1997 VALUATION ACTUARY SYMPOSIUM PROCEEDINGS

SESSION 7

Variable Annuities -- Modeling Issues

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VARIABLE ANNUITIES -- MODELING ISSUES

MR. THOMAS A. CAMPBELL: The first speaker is Duncan Briggs, who will discuss statutory modeling issues. Duncan is a consultant in the Tillinghast/Towers-Perrin Hartford office. He joined the firm's London office in 1994 and transferred to Hartford in 1996.

Duncan has experience in modeling a wide range of products for a variety of purposes. Before moving to the U.S., he had extensive experience with unit-linked products, which are the UK equivalent of variable products. Duncan is a Fellow of the Institute of Actuaries in the UK, and an Associate of the Society of Actuaries.

The second speaker will be Harry Miller, who will discuss GAAP modeling issues. Harry is the director of actuarial services for the Variable Annuity Life Insurance Company (VALIC). His current duties include a wide range of activities including product development, financial reporting, and special projects. He has been with VALIC since 1994. Prior to that, he served nearly 14 years with Milliman and Robertson in both the life and health insurance field.

I'll be the third speaker, and I will discuss valuation actuary issues. I'm an assistant vice president and corporate actuary with Hartford Life. I also co-chair the American Academy of Actuaries' work groups that developed Actuarial Guideline MMM and the revisions to Actuarial Guideline XXXIII. Modeling for variable annuities have increased in importance over the years, in part because of the rapid growth of this business. According to the Variable Annuity Research and Data Service (VARDS), assets in force have grown from $10 billion in 1989 to over $570 billion as of the end of June. VARDS further estimates that sales this year will exceed $85 billion, surpassing last year's record of $73 billion.

In addition to the significant size of the business is the characteristics of products which present challenges to actuaries who model variable annuities. It is these challenges that we'll be discussing during the session. With that I'll turn things over to Duncan.

MR. DUNCAN BRIGGS: The subject of my presentation is variable annuity modeling issues from a statutory perspective. The obvious application that comes to mind here is cash-flow-testing work. However, most of the material that I'm going to cover is relevant in a much wider context than cash-flow testing, including pricing, corporate planning work, embedded value calculations, and appraisals.

I'm going to start by discussing the selection of liability assumptions. I will focus here particularly on the persistency and mortality elements. I'm then going to consider the issues that arise in the modeling of guaranteed death benefits. I will discuss one approach that can be used in practice to allow for these benefits when modeling.

After a brief discussion of fund transfers, the rest of my presentation will consider the investment risks associated with variable annuities, and how investment fund performance can be modeled to reflect those risks.

As is the case with all product lines, there is no uniquely correct way to model variable annuities. The purpose of this presentation is not to state how these products should be modeled. Rather, it is to identify the issues that need to be considered in constructing variable annuity models. How individual companies address these issues will depend on the purpose of the model, the relative importance of the particular issue to the company, and, of course, the size of the variable annuity business lines.

Starting with persistency, I've identified four types of persistency that are relevant to variable annuities: full surrender, partial withdrawal, premium persistency, and annuitization.

There are a number of data sources available to actuaries when considering suitable assumptions for these variables. Probably the most important data source, at least for the larger companies that have a reasonable amount of credible experience data, is the company's own experience studies. Even if we were in the position of having a large amount of credible industry experience data available, the

company's own experience would still be highly relevant, since persistency is clearly influenced by company specific factors such as target markets, distribution methods and conservation management. LIMRA and the Society of Actuaries recently completed a study of variable annuity persistency covering the period 1992 through 1994. This study included experience in respect of 28 variable annuity writers.

Other studies have been completed by firms of consulting actuaries, and these are typically made available to the companies that actually participate in the surveys. The industry data that I've seen show a very low overall surrender rate for variable annuities. Surrender rates for variable products have been much lower than the surrender rates for comparable fixed annuities.

The LIMRA study reported an overall surrender rate of 2.6% for single premium variable annuities, which compares to 6.9% for single premium fixed annuities.

The available data also show a marked increase, or spike, in surrender rates in the year in which the surrender charge first hits zero, followed by a mini-spike in the following year.

As an example, the LIMRA study showed an overall cash value surrender rate of 2.7% in the year prior to the surrender charge reaching zero. In the following two years, the corresponding rates were 11.5% and 8.9%.

The LIMRA study also showed significant differences in surrender rates by distribution system. What's surprising is the study observed higher rates for career agent distribution than for other systems. However this was an overall result, and it wasn't actually broken down by policy duration, which could have produced a very different pattern of results.

A recent survey conducted by Tillinghast, which included several large variable annuity writers, showed lower surrender rates in the critical spike surrender year for career agency sales as compared to the sales under other distribution methods.

The level of partial or free withdrawals experienced varies by company and will reflect the distribution methods and markets targeted by individual companies. Assumptions typically used in modeling work varied between 1% and 3% of fund value per year.

The LIMRA study also looked at premium persistency for flexible premium variable contracts. The results showed that the prevalence of ongoing contributions depends heavily on contract type, with qualified contracts, and in particular 403(b) contracts, having higher premium persistency than nonqualified ones. This reflects the way in which these contracts are sold. Outside of the qualified markets, contracts tend to be sold as single premium, even though they're strictly flexible.

The issue from a modeling perspective is, when should we be allowing for future contributions in our projection work? The answer to this question will vary by company, reflecting how the company has marketed its products. The approach adopted would also depend on the particular modeling application. For asset adequacy analysis, where the overall approach is one of conservatism, future contributions would typically be ignored. However, for other applications that require best-estimate projections, it may be appropriate to include some level of future contributions.

The small amount of data on annuitization indicates that rates have been generally low outside of the 403(b) market. The number of annuitizations might be expected to increase in the future as the maturity of contracts starts to increase.

There are a number of factors that actuaries should consider when using historic persistency data in setting assumptions for projections. First, the number of policies past the surrender charge period is still relatively low, which places a limit on the credibility of past experience data.

Second, recent experience data are derived from a period of exceptional equity market performance. Not surprisingly, surrender rates have been very low. We need to ask ourselves how relevant is this experience going to be in prolonged periods of more modest returns?

Some actuaries have developed sets of rules that attempt to predict how contractholders will behave in different economic conditions and the resulting surrender rates. This raises the question of whether we should use lapse assumptions that are dynamically linked to the scenarios being tested. This may not be necessary in cash-flow testing work, where the overall approach being used is conservative, but in other situations, such as the potential acquisition of a block of annuity business, testing the effects of dynamic lapses would be highly desirable.

A final point worth mentioning is that the existence of a guaranteed minimum death benefit could, in itself, influence lapse rates. In theory, the existence of a valuable guaranteed death benefit might be expected to dampen surrenders in adverse investment scenarios.

Let's move on to mortality. There are currently no industry-wide studies available of deferred annuitant mortality. A Society working group is in the process of investigating deferred annuitant mortality, but they have not yet published any results. In the early years of deferred annuity products, mortality assumptions were commonly based on variations of population mortality tables. However, it soon became apparent that the profile of variable annuity contractholders was very different from that of the general population. This is apparent in the mortality assumptions currently being used by companies.

Examples of mortality assumptions that might be used at the moment in pricing variable annuities are: (1) 60-75% of 1975-80 Ultimate Basic Tables, and (2) 100% of 1983 Table A.

The importance of the mortality assumption has grown in recent years due to the increasingly valuable guaranteed death benefits that are being offered in the marketplace. The modeling of these benefits poses an interesting problem for actuaries. In the standard level growth scenario, the guarantee has little or no cost. The guarantee cost is only apparent in scenarios where the contract's surrender value falls below the guarantee level.

The issue facing actuaries is how to allow for this potential cost in modeling work. One approach that has been used in cash-flow testing work is to use what's called a pop-down scenario. Under this approach, the fund value is assumed to drop immediately by, say, 30% and then to grow steadily from this base. This approach generally produces a conservative allowance for the guaranteed death benefit cost.

While a conservative methodology such as this might be appropriate for asset adequacy analysis, it is probably not so for applications requiring best-estimate projections, such as corporate planning work. An alternative approach is to run a large number of stochastically generated scenarios. The guaranteed death benefit will have a cost in some of the scenarios but not in others. The main drawback of doing this is, of course, the amount of time and computing power involved, which often make this approach impractical.

A third method that can be used to model guaranteed death benefits is to express the cost as an asset-based charge, and use this charge in regular deterministic scenarios. The level of the charge could be derived using stochastic testing. I'll talk more in a few minutes about generating stochastic scenarios for variable funds, but for the moment let's assume that we have an adequate scenario generator.

For each scenario, we calculate the present value of the projected stream of guaranteed death benefit costs, and divide the result by the present value of the mean fund values in each year. This gives a cost for one scenario. This cost is then averaged over the scenarios tested to derive a suitable guaranteed death benefit allowance.

Stochastic testing of this manner shows that the guaranteed minimum death benefit cost depends on many factors. The definition of the guarantee has a big impact on its cost. Not surprisingly, guaranteed death benefit reset features add significantly to the cost, although this is dampened somewhat where the reset feature has an age cap such as 80 years.

A survey of variable annuity products taken two years ago, showed that nearly half of the products contain some sort of reset feature. So clearly this is a very significant issue for many companies.

The mortality rates assumed in testing guaranteed death benefits clearly influence the cost. One factor that might be considered is the possible effect on mortality of antiselective lapses in cases where a significant guaranteed death benefit is being offered.

The demographics of variable annuity contractholders are also very important. The guaranteed death benefit cost rises with mortality rates, and given the nonlinear shape of mortality curves, the age distribution of contractholders is clearly critical.

The relationship between guaranteed death benefit cost and attained age also makes the cost fairly sensitive to lapse assumptions.

The method used to generate the stochastic scenarios is another important factor in determining the cost, and I'll talk more about that later. Yet another factor is the mix of funds. The relative volatility of equity funds produces a much higher guaranteed death benefit cost as compared to say bond and money market funds.

The flip side of this is that the presence of the death benefit could, in itself, influence the fund mix. In theory, it could reduce the hindrance to invest in the more volatile funds.

One point that makes a significant difference to the cost is whether you assume that every contract invests in the same mix of funds, or whether the overall mix is made up of some contracts investing in all equities and others in all bonds or money market funds.

The first assumption results in a much lower guaranteed death benefit cost because of the lower volatility that is associated with holding a diversified portfolio of assets.

A few words about transfers between accounts. The financial effect of transfers from one separate account to another generally only has a second order effect. A possible exception to this is where fund-based charges vary significantly between funds, which could be the case if a company offers both internally managed funds and also funds that are managed by external providers.

Transfers from the general account to the separate account create a greater potential risk, since transfers could be made at a time when the market value of assets is lower than the corresponding book value. Fixed account funds are sometimes transferred to separate accounts on a systematic basis to gain the benefits of dollar-cost averaging. In theory, transfer activity should reflect both the absolute and relative levels of interest rates and stock market indices. In practice, the actual level of transfer activity for most companies is fairly low. There have been exceptions to this, most notably relating to individuals who fall under the influence of certain investment advisors who publish recommendations regarding the timing of switches between variable funds. I heard of one company where nearly 10% of the assets in one subfund was transferred to another subfund in a single day. The company attributed a large part of this to recommendations that were made by an advisor.

The rest of my presentation covers variable annuity investment risks and the methods of projecting fund performance. Excluding fixed investment options and ancillary benefits, most of the investment risk associated with an individual variable annuity product is borne by the contractholder.

The insurer's most significant risk is based on the level and timing of asset fees and surrender charges versus those expected in pricing. Typically, this investment risk is minimal when compared to the investment risk associated with fixed annuity products. The level and timing of asset fees are a function of the performance of the funds supporting the product and the mix of assets between funds. The level and timing of surrender charges are mainly a function of contractholder action and fund performance. Individual variable annuity products that include fixed and MVA account options have the added investment risks typically associated with these products. In addition, the mix of funds between these options and the variable funds comes into play.

Ancillary benefits also add risk to the individual variable annuity product, particularly, the guaranteed minimum death benefits that I've already discussed.

In practice, companies use both stochastic and deterministic scenarios to project fund growth for variable annuity business. Stochastic methods are typically used where the expected fund performance is modeled on a fund-by-fund basis. Each fund is projected separately using methods such as Monte Carlo simulations. Some companies may only model equity funds in this way, and then base the performance of bond funds on the scenario-specific fixed-interest-rate assumption.

Deterministic methods are typically used where the total fund performance is projected for the entire book of variable annuity business based on a reasonable total return consistent with the expected mix of funds. For asset adequacy analysis, the valuation actuary needs to be satisfied that the scenarios tested reflect the expected return and volatility of the underlying funds, and reasonably cover the distribution of possible outcomes.

A third approach, that is sort of a hybrid of the two, is to run a range of deterministic scenarios using a scenario generator to determine what a suitable range might be. This approach has been frequently used in pricing variable annuities.

One of the keys to the validity of using a level growth scenario is the result that, while profitability depends heavily on a mean growth rate, it is relatively insensitive to the precise path taken to get there. An important point to note is that this result ignores guaranteed death benefit costs.

If the approach I'm outlining is used, then guaranteed death benefit costs would need to be allowed for elsewhere; for example, by using the fund based charge methodology I discussed earlier.

To demonstrate the relative insensitivity of profit, I've constructed a simplified example based on a $10,000 single premium invested over a 20-year period. A 100-basis-point asset charge applies to the contract, and maintenance expenses are $50 per annum, inflating at 3%.

If we assume a 7% level growth rate, then the present value of profit margins for this contract is $1,313 using a 7% discount rate, and $816 using a 12% discount rate.

Now let's consider two alternative fund growth patterns. Both produce an average growth rate over the 20-year period of 7%. Pattern A alternates between growth rates of 11.15% and 3%, while Pattern B fluctuates from a high of 20% to a low of -10% over the period.

If we compare the present value of profit margins for each scenario, we see that there's not too much variation among the three. Pattern A produces a margin which is around 10-15% higher than the margin for Pattern B. This result is much less valid for annual premium contracts, where the profit does turn out to be much more sensitive to the precise path taken. So this methodology is really only appropriate for single premium type contracts.

The final item I'm going to cover is an approach that can be used to generate sets of stochastic fund growth scenarios for different asset classes. This approach is one that has been used for many years by pension fund actuaries, but not for as long by life office actuaries. The first step under this approach is to generate sets of future interest and price inflation rates. I won't say anything about generating interest rate scenarios because I'm sure you are all very familiar with that. Price inflation rates generated are consistent with the interest rate scenarios in that they are derived using the historic interrelationship between inflation and interest rates. Given suitable spread assumptions for the various bond categories held, the levels of interest rates and the changes in the rates from year to year lead to the total return for bond funds.

The next step is to develop simulations of dividend yields and dividend growth rates for large cap stocks, using the inflation and interest rate variables. The key here is the relationship between dividend growth and inflation. The simulations that take account of historic mean levels of real dividend growth and also the variability in real dividend growth rates over the historic analyzed period.

Returns for other asset equity classes, such as mid-cap stocks and international categories, are based on the simulated large cap returns together with assumptions for risk premiums, volatility, and co-variance.

There is a list of primary data sources used to develop the parameters required for the scenario generator I've just described. They include: the Consumer Price Index, Treasury yields, the Lehman Brothers Corporate Bond Index, Standard & Poor's 500, the Russell 2500 Index (small/mid cap), and the Morgan Stanley International EAFE Index. There are other sources available, such as Morningstar, which includes fund performance data for the entire industry by fund type. One drawback, however, of using Morningstar is that the data go back for at most ten years. In practice, we could augment the Morningstar data with data derived from indices for earlier periods.

That's all I have on the statutory side of variable annuity modeling. Harry Miller is going to talk about GAAP modeling issues.

MR. HARRY R. MILLER: As Duncan said, I'm going to focus on some of the modeling issues that arise for variable annuities from the GAAP perspective.

I plan to focus on three major areas:

1. Differences between the statutory perspective and the GAAP perspective for the modeling issues that Duncan previously discussed.
2. *FAS 97* modeling issues. I'll focus on some of the issues to keep in mind when developing models for *FAS 97*. I'm going to make a few comments about the process of unlocking deferred acquisition cost (DAC) assumptions for variable products based upon our experiences. I'm also going to look at a growing issue, which is the impact of short-term market fluctuations on DAC for variable products. I will also provide a few observations concerning some of the issues that may arise when dealing with transfers between fixed and

variable accounts. I'll also speak briefly about handling multiple variable funds under *FAS 97.*

3. Finally, I'll wind up with a few comments about a couple of other modeling issues relating to variable products.

Duncan provided an excellent overview of the modeling issues from a statutory perspective. From the GAAP perspective the issues tend to be the same. The primary difference I have found between the statutory and GAAP perspective is the level of flexibility you have as an actuary in addressing these issues.

From a statutory perspective, you tend to have less flexibility in dealing with the issues due to the presence of the various valuation regulations and less reliance on the materiality concept. From a GAAP perspective, I found you have a little more leeway when constructing your models.

The admonition that advance planning equals efficient models is true for any planning process. From a GAAP perspective, I found you can often achieve even greater benefits from a little advanced planning and an understanding of the key drivers of the results. For example, we're in the process of reducing some of our GAAP models by over 80% without materially impacting the results.

Another major difference is the basis of the assumptions used. Statutory assumptions tend to include margins for conservatism, while GAAP assumptions (particularly as they apply to *FAS 97*) are based on best-estimate assumptions. An interesting question is whether *best-estimate* is defined in terms of the individual assumptions or the aggregate results. If you assume it is defined in terms of aggregate results, this may allow you to further simplify your models.

I have one comment relating to Duncan's comments on annuitizations. There does tend to be a very low level of annuitization on these products. However, we have noticed a great deal of quasi-annuitizations, particularly in the qualified market. These appear as minimum distributions or

systematic withdrawals. In most instances these work the same as short-term certain annuities. These options should be looked at carefully in your pricing in order to maintain consistency with your short-term annuitization options.

Another modeling difference between statutory and GAAP that has impacted some of our work has been the degree of integration of the general and separate accounts. From a statutory perspective, the general and separate accounts are fairly distinct. This need not be the case from a GAAP perspective. In fact, in some instances you would definitely prefer not to have any distinction between the general and separate accounts for GAAP purposes.

One example is the situation where there is a moderate level of transfers between fixed and variable portions of a combination product. In that instance, you may wind up creating more trouble for yourself from a GAAP perspective by keeping them distinct due to the necessity of accounting for the transfers in your DAC models.

I believe the overriding factor to keep in mind is that the models constructed for *FAS 97* DAC amortization purposes are simply a fancy way of drawing a line between Point A and Point B. Point A would be the initial amount of acquisition costs deferred and Point B would be zero. From this perspective, you can demonstrate that the slope of the estimated growth profits is the key determinant of the DAC amortization pattern.

In constructing your models, it then becomes important to sensitivity test your various assumptions to determine which items are critical in determining the slope of the estimated gross profits. This tells you which items to focus on when building your models and which items can be handled in a simplified fashion.

The main lesson we have learned from our modeling experience is to keep it simple. Real life will make it complicated enough. We have been continually surprised by how much we can simplify our models without changing the results. This allows us more time to focus on the inevitable crisis

which arises. It also allows us to devote more effort to sensitivity testing and analysis rather than model maintenance. This is a big help when we get to our next topic of unlocking DAC assumptions.

I think in terms of two types of unlocking for *FAS 97*. One is retrospective, which is the process of reflecting the actual historical experience in the results, and the second, prospective, is changing the future assumptions due to changes in future expectations.

Using a southern analogy, there seems to be as many theories on how to handle DAC unlocking as there are fleas on a hound dog.

In my experience, the approach used for unlocking appears to be based upon a combination of factors: (1) the type and quality of data available; (2) the frequency required for reflecting historical experience (e.g., quarterly versus annually); and (3) the type of DAC methodology being used (e.g., companies using a factor-based approach will likely use a different approach than a company using a worksheet-based approach).

This is important to understand when you're comparing your methodology to those of other companies. The key is to make sure you understand what type of GAAP methodology they are using so you can make a meaningful comparison.

These issues are as applicable to variable products as they are to standard products. The key again is sensitivity testing the results of the unlocking to determine which items materially impact the results. In our sensitivity testing, we have found only very few items that materially impact the results and these are the ones we focus on.

Regarding the issue of unlocking, one item in particular that seems to be getting more interest as the amount of variable business grows is the question of how to deal with short-term fluctuations in the DAC amortization models.

Some DAC methodologies could result in sharp swings in DAC amortization. Take for example the first half of 1997. At the end of the first quarter we had a fairly significant drop in the market. If you were using a methodology that takes your actual account values at that point and projects out using your long-term growth rate, you would have experienced the equivalent of 10% extra lapses in your DAC models. This would result in a significant amount of additional amortization during the quarter.

Now you go forward one quarter and the market recovers to a level consistent with your long-term growth assumption. Your account values have recovered, and you slow down your DAC amortization and the unamortized DAC is near the point you expected it to be based upon your original assumptions.

I think the key question is, if you think your long-term appreciation assumption is right, should temporary market fluctuations around the long-term average return result in a change in the overall estimated growth profits for the business? If not, then it may be appropriate to utilize some type of smoothing technique to reduce the volatility of the results. This is consistent with the approach used under *FAS 97* and also with some of the approaches being used for recognizing realized gains and losses within the industry.

While there are a number of approaches, the ones I have seen typically involve some type of mean regression back to the long-term expected return.

Our experience has seen a somewhat higher level of transfers between fixed and variable accounts than was alluded to earlier. This is due, in part, to the education efforts we have undertaken to increase customer awareness of the benefits of investing in equity accounts. The levels of transfers we are seeing relating to market timing activities is fairly consistent with what Duncan noted.

These transfers can create some interesting issues for you when you're creating models for GAAP purposes. While your initial reaction may be to split the fixed and variable business into separate

components, this may not always be the most practical. For example, if you have a combination contract with both fixed and variable options in it modeled separately and money transfers from the fixed account to the variable account, would this create a need to transfer the DAC between the two models as well?

Transfers between fixed and variable can also impact your assumptions. For example, does the experience information for lapses handle transfers correctly for the particular model you have established? How will transfers and lapses interact in different economic scenarios? Will this materially impact your estimated future growth profits and DAC amortization or is this something you can safely ignore?

Again it's important, as part of your advance planning, to look at the various alternatives available for dealing with transfers. Perform adequate sensitivity testing to develop a good understanding of their impact.

In recent years, the number of available funds in variable annuities has increased. It is unlikely that these funds will all have the same expected growth rate. We have also seen less uniformity in the margins on funds within the same annuity over time. For group contracts, we have also seen different margins by group.

The growth and fund options creates a need to consider how to best reflect these options in the GAAP models. Different M&E levels on the same funds will tend to have a smaller impact than different long-term expected growth rates on the fund. This relates back to the point that the slope of the estimated gross profits is more important than the level of estimated gross profits in determining the amortization pattern. Our testing has indicated that, for our products, the different M&E levels can safely be composited.

Guideline MMM on the statutory side has prompted some discussion of the need for minimum death benefit reserves under GAAP. While it's an interesting theoretical discussion, our analysis using an

approach similar to that underlying Guideline MMM would suggest that for basic death benefit designs, this will not likely be a practical issue for GAAP. For some of the more aggressive death benefit designs this may get to be an issue. It is something you need to consider when modeling your variable annuities.

Another issue that has come up in relation to both GAAP and corporate planning is the appropriate levels of target surplus on variable products. As many of you are aware, the NAIC RBC levels can produce fairly low levels of required surplus on variable products. While the appropriate level depends upon the specific nature of your products, the level of target surplus for variable products seems to range from 0.5%-1.5% of reserves.

Finally, an interesting issue we have run across involves calculating GAAP return on equity (ROE) for combination products (those having both fixed and variable options). Calculating the ROE in total is fairly straightforward. However, management is naturally curious about the differences in the ROEs between the fixed and variable portions.

Calculating ROEs for these components can produce some interesting modeling issues for the actuary, particularly how to deal with issues such as how to allocate the DAC between fixed and variable components, and the treatment of the CARVM allowance on the variable business.

This is another reason I believe advanced planning and simplicity are the keys to modeling variable annuities. A thorough understanding of all the potential issues and uses of your models may lead you to choose different approaches that may increase the ability of the models to be used more effectively to provide management with the information necessary to achieve your organization's objective.

MR. THOMAS A. CAMPBELL: I'm going to be talking about valuation actuary issues that involve variable annuities. I'm going to include statutory reserves, and I'm going to talk briefly about accounting requirements and then get into actuarial opinion issues. Everything that I'm going

to cover is covered in the Variable Annuity Life Practice Note. However, my comments represent my own views and not necessarily those of the American Academy of Actuaries.

Let's look at statutory reserves. When you calculate reserves for variable annuities, you have several regulatory sources available to you for guidance. One of these is the NAIC Model Standard Valuation Law which requires what's commonly known as the Commissioner's Annuity Reserve Valuation Method (CARVM) for most annuities. It requires that reserves be the greatest present value of future guaranteed benefits.

Another regulatory source that has been discussed a great deal at the symposium is Actuarial Guideline XXXIII, which is an interpretation of the Standard Valuation Law. It interprets the standards for applying the concept of the greatest present value to annuities with multiple benefit streams. Revisions have been made to the guideline which are expected to become effective next year.

A third source is the NAIC Model Variable Annuity Regulation, which requires reserves for variable annuities to be based on the requirements of the Standard Valuation Law, taking into consideration the variable nature of the benefits.

A fourth source is Actuarial Guideline MMM, which is in the approval process at the NAIC, and is expected to become effective in 1998. This guideline requires minimum guaranteed death benefits to be projected and integrated with the Actuarial Guideline XXXIII multiple benefit streams by applying immediate drops and assumed returns that vary by different fund types. The guideline goes on to stipulate the valuation actuary is responsible for verifying the accuracy of the fund classifications used in the reserve calculation.

One of the key issues involving variable annuity reserves is the application of CARVM. This involves several issues. The first of which is the question of whether CARVM applies to variable annuities. Some have argued that it doesn't since variable annuities do not provide guaranteed cash

surrender values. This leads to the conclusion that reserves should then be cash surrender values since that is the only guaranteed benefit. However, I don't agree with this argument. I believe that CARVM does apply to variable annuities for several reasons. First, it's required by the Standard Valuation Law, which applies to all annuities other than a few group annuities. Second, it's required by the Model Variable Annuity Regulation, as I mentioned earlier. Third, variable annuities do have other guarantees such as guaranteed expense charge levels, guaranteed annuitization benefits, minimum guaranteed death benefits, and guarantees that the surrender charge will decline over time.

Because of this, I think the question should not be whether CARVM will apply, but rather how should CARVM be applied to variable annuities?

Some actuaries interpret CARVM for variable annuities to be either cash surrender value or account value. However, many actuaries use the method that was prescribed in the American Academy of Actuaries 1991 *White Paper on the Practical Applications of Reserving for Contemporary Annuities*. This method involves projecting for the account value at the valuation date at some interest rate to determine future guarantee benefits. You would then discount the benefits at the valuation interest rate, and hold the greatest value of the resulting guaranteed benefit streams.

Now I want to focus on this interpretation of CARVM since it seems that it's the most popular method for reserving variable annuities. It's also a method that has many different variations in its applications. Part of these variations are due to the way some of the issues are handled, and I'll go through them.

The first, and probably most important interpretation issue is the spread between the projection and discount rates used in the projection of guaranteed benefits. Most companies handle this by using a projection rate equal to the valuation rate less some or all of the contractual asset-based charges. The theory here is that the discount rate represents the earn rate and the projection rate represents the credited rate. By using this method they're reflecting the guarantee that the credited rate will be the earned rate less contractual asset-based charges.

The issue of interest rate spread also brings up the issue of the appropriateness of reducing that spread for maintenance expenses.

My opinion is that there should not be any reduction for several reasons. First, there's no specific requirement for maintenance expenses in any annuity reserving method. Second, I believe there is enough conservatism in the greatest present value requirement that CARVM provides, especially if a company is using the continuous CARVM which I'll comment on soon.

Third, maintenance expenses are analyzed as part of the actuarial opinion. If there's not enough conservatism in the greatest present value requirements, it will be picked up in asset adequacy analysis and in the opinion.

A second CARVM interpretation issue is whether to use plan type A, B or C valuation interest rate. Most actuaries directly apply the plan type definitions in the Standard Valuation Law to the annuity contract. This typically results in a plan type A rate. Bear in mind that, when you're applying the Academy White Paper's interpretation of CARVM, a higher valuation interest rate will usually result in a higher reserve.

A third issue is whether to use continuous or curtate CARVM. Under continuous CARVM the guaranteed benefits are considered at all future points in time, whereas for curtate, they're only considered at the end of every policy year. A literal reading of the Standard Valuation Law specifies that curtate CARVM is required. However, some states, such as New York, may require that continuous CARVM be used.

A fourth issue is how the fixed account option is incorporated into the variable annuity reserve calculation. Many companies calculate a separate reserve for the fixed account options using methods that are consistent with fixed products. Others combine the fixed and variable options, essentially treating the fixed account option as an additional variable fund.

Finally, a fifth issue is how ancillary benefits, such as death and disability benefits, are incorporated into the reserve calculation. Some companies integrate the benefits into the CARVM benefit streams, while others simply hold an add-on reserve. Both the revisions to Actuarial Guideline XXXIII and the new Actuarial Guideline MMM will bring uniformity to this issue by requiring that ancillary benefits be integrated into the CARVM benefit stream.

Before I move onto actuarial opinion issues, I want to comment on the NAIC accounting requirements that were effective with the 1996 annual statement. Prior to 1996, there were variations on how companies accounted for variable annuities in the blue book. That resulted not only in different presentations but also different treatments for risk-based capital. These updated requirements were meant to bring uniformity to how companies treated variable annuities. Beginning in 1996, the CARVM allowance, which represents the excess of separate account assets that support variable annuities over the reserves held in the separate account, is reported as a negative liability in the general account.

The annual statement instructions state that the amount reported as a negative liability should be the same as the amount of surplus that would have been reported in the separate account statement if the CARVM allowance was left in the separate account statement rather than being transferred to the general account statement. So according to the annual statement instructions this accounting requirement represents a transfer of the CARVM allowance to the general account.

This account treatment is also supported by risk-based capital requirements that apply a dual set of factors to the CARVM allowance. It applies a 10% factor to the CARVM allowance on products where the surrender charge is based on the fund balance and a 2% factor on products where the surrender charge is based on fund contributions, (but only if the fund balance exceeds the sum of the premiums less withdrawal). In other words, if you have a loss of principal, you don't apply the 2%; you apply a 10% factor. The requirements also apply a 10% factor to any separate account cede money.

Next I'd like to discuss actuarial opinion issues by commenting on some of the things that the valuation actuary should consider regarding variable annuities. The first consideration is whether the actuarial opinion should include variable annuities.

Now some have argued that the opinions should not cover variable annuities because the investment risk is passed on to the contractholder. However, my opinion is that it is appropriate to include variable annuities in the opinion for several reasons, the first of which is risks such as fixed account options, annuitization benefits and other ancillary benefits, especially minimum guaranteed death benefits. Second, as Duncan covered earlier, variable annuities do subject the insurer to investment risk. Third, the Actuarial Opinion and Memorandum Regulation requires that separate account reserves be covered by the actuarial opinion.

For similar reasons, it's also appropriate to include variable annuities in asset adequacy analysis. This is further supported in three places. The model Actuarial Opinion and Memorandum Regulation requires asset adequacy analysis for companies subject to Section 8. I believe that most companies that are active in the variable annuity marketplace do qualify for Section 8 opinions. Second, Actuarial Standard of Practice No. 22 states that only those reserves that are immaterial can be reported as nonanalyzed. Third, some states explicitly require that variable annuities be analyzed.

This leads to the question, if asset adequacy analysis is required, what method is most appropriate? In general, cash-flow testing is the most appropriate method where cash flows vary under different economic conditions. I think this applies to variable annuities in most situations, especially for products that have characteristics such as a fixed account option, surrender charges that decrease by more than 1% in any given year, annuitization guarantees and ancillary benefits, and, especially, minimum guaranteed death benefits.

Other methods, such as documented conservatism, may be acceptable under certain circumstances. For instance, this occurs if you have a run-off block of business that has been on the books for a

while or one with a steady surrender charge pattern. I think that cash-flow testing is being used by most companies that have significant blocks of variable annuity business.

Another Actuarial Opinion consideration involving variable annuities is the treatment of the CARVM allowance. I've found that there are many different opinions about what the CARVM allowance is, how it impacts the balance sheet, and how it should be handled in asset adequacy analysis. I'd like to offer my comments on the topic.

As I mentioned earlier, the CARVM allowance represents separate account assets in excess of the reserves supporting variable annuities. According to the NAIC Model Variable Annuity Regulation, separate account assets supporting variable annuities are insulated from the general account up to the level of statutory reserves.

What that means is that the CARVM allowance, which is the separate account assets in excess of the level of reserves, is available to support general account liabilities. Furthermore, as I mentioned earlier, the accounting treatment in the annual statement instructions requires that the CARVM allowance be transferred to the general account. Therefore, I believe that the CARVM allowance represent assets that are owned by the company not the separate account. It is not owned by variable annuity contractholders.

Now the CARVM allowance does represent assets that are invested in the variable funds of the separate account. Because of this, the investments of these funds are controlled by variable annuity contractholders. However, I don't think that this means that the assets are owned by the variable annuity contractholders. In other words, the fact that the assets are controlled by variable annuity contractholders is a cash-flow and liquidity issue rather than an ownership issue. It's a cash-flow issue because what the general account sees as cash flows from these assets are future variable annuity fees, surrender charges, and fund transfers.

In my opinion, the CARVM allowance should be recognized in asset adequacy analysis. In fact, some states require that it be recognized and require that the actuarial memorandum state how this is handled in the analysis.

One way to do this is to include the CARVM allowance as an asset supporting some of the general account reserves being analyzed. I think this method works particularly well with the general account reserves supporting the fixed-account option of the variable annuity contract.

If you look at a given variable annuity contract, you often see that there's money invested in both the fixed account option and variable funds. This method allows the contracts to be analyzed as a whole, where the fixed account option cash flows are integrated with the separate account cash flows are analyzed as one block of business.

Under this approach, the pool of assets supporting these contracts would then consist of both general account and separate account assets. The asset cash flows would contain the future variable annuity fees, surrender charges, and fund transfers that make up the CARVM allowance cash flows.

Now this would obviously present the valuation actuary with cash-flow patterns that are much different than other general account assets. Sensitivity testing would need to be considered.

This would involve sensitivity testing of not only fund performance and fixed interest rates, but also assumptions such as lapses, and fund transfers. You get into some of the issues that Duncan mentioned earlier.

Let me give you an example. Consider a variable annuity with $100 of separate account, account value of $20 of fixed account value, where the CARVM reserves are $95 and $18. Therefore, the CARVM allowance is the difference between separate account assets and CARVM reserves, or $5.

The balance sheet would show an entry of separate account liabilities equal to separate account assets and the CARVM allowance is transferred to the general account and shown as a negative liability which brings the net separate account reserve down to $95. The $18 of fixed account reserves is also shown in the balance sheet, but on a different line.

When performing cash-flow testing, you would need to analyze $113 of reserves. Since cash-flow testing is generally performed with initial assets equal to reserves, you would then have to select and analyze $113 out of $120 of assets.

Let me show you two alternative ways that this can be handled. In Alternative 1, the CARVM allowance is not used as an asset, so you select $95 of separate account assets and $18 of general account assets. Under this method, the separate account and general account portions of the contract may end up being analyzed separately.

Under Alternative 2, the separate account and general account portion of the variable annuity contract are combined and analyzed as a single contract. The CARVM allowance is used as a general account asset so that the full $100 of separate account assets are used leaving $13 of general account assets to be selected. As the separate account portion of the variable annuity contract produces fees, surrender charges, and fund transfers, these flows are available to support the liability flows of the contract.

Under either alternative, the valuation actuary should consider the Actuarial Opinion and Memorandum Regulation requirement on asset selections and avoid any situations where using either one of these alternatives would unduly bias the results of the analysis versus using other alternatives.

In summary, my comments center on three points. First, CARVM should be used for variable annuities, and many actuaries who do use CARVM are applying the Academy White Paper method. Second, the Actuarial Opinion and Asset Adequacy Analysis should include variable annuities.

Cash-flow testing is the most appropriate method in most situations. Third, it is appropriate to use the CARVM allowance as an asset to support general account liabilities when performing cash-flow testing.

MS. GRACE L. ROKOSZ: I'm wondering whether anyone here has knowledge about whether the IRS has accepted variable annuity reserves in excess of the cash surrender value? In particular, has it accepted variable annuity reserves as high as the CARVM reserve might be if surrender charges happen to all change on January 1?

MR. CAMPBELL: I have not heard of any situations where the IRS has made a specific ruling on variable annuity reserves. If anyone in the audience knows of any situations where that is happening, I'd certainly like to hear about it.

MR. STEVEN A.J. SEDLAK: I have two questions. One was for Harry Miller. You said something about smoothing techniques, and one of them was to basically track your return so that your average return at some point in the future equals your underlying assumption. Are there any other techniques?

MR. MILLER: Yes, there are. I've also heard options such as only using your long-term assumption. Your results would not be based on the actual account values, however. This would be a static GAAP projection.

You could also vary the amortization period. For example, increase the amortization period from 20 years to 25 years if returns decline. Shorten the period to 15 years if returns increase. The methods all seem to try to keep the level of estimated gross profits constant over the life of the business.

MR. SEDLAK: My second question was for Tom Campbell. You mentioned that a number of states were requiring continuous CARVM. I know New York does, but what other states are doing so?

MR. CAMPBELL: New York is the only one I'm aware of that requires continuous CARVM for variable annuities through a regulation. I know Illinois has a continuous CARVM requirement for certain types of annuities. I also know California has been discussing it, but at this point they're not going to move forward with it. I've heard about states enforcing continuous CARVM outside of regulations, so it's important to talk to your state regulator and find out what they're requiring.

MR. JOHN F. BEVACQUA: I have a question on temporary aberrations. I'm just curious as to when the temporary one is considered temporary versus the beginning of a long-term trend?

MR. MILLER: That's a very good question and one we have debated a fair amount. Our senior management shares this concern about knowing when to recognize a temporary difference as a permanent trend. At this time we have not determined an easy way to accomplish this. The best I can offer at this point is that it is something that you need to consider when you are using this technique. If you are going to use some type of smoothing technique, you definitely need to validate your long-term assumptions periodically.

MR. PAUL J. SULEK: I have a question on the topic of asset adequacy analysis. In certain forums, there has been a lot of enthusiasm expressed for methods of asset adequacy analysis other than cash-flow testing. The only one mentioned here was documented conservatism. Are there other methods that you might recommend or that you've seen used?

MR. CAMPBELL: The reason I mentioned cash-flow testing and documented conservatism is because they were the only methods of asset adequacy analysis for variable annuities that I know are being used, based on conversations with other actuaries. If anyone is aware of other methods being used, I'd certainly like to hear about them.

MR. MARC ALAN CAGEN: On the reversion to the mean method, I assume that, when the market drops, you would assume that it recovers at a faster rate than its long-term historical trend. In practice, how much has that tended to smooth out the amortization of DAC?

MR. MILLER: It can't completely eliminate the variations. However, remember that the basic point in most techniques is to keep the estimated gross profits the same over the life of the business. This type of smoothing technique can take care of a majority of the variations.

MR. BRIAN TODD CORNISH: A quick question for Duncan Briggs. During your presentation, you talked about transfers between accounts and commented that the separate accounts have a "second order effect." Could you describe that a little bit more?

MR. BRIGGS: The basic principle I was trying to convey was that first, the level of transfers between accounts is relatively low. Second, when the transfers do occur, then you're basically talking about a difference in the projected future fund growth and the margins that come off the funds resulting from the switch. The combined effect on the change in margins due to both the changing growth rate and the level of transfers tends to be fairly small.

MR. DANIEL EDWARD RUBIN: Ignoring continuing premium might not necessarily be conservative for an annuity where the policyholder can reallocate premiums to the fixed option in a down scenario where spreads might get squeezed due to the credit rate floor. My question is, what specifically have you done to reduce your model size by 80%?

MR. MILLER: We performed a fair amount of sensitivity testing. Our products are concentrated in the qualified market and tend to be of a very similar nature. The biggest differences tend to be in the surrender charge features and the M&Es that are available on the various fund options.

For our particular products, the interest margin accounts for well over 90% of the profitability on the products. Our products also tend to have very low lapse rates. In that type of scenario, the

interest margin overwhelms the other components of profitability. This allows you to compress many of the other product features because they do not materially impact the slope of the estimated gross profits.

It's from going through the sensitivity testing and identifying the critical features that we are able to composite most of the product features together.

MR. HANS J. WAGNER: I have a comment that Duncan might want to react to. In looking at guaranteed minimum death benefit costs, do you occasionally find that depending on the design, the not-so-volatile funds can sometimes actually be the costly ones? In particular, rather than just being a step-up design, is there an underlying guaranteed interest rate? A less volatile fund might actually have scenarios where it doesn't give you a proper return.

MR. BRIGGS: That's a good point. That's certainly true with some of the higher guarantees such as a 5% guaranteed interest rate.

MR. CAMPBELL: Yes, if you have a 5% guarantee, and you have a lot of money in the money market, you could lose money on the death benefit guarantee.

1997 VALUATION ACTUARY SYMPOSIUM PROCEEDINGS

SESSION 8

Health Risk-Based Capital

Donna C. Novak, Moderator

William C. Weller