,121,491.75	8.176		0.000
1	3A	1,971,624.82	101.125	8.500	051115	05151999	1,928,965.81	8.212		0.000
1	3A	2,960,603.48	101.125	8.500	051115	05151999	2,904,663.63	8.249		0.000
1	3A	218,237.18	99.625	8.375	020815	08152000	224,298.35	8.718		0.000
4	3A	1,261,969.60	100.125	10.000	010201	02012009	1,285,369.50	10.208		0.000
4	3A	1,257,873.58	100.125	10.000	010201	04012009	1,281,224.36	10.208		0.000
4	3A	2,571,332.48	100.125	10.000	010201	04012009	2,605,838.45	10.150		0.000
4	3A	6,520,714.99	100.125	10.000	010201	06012009	6,608,316.10	10.150		0.000
4	3A	1,291,899.70	100.125	10.000	010201	07012009	1,309,265.26	10.150		0.000
4	3A	2,526,376.56	100.125	10.000	010201	09012009	2,560,373.29	10.150		0.000
4	1A	663,488.07	108.552	9.875	010701	01012003	672,895.05	10.052	1992	103.000
6	1A	225,178.74	82.000	7.500	061201	12012003	224,298.35	7.459	1987	100.970
6	3B	448,596.70	87.000	7.750	061215	12152000	448,596.70	7.750	1987	103.300
6	3B	454,035.31	81.375	7.500	020801	02012003	448,596.70	7.370	1988	104.380
7	1A	1,205,654.52	97.750	9.375	041001	10012000	1,121,491.75	8.442		0.000
7	2B	1,166,438.76	96.625	9.500	061201	12011999	1,121,491.75	8.070	1987	102.975
7	2A	79,401.62	100.875	9.750	061201	12011999	79,401.62	9.750	1987	103.420
7	2A	331,514.35	100.875	9.750	061201	12011999	317,606.46	8.357	1987	103.420
7	1A	2,142,321.98	97.375	8.625	041001	10012000	2,079,245.70	8.021	1987	102.760
7	NR	442,604.34	95.000	7.100	030901	09011992	448,596.70	7.393		0.000
7	NR	222,243.33	95.000	7.100	030901	09011992	224,298.35	7.300		0.000
7	1A	1,151,519.15	97.750	9.000	061201	06011999	1,121,491.75	8.644	1987	102.888
7	1A	2,314,284.60	96.750	8.625	051101	11011999	2,242,983.49	8.074	1987	102.930
7	1A	2,258,813.84	100.748	7.100	030915	07181988	2,242,983.49	6.613		0.000
7	2A	2,260,946.99	101.290	7.875	051101	05011991	2,242,983.49	7.654		0.000
6	3B	1,118,652.80	111.000	12.000	010715	01151995	1,121,491.75	12.050	1988	107.810
7	1A	2,242,983.49	114.960	12.200	010715	02241992	2,242,983.49	12.200		0.000
7	1A	2,242,983.49	115.000	12.000	051101	11011994	2,242,983.49	12.000		0.000
7	1A	4,485,966.99	115.000	12.000	051101	11011994	4,485,966.99	12.000		0.000
7	3B	2,223,899.72	96.500	8.500	020815	08151993	2,242,983.49	8.672		0.000
7	3B	2,231,117.62	108.375	11.750	010715	01151990	2,242,983.49	11.963		0.000
7	2A	2,225,534.03	106.375	11.875	020801	02011995	2,242,983.49	12.028	1990	100.000
7	NR	2,018,685.15	110.802	17.000	061201	12011989	2,018,685.15	17.000		0.000
7	1A	2,242,983.49	101.250	13.200	020815	08151989	2,242,983.49	13.200	1987	100.000
7	3B	2,233,522.93	111.500	13.500	051115	05151989	2,242,983.49	13.714		0.000
7	NR	1,121,491.75	109.649	11.375	041030	10301992	1,121,491.75	11.375		0.000
4	2A	862,948.29	104.000	11.500	061201	06011993	844,003.29	11.003	1988	104.830
4	3A	2,777,381.40	98.125	9.500	010201	09012001	2,736,657.07	9.314		0.000
5	1A	3,342,280.27	104.500	9.625	020801	02011996	3,364,475.24	9.736	1993	100.000
5	1A	3,342,280.27	104.500	9.625	020801	02011996	3,364,475.24	9.736	1993	100.000
5	1A	3,882,604.43	103.375	13.250	11 01	11011992	3,882,604.43	13.250		0.000
6	2A	2,172,556.10	94.000	7.750	041015	04151996	2,242,983.49	8.240	1991	102.220
6	2B	2,286,340.16	103.750	13.750	030901	03011994	2,242,983.49	13.323	1988	105.890
6	2B	2,286,347.09	103.750	13.750	030901	03011994	2,242,983.49	13.323	1988	105.890
6	NR	5,607,458.74	114.790	12.000	051130	11301995	5,607,458.74	12.000	1990	107.125
6	2B	11,457,402.58	103.750	13.750	030901	03011994	11,214,917.47	13.273	1988	105.890
6	3B	4,876,334.51	114.750	15.125	061201	06011994	4,485,966.99	12.669	1987	108.140
6	3B	536,741.71	104.500	12.250	010701	07011993	560,745.87	13.253	1987	106.650
6	2A	4,345,112.20	94.000	7.750	041015	04151996	4,485,966.99	8.240	1991	102.220
6	NR	6,675,387.79	100.000	13.500	020524	02241992	6,728,950.48	13.718		0.000
6	3B	4,462,708.26	96.268	9.000	051115	11151996	4,485,966.99	9.081		0.000
6	3B	2,231,354.14	96.268	9.000	051115	11151996	2,242,983.49	9.081		0.000
6	3B	4,648,400.62	111.125	15.750	030915	09151994	4,373,817.82	14.376	1987	108.290
6	3B	1,190,734.49	111.125	15.750	030915	09151994	1,121,491.75	14.398	1987	108.290
6	3B	5,346,656.37	115.500	15.000	061201	06011994	4,968,208.44	13.351	1987	109.250
6	3B	715,693.75	111.125	15.750	030915	09151994	672,895.05	14.359	1987	108.290
6	1A	1,143,998.94	101.375	9.625	020801	02011996	1,121,491.75	9.293	1988	106.880
6	3B	3,311,772.60	107.250	13.750	041015	10151992	3,364,475.24	14.155	1987	103.000

6	3B	1,110,410.69	107.250	13.750	041015	10151992	1,121,491.75	14.005	1987	103.000
6	3B	6,696,962.06	107.250	13.750	041015	10151992	6,504,652.14	13.007	1987	103.000
7	3A	5,677,522.45	93.750	8.850	030601	09012015	5,607,458.74	8.731		0.000
7	NR	9,103,876.79	107.259	12.950	030630	03301992	9,103,876.79	12.950		0.000
7	3B	2,081,265.19	100.000	12.500	030901	03011994	2,242,983.49	14.133	1988	100.000
7	3A	6,897,174.25	93.750	8.850	030601	09012015	6,728,950.48	8.614		0.000
7	3B	2,081,265.19	100.000	12.500	030901	03011994	2,242,983.49	14.133	1988	100.000
7	3A	2,299,058.08	93.750	8.850	030601	09012015	2,242,983.49	8.614		0.000
7	3B	10,871,568.29	100.000	12.500	030901	03011994	11,214,917.47	13.173	1988	100.000
7	3B	2,100,493.21	100.000	12.500	030901	03011994	2,242,983.49	13.930	1988	100.000
7	2B	1,759,545.93	93.500	9.500	020801	08011993	2,242,983.49	14.723	1987	100.000
7	NR	567,999.95	104.269	9.750	02	28	02281991	567,999.95	9.750	0.000
7	NR	1,790,116.16	104.269	9.750	02	28	02281991	1,790,116.16	9.750	0.000
7	NR	508,219.69	104.269	9.750	02	28	02281991	508,219.69	9.750	0.000
7	2B	1,819,540.80	93.500	9.500	020801	08011993	2,242,983.49	13.979	1987	100.000
7	2B	906,764.66	93.500	9.500	020801	08011993	1,121,491.75	14.052	1987	100.000
7	NR	3,364,475.24	99.680	8.300	020801	08011992	3,364,475.24	8.300		0.000
7	1A	4,411,581.85	106.250	10.750	020815	08151995	4,485,966.99	11.053	1992	100.000
7	1B	2,744,895.28	102.500	14.875	020801	08011992	2,691,580.19	14.347		0.000
7	NR	2,242,983.49	108.018	13.350	061215	12151989	2,242,983.49	13.350		0.000
7	NR	8,971,933.98	109.498	13.350	061215	12151990	8,971,933.98	13.350		0.000
7	2B	6,771,906.96	113.000	14.250	061215	12151990	6,728,950.48	14.034	1990	100.000
7	3B	1,709,573.35	93.500	8.950	041015	04151994	2,242,983.49	14.311	1989	100.000
7	3B	4,485,966.99	116.850	12.200	010715	02241993	4,485,966.99	12.200		0.000
7	3B	2,235,485.25	111.500	12.250	020815	02151995	2,242,983.49	12.316	1992	100.000
7	3B	2,235,485.25	111.500	12.250	020815	02151995	2,242,983.49	12.316	1992	100.000
7	3B	2,235,485.25	111.500	12.250	020815	02151995	2,242,983.49	12.316	1992	100.000
7	3B	2,237,958.07	111.500	12.250	020815	02151995	2,242,983.49	12.294	1992	100.000
7	2B	4,391,258.90	100.250	12.750	041001	10011989	4,485,966.99	13.697	1987	100.000
7	2B	3,140,176.89	100.250	12.750	041001	10011989	3,140,176.89	12.570	1987	100.000
7	1A	6,728,950.48	115.580	12.350	010715	02281992	6,728,950.48	12.350		0.000
7	1A	4,485,966.99	114.960	12.200	010715	02241992	4,485,966.99	12.200		0.000
7	1A	5,568,895.39	106.625	11.500	020801	08011995	5,607,458.74	11.629	1992	100.000
7	1A	672,284.64	103.500	9.250	020815	02151993	672,895.05	9.270		0.000
7	3B	2,803,729.37	106.250	10.250	010715	01151996	2,803,729.37	10.250	1993	100.000
7	3B	1,121,491.75	106.250	10.250	010715	01151996	1,121,491.75	10.250	1993	100.000
7	3B	1,121,491.75	106.250	10.250	010715	01151996	1,121,491.75	10.250	1993	100.000
7	3B	4,467,045.88	111.500	13.500	051115	05151989	4,485,966.99	13.714		0.000
7	3B	2,248,574.11	109.625	11.625	020801	02011992	2,242,983.49	11.559		0.000
7	3A	7,126,925.72	104.750	10.100	030901	09012003	6,728,950.48	9.391		0.000
7	3B	5,681,476.00	108.250	13.250	041015	10151994	5,607,458.74	12.872	1991	100.000
7	3B	1,111,315.33	110.875	12.000	020801	02011992	1,121,491.75	12.245		0.000
7	3B	455,488.02	108.250	13.250	041015	10151994	448,596.70	12.811	1991	100.000
7	3B	2,242,983.49	110.875	12.000	020801	02011992	2,242,983.49	12.000		0.000
7	3B	2,209,972.03	106.000	10.600	030901	09011990	2,242,983.49	11.099		0.000
7	3B	2,200,141.23	113.000	13.375	030901	03011994	2,242,983.49	13.803	1991	100.000
7	3B	2,209,835.70	106.000	10.600	030901	09011990	2,242,983.49	11.102		0.000
7	3B	3,359,930.55	113.000	13.375	030901	03011994	3,364,475.24	13.405	1991	100.000
7	2A	4,481,192.78	102.875	12.500	051115	11151993	4,485,966.99	12.524	1988	100.000
7	3B	4,557,751.41	113.000	13.375	030901	03011994	4,485,966.99	12.867	1991	100.000
7	3B	3,439,952.18	113.000	13.375	030901	03011994	3,364,475.24	12.666	1991	100.000
7	3B	4,579,653.90	108.250	13.250	041015	10151994	4,485,966.99	12.655	1991	100.000
7	2A	4,485,966.99	106.375	11.875	020801	02011995	4,485,966.99	11.875	1990	100.000
7	2A	4,456,113.31	106.375	11.875	020801	02011995	4,485,966.99	12.006	1990	100.000
7	2A	1,116,862.27	106.625	11.000	020801	08011995	1,121,491.75	11.076	1990	100.000
7	1A	4,485,966.99	113.270	11.000	030915	10301992	4,485,966.99	11.000		0.000
7	NR	11,214,917.47	100.000	11.800	010702	01021992	11,214,917.47	11.800		0.000
7	1A	4,475,916.70	115.625	12.125	030901	03011995	4,485,966.99	12.169		0.000
7	1A	7,850,442.23	108.000	11.400	020801	08011995	7,850,442.23	11.400	1992	100.000
7	1A	3,364,475.24	108.000	11.400	020801	08011995	3,364,475.24	11.400	1992	100.000
7	NR	11,214,917.47	100.000	11.800	010702	01021992	11,214,917.47	11.800		0.000
7	NR	4,485,966.99	103.633	9.850	010415	07151993	4,485,966.99	9.850		0.000
7	NR	4,485,966.99	103.633	9.850	010415	07151993	4,485,966.99	9.850		0.000
7	NR	3,588,773.59	110.802	17.000	061201	12011989	3,588,773.59	17.000		0.000
7	3B	2,232,309.65	90.000	8.375	041015	04151996	2,242,983.49	8.450	1993	100.000
7	1A	4,455,116.30	106.625	11.500	020801	08011995	4,485,966.99	11.629	1992	100.000
7	3B	4,477,217.07	112.750	12.500	051115	11151991	4,485,966.99	12.555		0.000
7	1A	4,485,966.99	110.125	11.000	061201	06011995	4,485,966.99	11.000	1992	100.000
7	1A	2,242,983.49	110.125	11.000	061201	06011995	2,242,983.49	11.000	1992	100.000
7	3B	2,283,1102.51	109.500	11.500	010701	07011995	2,242,983.49	11.057	1992	100.000
7	1B	2,240,334.87	99.625	9.750	020815	02151996	2,242,983.49	9.770	1993	100.000
7	3B	2,247,814.32	109.500	11.500	010701	07011995	2,242,983.49	11.446	1992	100.000
7	1A	6,746,176.60	99.520	6.900	061215	11281988	6,728,950.48	6.754		0.000
7	3A	11,214,917.47	98.375	7.500	030620	04202009	11,214,917.47	7.500		0.000
7	3A	5,817,738.44	98.500	9.150	020525	03252008	5,607,458.74	8.759		0.000

TOTAL COUNT : 208  
TOTAL BOOK VALUE : \$665,200,000  
TOTAL PAR VALUE : \$669,494,340  
TOTAL MARKET : \$701,660,573  
COMPOSITE YIELD : 11.67

7	3B	6,630,307.39	109.375	10.750	061201	06011995	6,728,950.48	11.022	1992	100.000
7	2A	2,242,983.49	100.375	9.250	020815	02151993	2,242,983.49	9.250	1991	100.000
7	2A	2,242,983.49	100.375	9.250	020815	02151993	2,242,983.49	9.250	1991	100.000
7	2A	2,242,983.49	100.375	9.250	020815	02151993	2,242,983.49	9.250	1991	100.000
7	2A	1,121,491.75	100.375	9.250	020815	02151993	1,121,491.75	9.250	1991	100.000
7	3B	2,238,647.56	109.125	13.500	041001	10011991	2,242,983.49	13.557		0.000
7	3B	1,118,802.77	98.000	9.250	051115	05151996	1,121,491.75	9.289		0.000
7	3B	559,401.38	98.000	9.250	051115	05151996	560,745.87	9.289		0.000
7	1A	5,551,583.42	110.111	11.875	020801	02011995	5,607,458.74	12.071		0.000
7	2A	2,240,395.23	106.250	11.000	030930	09301995	2,242,983.49	11.021	1992	100.000
7	3B	3,224,990.83	105.250	14.500	061201	06011991	3,196,251.48	13.780	1988	100.000
7	3B	2,432,944.97	105.250	14.500	061201	06011991	2,411,207.26	13.778	1988	100.000
7	3B	4,462,072.02	108.500	11.750	051101	05011995	4,485,966.99	11.852	1992	100.000
7	3B	4,477,293.80	109.125	13.500	041001	10011991	4,485,966.99	13.557		0.000
7	3B	2,232,588.75	103.250	9.750	030901	03011994	2,242,983.49	9.842		0.000
7	1A	4,459,885.56	108.125	11.625	051115	05151997	4,485,966.99	11.723	1992	100.000
7	NR	10,445,604.80	114.863	12.750	020830	07311991	10,445,604.80	12.750		0.000
7	1A	4,469,279.44	104.750	10.875	051101	11011995	4,485,966.99	10.942	1992	100.000
7	1A	3,007,781.14	107.375	13.500	030915	09151991	3,028,027.72	13.697	1988	100.000
7	1A	1,446,793.06	107.375	13.500	030915	09151991	1,457,939.27	13.726	1988	100.000
7	1A	2,225,813.82	107.375	13.500	030915	09151991	2,242,983.49	13.726	1988	100.000
7	1A	4,494,306.65	107.375	13.500	030915	09151991	4,485,966.99	13.374	1988	100.000
7	1A	1,122,139.32	97.125	8.750	030901	03011996	1,121,491.75	8.738	1993	100.000
7	3B	1,117,774.29	103.000	12.125	010715	01151995	1,121,491.75	12.191	1992	100.000
7	3B	2,235,547.47	103.000	12.125	010715	01151995	2,242,983.49	12.191	1992	100.000
7	3B	4,512,901.92	103.000	12.125	010715	01151995	4,485,966.99	11.963	1992	100.000
7	3A	6,728,950.48	114.338	11.540	041001	10012015	6,728,950.48	11.540	1993	105.000
7	3B	2,232,588.75	103.250	9.750	030901	03011994	2,242,983.49	9.842		0.000
4	3A	2,920,418.95	98.125	9.500	010201	09012001	2,877,597.30	9.314		0.000
6	3B	9,544,980.82	111.125	15.750	030915	09151994	8,971,933.98	14.353	1987	108.290
6	3B	2,190,260.19	111.000	12.000	010715	01151995	2,242,983.49	12.471	1988	107.810
6	2B	6,883,166.70	103.750	13.750	030901	03011994	6,728,950.48	13.245	1988	105.890
6	NR	5,607,458.74	114.790	12.000	051130	11301995	5,607,458.74	12.000	1990	107.125
6	3B	1,103,909.18	107.250	13.750	041015	10151992	1,121,491.75	14.156	1987	103.000
6	3B	1,103,924.18	107.250	13.750	041015	10151992	1,121,491.75	14.155	1987	103.000
6	3B	2,212,115.24	107.250	13.750	041015	10151992	2,242,983.49	14.106	1987	103.000
6	NR	4,450,258.67	100.000	13.500	020524	02241992	4,485,966.99	13.718		0.000
7	3A	5,677,522.45	93.750	8.850	030601	09012015	5,607,458.74	8.731		0.000
7	3B	2,089,169.42	100.000	12.500	030901	03011994	2,242,983.49	14.049	1988	100.000
7	3B	2,084,211.17	100.000	12.500	030901	03011994	2,242,983.49	14.101	1988	100.000
7	3B	4,287,467.82	100.000	12.500	030901	03011994	4,485,966.99	13.482	1988	100.000
7	2B	1,833,319.81	93.500	9.500	020801	08011993	2,242,983.49	13.813	1987	100.000
7	3B	2,083,982.77	100.000	12.500	030901	03011994	2,242,983.49	14.104	1988	100.000
7	3B	2,151,180.89	100.000	12.500	030901	03011994	2,242,983.49	13.406	1988	100.000
7	2B	1,759,622.14	93.500	9.500	020801	08011993	2,242,983.49	14.722	1987	100.000
7	2B	1,758,627.49	93.500	9.500	020801	08011993	2,242,983.49	14.735	1987	100.000
7	2B	1,819,540.80	93.500	9.500	020801	08011993	2,242,983.49	13.979	1987	100.000
7	2B	906,764.66	93.500	9.500	020801	08011993	1,121,491.75	14.052	1987	100.000
7	2B	1,833,319.81	93.500	9.500	020801	08011993	2,242,983.49	13.813	1987	100.000
7	3B	1,709,573.35	93.500	8.950	041015	04151994	2,242,983.49	14.311	1989	100.000
7	3B	3,497,176.83	96.750	9.650	041015	10151994	4,485,966.99	14.458	1987	100.000
7	3B	2,242,983.49	116.850	12.200	010715	02241993	2,242,983.49	12.200		0.000
7	3B	5,589,705.28	114.750	13.625	041001	04011994	5,439,234.98	12.761	1991	100.000
7	3B	460,993.38	114.750	13.625	041001	04011994	448,596.70	12.762	1991	100.000
7	3B	1,169,858.86	114.750	13.625	041001	04011994	1,121,491.75	12.292	1991	100.000
7	3B	2,151,069.22	100.000	12.500	030901	03011994	2,242,983.49	13.407	1988	100.000
7	3B	2,266,931.61	108.250	13.250	041015	10151994	2,242,983.49	12.944	1991	100.000
7	3B	4,583,236.12	107.500	13.500	030915	03151991	4,485,966.99	12.347	1989	100.000
7	3B	4,400,282.51	113.000	13.375	030901	03011994	4,485,966.99	13.803	1991	100.000
7	3B	1,119,976.86	113.000	13.375	030901	03011994	1,121,491.75	13.405	1991	100.000
7	3B	4,436,871.09	104.808	12.000	051101	11011991	4,485,966.99	12.307		0.000
7	2B	5,646,155.99	103.750	10.875	061201	06011995	6,728,950.48	14.213	1993	100.000
7	3A	6,977,080.53	98.500	9.150	020525	03252008	6,728,950.48	8.766		0.000
4	3A	4,582,695.65	99.437	7.400	051125	05251989	4,485,966.99	6.411		0.000
4	3A	2,208,467.01	96.313	9.000	010201	01012002	2,140,246.64	8.620		0.000
4	3A	2,301,981.21	96.313	9.000	010201	01012002	2,230,872.17	8.620		0.000
4	3A	2,297,070.19	96.313	9.000	010201	01012002	2,226,112.83	8.620		0.000
4	3A	2,296,586.58	96.313	9.000	010201	01012002	2,225,644.18	8.620		0.000
4	3A	2,296,381.42	96.313	9.000	010201	01012002	2,225,445.34	8.620		0.000
7	1A	2,233,880.53	109.875	11.125	061215	05151995	2,242,983.49	11.201	1992	100.000
7	3A	7,015,441.47	102.000	12.500	041001	04011999	6,705,320.41	11.777		0.000
7	1A	448,189.75	103.500	9.250	020815	02151993	448,596.70	9.270		0.000

SECTION 3A

CASE STUDY LIFE INSURANCE COMPANY

REGULATION 126 - NEW YORK SCENARIOS

Description of Scenarios

<u>Trial</u>	<u>Description</u>
1	Level (Constant Yield Curve)
2	Gradual Increase
3	Gradual Up and Down
4	Pop Up and Stay
5	Gradual Decrease
6	Gradual Down and Up
7	Pop Down and Stay

Results

(000's omitted)

<u>Interest Crediting Strategy</u>	<u>Investment Strategy</u>	<u>Mean 20th Year Surplus</u>	<u>Lowest 20th Year Surplus (Trial)</u>
Earned less 150	GNMA	\$ 84,696	\$ -27,152 (2)
Earned less 150	5-Yr. Corporate	109,528	51,381 (5)
Earned less 150	Highest Yield	95,001	-15,207 (2)
Market	GNMA	\$ 69,886	\$ -253,503 (2)
Market	5-Yr. Corporate	102,614	23,410 (2)
Market	Highest Yield	118,126	-80,147 (2)

CAL STONY LIFE INSURANCE COMPANY

RISK ANALYSIS SYSTEM

PRODUCT: SPDA - NEW YORK SCENARIOS - REG 126  
 STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES  
 UNITS: 1000

LIABILITIES

3-56

TRIAL	12/86	12/87	12/88	12/90	12/95	12/00	12/03	12/06	
1	643,059	675,831	698,097						
2	643,059	675,831	698,687	733,807					
3	643,059	675,831	698,687	736,756	739,995	447,930	138,518	0	
4	643,059	675,476	703,412	736,756	317,049	12,251	450	0	
5	643,059	675,831	697,414	755,395	760,592	409,224	151,335	0	
6	643,059	675,831	697,414	729,990	808,134	553,485	190,789	0	
7	643,059	675,831	695,216	729,990	693,640	406,637	124,052	0	
				720,676	665,828	347,932	103,942	0	
MEAN:	643,059	675,781	698,418		660,920	391,147	118,650	0	
HIGH:	643,059	675,831	703,412	734,767		662,300	378,372	118,662	0
LOW:	643,059	675,476	695,216		755,395	808,134	553,485	190,789	0
STANDARD DEVIATION:				720,676		317,048	12,251	450	0
	0	124	2,313	9,845	149,587	162,007	54,460	0	



CASE STUDY LIFE INSURANCE COMPANY  
RISK ANALYSIS SYSTEM

PRODUCT: SPDA - NEW YORK SCENARIOS - REG 126  
STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES  
UNITS: 1000

ASSETS

		-----							
TRIAL	12/86	12/87	12/88	12/90	12/95	12/00	12/05	12/06	
3-57	1	643,059	677,302	700,789					
	2	643,059	677,268	701,409	742,414	777,493	526,183	252,986	121,454
	3	643,059	677,268	701,409	745,742	358,273	71,319	81,129	86,585
	4	643,059	675,091	704,570	745,742	803,911	574,619	276,067	132,335
	5	643,059	677,503	700,227	763,355	855,628	660,954	366,169	190,485
	6	643,059	677,503	700,227	738,580	713,953	447,714	173,250	51,381
	7	643,059	677,515	697,365	738,580	698,252	416,514	208,160	105,204
					727,864	690,226	445,503	193,964	79,251
	MEAN:	643,059	677,064	700,857	743,182	699,677	448,972	221,676	109,528
	HIGH:	643,059	677,515	704,570	763,355	855,628	660,954	366,169	190,485
	LOW:	643,059	675,091	697,365	727,864	358,273	71,319	81,129	51,381
	STANDARD DEVIATION:								
	0		812	1,978	9,983	150,282	173,359	82,692	41,506

CASE STUDY LIFE INSURANCE COMPANY  
RISK ANALYSIS SYSTEM

PRODUCT: SPDA - NEW YORK SCENARIOS - REG 126  
STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES  
UNITS: 1000

SURPLUS

TRIAL	12/86	12/87	12/88	12/90	12/95	12/00	12/05	12/06
1	0	1,471	2,692		37,498			
2	0	1,436	2,723	8,606	41,225	78,253		
3	0	1,436	2,723	8,986	43,319	59,068	114,468	121,454
4	0	-385	1,158	8,986	47,494	85,395	124,732	86,565
5	0	1,671	2,813	7,960	39,313	107,470	175,380	132,335
6	0	1,671	2,813	8,591	32,424	41,076	49,206	150,485
7	0	1,684	2,149	7,188	29,306	60,583	99,217	51,381
MEAN:	0	1,284	2,439	8,415	37,369	54,356	75,314	79,251
HIGH:	0	1,684	2,813	8,986	47,494	70,600	102,714	109,528
LOW:	0	-385	1,158	7,188	29,306	107,470	175,380	190,485
STANDARD DEVIATION:	0	689	564	593	6,459	41,076	49,206	51,381
						20,387	37,825	41,506

APPENDIX C-2

CASE STUDY LIFE INSURANCE COMPANY

RESULTS OF 40 TRIALS - (STOCHASTICALLY GENERATED)

(000's omitted)

	<u>Investment Crediting Strategy</u>	<u>Investment Strategy</u>	<u>Mean 20th Yr Surplus</u>	<u>Lowest 20th Yr Surplus</u>	<u>Standard Deviation</u>	<u># of Neg. Trials</u>	<u>Prob of 20th Yr Surplus &lt; \$0*</u>	<u>Additional Reserve Required to Make Probability of Insolvency</u>			
								<u>&lt; 10%</u>	<u>&lt; 5%</u>	<u>&lt; 2.5%</u>	<u>&lt; 1%</u>
	Earned less 150	GNMA	\$ 47,883	\$ -104,645	\$ 56,973	9	20.1%	\$ 5,590	\$ 14,632	\$ 22,091	\$ 30,851
3-59	Earned less 150	5-Yr. Corporate	90,644	-86,135	42,721	1	1.7	-	-	-	1,815
	Earned less 150	Highest Yield	72,880	-105,136	54,895	5	9.2	-	4,999	12,125	20,496
	Market	GNMA	\$ -3,371	\$ -1,049,880	\$ 246,137	11	50.6%	\$ 81,303	\$110,801	\$136,259	\$166,162
	Market	5-Yr. Corporate	70,743	-755,930	143,464	4	31.2	1,452	14,702	26,137	39,568
	Market	Highest Yield	71,553	-979,664	212,962	6	36.9	38,822	63,254	84,338	109,104

\*Based on assumption that results are normally distributed.

CASE STUDY LIFE INSURANCE COMPANY

RISK ANALYSIS SYSTEM

PRODUCT: SPDA  
 STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES  
 UNITS: 1000

ASSETS

TRIAL	12/86	12/87	12/88	12/90	12/95	12/00	12/05	12/06
1	643,059	677,503	700,217	739,438	714,728	355,958	175,491	105,915
2	643,059	677,503	700,227	738,793	716,686	455,380	191,506	98,872
3	643,059	677,268	701,624	743,743	723,123	452,571	154,756	52,191
4	643,059	677,302	700,789	742,820	631,964	74,429	70,985	74,968
5	643,059	677,268	701,409	745,261	802,879	442,436	203,120	125,263
6	643,059	676,266	704,020	754,033	763,472	475,379	172,774	128,612
7	643,059	677,517	699,608	738,650	755,115	495,939	228,530	115,675
8	643,059	677,503	700,217	740,351	749,266	116,272	99,481	103,295
9	643,059	677,503	700,217	738,948	516,519	303,393	186,180	118,337
10	643,059	677,268	701,411	744,894	772,965	507,046	219,883	90,586
11	643,059	676,305	703,148	755,143	303,220	44,144	45,193	47,416
12	643,059	677,302	700,789	742,967	795,694	553,776	150,343	126,744
13	643,059	677,503	700,214	733,056	654,230	303,782	188,287	135,814
14	643,059	677,302	700,973	741,577	767,168	506,181	232,198	106,035
15	643,059	677,302	700,963	741,289	727,196	475,095	248,019	126,316
16	643,059	677,302	700,963	741,887	753,202	453,766	191,612	86,840
17	643,059	677,302	700,789	741,804	744,158	182,327	128,621	109,325
18	643,059	677,517	699,606	737,250	674,093	487,402	233,174	129,571
19	643,059	677,302	700,789	741,729	709,986	426,920	141,510	17,334
20	643,059	676,305	702,885	755,354	93,570	22,564	19,021	20,490
21	643,059	677,268	701,411	745,098	765,703	497,904	126,507	111,970
22	643,059	677,302	700,973	740,188	735,540	391,529	182,225	101,718
23	643,059	677,302	700,789	743,150	793,949	541,796	245,141	115,635
24	643,059	677,268	701,624	741,552	706,451	438,175	164,074	42,555
25	643,059	677,302	700,972	741,469	727,065	442,183	177,327	69,800
26	643,059	677,503	700,226	736,971	688,946	440,092	187,286	73,418
27	643,059	676,305	703,144	751,905	728,855	155,181	117,806	124,212
28	643,059	676,266	703,994	570,290	-86,135	-86,135	-86,135	-86,135
29	643,059	676,305	703,148	633,992	482,011	277,619	105,883	97,631
30	643,059	677,503	700,226	736,399	681,958	387,815	148,107	73,604
31	643,059	675,460	705,584	763,133	818,247	507,228	129,027	113,120
32	643,059	677,268	701,440	744,302	787,044	523,785	213,071	76,015
33	643,059	677,517	699,606	737,250	553,296	137,409	104,916	110,900
34	643,059	677,503	700,227	738,793	705,561	343,233	170,143	117,282
35	643,059	677,516	699,036	733,018	695,389	425,289	156,916	42,962
36	643,059	677,302	700,787	743,667	798,663	575,050	275,040	133,464
37	643,059	677,302	700,973	740,188	709,784	377,971	184,680	93,392
38	643,059	676,305	703,144	753,116	840,560	605,395	284,325	129,835
39	643,059	677,503	700,216	740,508	250,798	42,262	39,345	41,762
40	643,059	677,302	700,963	742,478	723,446	444,113	235,163	123,001
MEAN:	643,059	677,141	701,234	735,911	661,909	365,066	161,038	90,644
HIGH:	643,059	677,517	705,584	763,133	840,560	605,395	284,325	135,814
LOW:	643,059	675,460	699,036	570,290	-86,135	-86,135	-86,135	-86,135
STANDARD DEVIATION:	0	501	1,377	32,092	194,356	173,878	72,486	42,721

CASE STUDY LIFE INSURANCE COMPANY

RISK ANALYSIS SYSTEM

PRODUCT: SPDA  
 STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES  
 UNITS: 1000

LIABILITIES

TRIAL	12/86	12/87	12/88	12/90	12/95	12/00	12/05	12/06
1	643,059	675,831	697,414		680,674			
2	643,059	675,831	697,414	730,650	684,030	285,474	75,490	0
3	643,059	675,831	698,687	730,134	692,254	387,783	97,159	0
4	643,059	675,831	698,097	734,494	593,438	411,761	104,116	0
5	643,059	675,831	698,687	734,155	762,143	22,883	837	0
6	643,059	675,831	702,138	736,338	725,380	361,937	85,610	0
7	643,059	675,831	696,883	744,664	718,868	394,352	52,860	0
8	643,059	675,831	697,414	729,788	711,465	421,490	119,662	0
9	643,059	675,831	697,414	731,674	475,653	51,613	3,086	0
10	643,059	675,831	698,687	730,291	736,380	225,231	74,107	0
11	643,059	675,831	701,278	736,033	268,047	438,971	133,307	0
12	643,059	675,831	698,097	746,681	755,245	9,211	305	0
13	643,059	675,831	697,414	734,258	611,966	471,189	32,435	0
14	643,059	675,831	698,097	724,047	730,830	218,835	60,988	0
15	643,059	675,831	698,097	732,896	688,652	433,657	131,215	0
16	643,059	675,831	698,097	732,392	718,050	394,696	129,323	0
17	643,059	675,831	698,097	733,192	704,935	392,590	109,076	0
18	643,059	675,831	696,883	732,893	633,802	108,782	25,755	0
19	643,059	675,831	698,097	728,686	684,539	406,651	112,011	0
20	643,059	675,831	701,013	732,906	69,831	407,172	124,215	0
21	643,059	675,831	698,687	746,892	729,868	2,330	73	0
22	643,059	675,831	698,097	736,161	702,189	424,407	22,463	0
23	643,059	675,831	698,097	731,556	754,253	323,949	86,162	0
24	643,059	675,831	698,687	734,385	679,269	464,091	135,321	0
25	643,059	675,831	698,097	732,906	694,578	404,038	123,256	0
26	643,059	675,831	697,414	732,451	659,773	393,265	111,244	0
27	643,059	675,831	701,278	728,717	685,454	386,994	117,535	0
28	643,059	675,831	702,123	743,174	0	76,126	3,039	0
29	643,059	675,831	701,278	560,942	448,383	0	0	0
30	643,059	675,831	697,414	625,551	661,573	213,926	15,215	0
31	643,059	675,831	704,464	728,062	780,241	342,563	78,748	0
32	643,059	675,831	698,687	755,020	748,815	428,297	22,901	0
33	643,059	675,831	696,883	735,522	514,037	455,387	138,924	0
34	643,059	675,831	697,414	728,686	665,869	67,164	2,630	0
35	643,059	675,831	696,423	730,134	668,109	267,957	60,393	0
36	643,059	675,831	698,097	725,041	755,996	397,392	116,649	0
37	643,059	675,831	698,097	734,811	679,075	488,587	149,374	0
38	643,059	675,831	701,278	731,556	797,075	314,825	95,951	0
39	643,059	675,831	697,414	744,753	214,908	517,590	160,720	0
40	643,059	675,831	698,097	731,603	685,219	7,224	236	0
				733,295		365,308	119,481	0
MEAN:	643,059	675,831	698,651	727,185	629,272	304,642	75,797	0
HIGH:	643,059	675,831	704,464	755,020	797,075	517,590	160,720	0
LOW:	643,059	675,831	696,423	560,942	0	0	0	0
STANDARD DEVIATION:	0	0	1,756	32,155	-181,946	159,073	51,457	0

CASE STUDY LIFE INSURANCE COMPANY

RISK ANALYSIS SYSTEM

PRODUCT: SPDA  
 STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES  
 UNITS: 1000

SURPLUS

TRIAL	12/86	12/87	12/88	12/90	12/95	12/00	12/05	12/06
1	0	1,671	2,803	0,787	34,054	70,484		
2	0	1,671	2,813	8,659	32,656	67,598	100,000	105,915
3	0	1,436	2,937	9,249	30,870	40,810	94,347	98,872
4	0	1,471	2,692	8,665	38,526	51,546	50,639	52,191
5	0	1,436	2,723	8,924	40,736	80,499	70,148	74,968
6	0	434	1,882	9,369	38,092	81,027	117,510	125,263
7	0	1,685	2,725	0,862	36,247	74,450	119,914	128,612
8	0	1,671	2,803	8,677	37,801	64,659	108,868	115,675
9	0	1,671	2,803	0,657	40,866	78,162	96,395	103,295
10	0	1,436	2,724	8,862	36,586	68,075	112,073	118,337
11	0	474	1,870	0,462	35,173	34,932	86,577	90,586
12	0	1,471	2,692	8,709	40,449	82,587	44,887	47,416
13	0	1,671	2,800	9,009	42,264	84,947	117,908	126,744
14	0	1,471	2,876	8,681	36,338	72,524	127,299	135,814
15	0	1,471	2,865	8,897	38,543	80,399	100,982	106,035
16	0	1,471	2,865	8,695	35,152	61,176	118,696	126,316
17	0	1,471	2,692	8,911	39,223	73,545	82,537	86,840
18	0	1,685	2,723	0,564	40,291	80,751	102,865	109,325
19	0	1,471	2,692	8,823	29,448	19,748	121,164	129,571
20	0	474	1,871	8,462	23,739	20,233	17,296	17,334
21	0	1,436	2,724	8,936	35,836	73,497	10,948	20,490
22	0	1,471	2,876	8,632	33,351	73,497	104,044	111,970
23	0	1,471	2,692	8,765	39,696	67,580	95,062	101,718
24	0	1,436	2,937	8,646	27,182	34,137	109,820	115,635
25	0	1,471	2,875	9,017	32,487	48,917	40,818	42,555
26	0	1,671	2,812	8,255	29,172	53,097	66,093	69,800
27	0	474	1,866	8,732	43,401	79,054	69,751	73,418
28	0	434	1,871	9,348	-86,135	-86,135	114,767	124,212
29	0	474	1,870	8,441	33,628	63,693	-86,135	-86,135
30	0	1,671	2,812	8,338	20,385	45,252	90,668	97,631
31	0	-371	1,120	8,114	38,006	78,931	69,359	73,604
32	0	1,436	2,753	8,780	38,229	106,126	106,126	113,120
33	0	1,685	2,723	8,564	39,260	68,397	74,147	76,015
34	0	1,671	2,813	8,659	70,245	70,245	102,286	110,900
35	0	1,684	2,612	7,978	39,692	27,279	109,750	117,282
36	0	1,471	2,690	0,856	42,666	86,464	40,268	42,962
37	0	1,471	2,876	8,632	30,710	63,145	125,667	133,464
38	0	474	1,866	8,363	43,486	87,805	88,729	93,392
39	0	1,671	2,802	8,905	35,889	35,038	123,604	129,835
40	0	1,471	2,865	9,183	38,227	78,805	39,109	41,762
MEAN:	0	1,310	2,583	8,727	32,638	60,424	115,682	123,001
HIGH:	0	1,685	2,937	9,369	43,486	87,805	85,241	90,644
LOW:	0	-371	1,120	7,978	-86,135	-86,135	127,299	135,814
STANDARD DEVIATION:	0	501	424	294	19,766	29,933	-86,135	-86,135
							40.5	42,721

SECTION 3B

CASE STUDY LIFE INSURANCE COMPANY

DETAILED RESULTS OF TRIAL 1

Detailed results of the first trial are contained in the following pages.

The reports are

- Report 6: Interest Rates used in this Trial
- Report 7: Sources of Funds (Cash Flows)
- Report 8: Assets Retained From Prior Period
- Report 9: Liability Summary
- Report 12: Statutory Gains
- Report 13: Profits Released by Source
- Report 14: Lapse Rate, Mortality Rate and Interest Rate Data
- Report 15: Balance Report
- Report 16: Statutory Gains - Fiscal Period
- Reports 19-20: Supplemental Asset Data

CASE STUDY LIFE INSURANCE COMPANY

PAGE: 1

REPORT: 7

TRIAL: 1

RISK ANALYSIS SYSTEM

DATE: 9/ 4/87 TIME: 18:16: 1

PRODUCT: SPDA

STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES

UNIT FACTOR IS 1,000.

SOURCES OF FUNDS	12/86	12/87	12/88	12/89	12/95	12/ 0	12/ 5	12/ 6
INVESTMENT INCOME	-	74,445	67,898	67,234	47,885	28,293	14,095	12,990
+MATURITIES	-	-	20,846	19,461	101,166	44,716	-52,367	20,345
+CALLS	-	-17,151	4,337	30,398	-	-	-	-
+INSURANCE CASH FLOW	-20,380	-43,393	-45,844	-49,378	-84,708	-72,516	-28,854	-66,307
+LIQUIDATIONS	-	-	-	-	-	-	-	-
-TAXES	-2,026	1,738	873	1,800	3,692	3,417	2,953	3,083
-PROFITS RELEASED	-	-	-	-	-	-	-	-
CASH AVAILABLE TO REINVEST	-10,354	142,725	46,364	73,915	60,651	-2,924	-70,079	-36,055
FUNDS APPLIED								
POLICY LOANS	-	-	-	-	-	-	-	-
SHORT TERM	-10,354	-	-	-	-	-	-	-
1 YEAR BONDS	-	-	-	-	-	-	-	-
2 YEAR BONDS	-	-	-	-	-	-	-	-
3 YEAR BONDS	-	-	-	-	-	-	-	-
4 YEAR BONDS	-	-	-	-	-	-	-	-
5 YEAR BONDS	-	-	-	-	-	-	-	-
6 YEAR BONDS	-	-	-	-	-	-	-	-
7 YEAR BONDS	-	-	-	-	-	-	-	-
8 YEAR BONDS	-	-	-	-	-	-	-	-
9 YEAR BONDS	-	-	-	-	-	-	-	-
10 YEAR BONDS	-	-	-	-	-	-	-	-
30 YEAR GMA'S	-	-	-	-	-	-	-	-
TOTAL	-10,354	142,725	46,364	73,915	60,651	-2,924	-70,079	-36,055



TRIAL: 1

RISK ANALYSIS SYSTEM

DATE: 9/ 4/87 TIME: 18:16: 1

PRODUCT: SPDA

UNIT FACTOR IS 1,000.

STRATEGY: CREDITED = EARNED LESS 150 NET - INVEST IN 5 YR CORPORATES

	12/85	12/87	12/88	12/90	12/95	12/ 0	12/ 5	12/ 6
LIABILITY SUMMARY--INTEREST SENSITIVE LIABILITIES								
PREMIUMS	-	-	-	-	-	-	-	-
-DEATH BENEFITS	2,926	6,569	7,477	9,447	13,916	9,185	3,767	1,688
-DIVIDENDS	-	-	-	-	-	-	-	-
-PARTIAL SURRENDERS	-	-	-	-	-	-	-	-
-NET SURRENDERS	16,283	34,405	35,911	37,455	68,621	62,441	24,854	64,529
-EXPENSES	1,171	2,419	2,457	2,476	2,171	890	233	90
-NET COMMISSIONS	-	-	-	-	-	-	-	-
-SURPLUS RELIEF CHARGE	-	-	-	-	-	-	-	-
INSURANCE CASH FLOW	-20,380	-43,393	-45,844	-49,378	-84,708	-72,516	-28,854	-66,307
BEGINNING ACCOUNT VALUE	665,199	645,430	669,665	702,009	684,394	303,782	85,941	62,444
+INTEREST CREDITED	-	66,226	63,227	57,587	34,728	17,379	5,124	3,773
+PREMIUMS	-	-	-	-	-	-	-	-
-FUNDS RELEASED BY DEATH	2,926	6,569	7,477	9,447	13,916	9,185	3,767	1,688
-MORTALITY CHARGE	-	-	-	-	-	-	-	-
-PARTIAL SURRENDERS	-	-	-	-	-	-	-	-
-GROSS SURRENDERS	16,843	35,422	36,653	37,748	68,621	62,441	24,854	64,529
-CHARGES	-	-	-	-	-	-	-	-
ENDING ACCOUNT VALUE	645,430	669,665	688,762	712,400	636,584	249,535	62,444	-
CASH VALUE	623,937	653,574	677,524	708,614	636,584	249,535	62,444	-
INSURANCE IN FORCE	645,430	669,665	688,762	712,400	636,584	249,535	62,444	-
POLICIES IN FORCE	23,772	22,369	21,023	18,514	12,339	3,718	692	-
RESERVE	628,638	658,322	678,361	708,861	636,584	249,535	62,444	-
LESS SURPLUS RELIEF	-	-	-	-	-	-	-	-
NET RESERVES	628,638	658,322	678,361	708,861	636,584	249,535	62,444	-
BEGINNING LOANS	-	-	-	-	-	-	-	-
+LOAN INTEREST	-	-	-	-	-	-	-	-
+NEW LOANS	-	-	-	-	-	-	-	-
-LOAN TERMINATIONS	-	-	-	-	-	-	-	-
ENDING LOANS	-	-	-	-	-	-	-	-

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