

**1996 VALUATION ACTUARY  
SYMPOSIUM PROCEEDINGS**

**SESSION 11**

**Health Financial Projections -- Short and Long Range**

**Burton D. Jay, Moderator**

**Paul Janus**

**Brian S. Reid**

**Max J. Rudolph**



## HEALTH FINANCIAL PROJECTIONS -- SHORT AND LONG RANGE

**MR. BURTON D. JAY:** I'm the financial actuary for the Mutual of Omaha Companies. Our first speaker will be Max Rudolph. Max is first vice president and assistant actuary at the Mutual of Omaha Companies. He's involved with the actuarial responsibilities for our corporate asset/liability management. He also has experience in management reporting and short- and long-term projections for life, annuity, and health lines.

Our second speaker will be Paul Janus. Until recently Paul was senior vice president, chief actuary, and director of Bankers Life and Casualty, one of the top five individual health insurers in the country and a leader in the sale of Medicare supplement and long-term-care insurance. He has currently retired and is a part-time consultant working under the name of P & L Consulting. He has been active in the Health Insurance Association of America (HIAA), serving a term as Chairman of its Individual Health Insurance Committee, and was past President of the Chicago Actuarial Association.

Our final speaker is Brian Reid. Brian is the Account Executive of SS&C/Chalke. Brian is responsible for sales and support of the PTS 2000 System and other related quantitative products in the northeast part of the U.S. His prior experience includes product development for disability income and executive benefits at Connecticut Mutual and disability income and long-term-care product development at the Travelers. At this time I'd like to call on Max to begin the presentation.

**MR. MAX J. RUDOLPH:** My talk is general in nature and will apply to all lines of business, not just health lines. It will lead into the product specific discussions that will be given later by Paul and Brian. I look forward to hearing later how you're using projections in ways other than those I will talk about. We're hopeful of making this an interactive session. I'm going to be talking about various uses for projections. Using a detailed versus rolled up model generally depends on your resources, especially time and the opportunity cost. You could be doing

something else besides this projection. For example, you may want a more detailed model for your initial pricing than for sensitivity to an existing block. You have to make a decision between the detailed and rolled up model each time you do a projection.

Synergies between projects, using one model for multiple projects, is definitely a soapbox issue for me. I think that there are many benefits from making a model improvement in one project that gets carried over in another project. Say you're doing a statutory projection and you find something that can improve it. If you're using the same model to do a generally accepted accounting principles (GAAP) projection, then that model improvement automatically gets carried over into the GAAP model as well. That leads directly to a single pass for statutory, GAAP, value added and duration studies. There's no reason why we can't use these same models to measure duration. Short-term versus long-term projections are often differentiated at five years; this is an arbitrary figure.

There are a lot of assumptions that vary depending on what you're going to do with your projection. Almost always, you're going to want to include target surplus. I think the only time that I can think of that you wouldn't want it would be if you were doing a pure statutory, before-tax projection.

With regard to using before or after federal income tax and deferred acquisition cost (DAC) tax, you generally want to include the impact of taxes whenever possible.

A corporate line of business is something that I'm going to talk about very briefly. You want to make sure that you're not allocating income from your free surplus back to the lines, because you'll make bad decisions based on that.

Whether to include new business or not will vary with the purpose of the projection.

Whether to do expenses on a marginal, total or some other basis really depends on the level of discipline at your company. All your expenses should be accounted for somewhere. If you're a disciplined company and you can show marginal expenses and make sure that there's a corporate line

that covers everything else and someone has responsibility for it, then you can get away with that. Most of the time, you're going to want to use total.

Validation is something I'm sure all of you are familiar with. Balance sheet items are an inventory of the extract. The income statement items show your experience. If you can do a one-year backwards projection to get an idea of what your model says should have happened in the last year, that can help to justify your assumptions quite a bit.

The level of sophistication will vary based on what you're going to do with the model and what you're trying to accomplish. Here is an example of how you can take your detailed model and roll it up for cash-flow testing. Say you're testing a line where the liabilities don't vary with interest rates. Your mortality or morbidity doesn't vary with interest rates, but your lapses do. Hold the decrements steady by turning off the pieces that vary with interest rates, and let your morbidity and mortality experience come out. Take the results from that and roll your model back up. Now you have a lot smaller model. Your smaller model could then be used to run the assets through stochastically generated interest rates or how ever you want to do it. If you run multiple scenarios, this process will save you a lot of run time.

You want to use a detailed model, especially for your most recent issue year. It can improve your results, especially the premium and commission income statement items, due to model premiums. You may have old business that was written as annual mode and then last year all of a sudden you started writing monthly mode. Monthly mode shows up much differently in your results. Trending is a good reasonableness check, but can be dangerous if your block is entering an unknown part of its exposure. For example, if you have a block of long-term care that's aging, and you don't have any prior exposure to age 80 or 85, it's dangerous to trend that. There may be a spike somewhere along the way. The same thing would happen in another line of business if you expected shock lapses for some reason.

You want to try not to fall into the trap of an increasingly detailed model. There are many of us who have been filing an actuarial opinion and memorandum for several years now. Every year you go

back and review the model. It seems like there is a tendency to add more to your model every year. I know I fall into that trap. When you look at your model, you want to go back every year and see whether there's something you can roll up that maybe you thought was important, but now you know that it really doesn't add any material information. There's no reason to keep it out there in the detail.

Let's discuss some tools and techniques. You could list cost as a pro or a con between purchased systems and the spreadsheet method. With a purchased system, you pay upfront, but you don't have to keep track of new regulations as closely. Someone else will take care of that for you. Obviously you have to perform reasonableness checks of purchased software. One pro is that you'll get buy in from the regulators, because they've seen these vendor software packages previously. If you're using a spreadsheet, the regulators may look at it a lot closer than they would if you were using one of the common vendor software packages.

You can also use the vendor as an idea generator or as someone to throw an idea past to see if he or she has seen it or tried it before. Sometimes you can get some good advice out of vendors with the spreadsheet method, sometimes the pro on that would be cost, because the initial cost is very low to set up a small spreadsheet. The control factor can be a problem. If you're dependent on one individual, it's the old hit by the bus theory. If only one person knows how this model works and he or she gets hit by a bus, then you're essentially back to square zero.

Another problem with the spreadsheet method can be lack of peer review for reasonableness. There's only one person looking at the model, so no one else is throwing out ideas to help make that model better. It can be easily modified, that's a positive, but in general, it's not going to be as sophisticated. It's going to be essentially a spreadsheet model, just multiplication and addition, and there's not a whole lot more you can do with it than that, especially in terms of the interaction between liabilities and assets.

At Mutual of Omaha, we use a combination of the two. We'll use the purchased system to do a detailed model, but then we'll take the results and put them into a spreadsheet. We build an in-force model and a new business model and adjust the new business premium as a what if. What if the new

business premium is twice as big, how would that affect the bottom line in total? You can see some of your risks and do some what if projections using that.

Having a communication path with senior management is extremely important. It really doesn't matter how good your model is if nobody looks at it. You really want to encourage your management team to provide ideas and suggestions as you're going along. Show them some intermediate results as well. Today's management teams are much more interested and understand much better the risks that insurance companies are taking. Oftentimes, you can use the projections, especially the "what if" analyses, to educate them about some of the risks your company is taking. What if your morbidity is twice as high? What if, on a long-term-care block, your persistency is a lot better than you thought it was going to be? The risks can go a lot of different ways. Sometimes you will be surprised at the results. Test your paradigms.

You should always show your model to somebody else for peer review somewhere along the way. It goes back to the spreadsheet risk, where you're relying on one person. Find someone who you can just throw it out to who works in pricing or does asset work. Find someone who will give you constructive feedback; someone who's not really looking at the pinecones; someone who can step back and take a look at the trees and ask questions. They can be very helpful. Oftentimes you'll miss something that's really obvious to others, and someone with a fresh perspective can really help you out.

Sensitivity testing is really why we do these projections. What if this happens? One of your sensitivities should be the base case. What if things continue as they are? In addition to that, I will toss out a few different things that you could use the model for. This is certainly not all encompassing by any means. It includes morbidity or mortality and things like repricing lag. States don't always approve your increase or decrease in premiums right away, and you could test to see what types of risks you have there.

You should look at long-term-care persistency. You may have concern that the lapses are going to be better than you expected.

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Interest rates is another topic I like to talk about. With health blocks, some people say they don't have to worry about the asset side and interest rates. At least in the back of your mind, you need to make sure that you don't have a mismatch, that your asset and liability cash flows and durations are somewhat close together, especially for your long-term liability blocks like long-term care. You want to make sure that you invest as long as you can on those blocks. You also need to make sure that you're not backing a block of major medical business with z-tranche collateralized mortgage obligations (CMOs). You can have some major risk there that the line managers maybe don't even realize they have.

Health care reform is a risk all of you deal with every day. But another risk would be the tax status for long-term care. How will that end up? Obviously major medical is a daily changing environment. For new business premium your sensitivity would not only be the level of premium, but also what if your premium increases or decreases a great deal? Is the cohort of policyholders going to have the same type of experience that you would have with a continuing stable block? They may have different morbidity characteristics. Then I would suggest a couple of GAAP sensitivities. You could play with your *Financial Accounting Standard (FAS) 115* implementation in terms of whether you put your assets in available for sale versus trading or held to maturity.

For GAAP recoverability and loss recognition, you could play with the provision for adverse deviation and how the DAC amortization changes based on whether it is, for example, at a 5% level or a 10% level. You can do a lot of that in advance before you actually lock in your GAAP assumptions for that year's block of business.

In terms of the type of projections, these would all be GAAP and/or statutory, depending on how your company is managed. I encourage you to try to make one model that will do both on one pass if your company is being managed on both and is interested in the information coming out of both. With short-term projections, you're going to do things like short-term planning, expense budgeting, incentive compensation and maybe even some tax planning. Your long-term projections should be based on economic value added. That should be of paramount importance and be your primary objective. If you get stuck on doing statutory or GAAP projections, sometimes that's not the right

thing. There are a lot of rules out there in statutory and GAAP accounting that may or may not make true economic sense.

With appraisals and acquisitions or divestitures, the market often doesn't allow as much time as you'd really like. There you're bringing in a large block of business in a short period of time. There are some really basic models out there that are currently doing acquisitions. The market requires that. Again, it's the opportunity cost. You do what you can with the time that you have. In terms of asset adequacy or cash-flow testing, it can really be a building block for the other projections. It forces you to do a new extract every year, where a lot of times, if somebody didn't force you to do that, you may not. You may think, well I'll get around to it next quarter and pretty soon it's next year. So asset adequacy can provide a useful by-product as well.

An extension of asset adequacy would be dynamic solvency testing, where you would include new business. Allocation of capital would show the impact on risk-based capital and free surplus. Value-added accounting is another extension that I personally think we should spend a lot more time with, because it looks at, or at least tries to look at, the true economic value of a block of business. With asset/liability management, you can do cash-flow matching, which is very important for a block of major medical. Again, I'd go back to my example, where you don't back a block of major medical with a long-term asset. In addition to cash-flow matching, you should do duration matching as well and be testing different investment strategies. Look at whether you're investing in ten-year bonds or seven-year bonds, look at the different results, and then value the options that you're providing to the policyholder.

In conclusion, the key is to do something now. Don't go off in a room for five years and think you're going to have the answer. Today's management teams want to understand their lines, what they can expect, and how they can impact it going forward. They're interested in what their risks are and want to manage those risks. The last soapbox I'll get on is that models provide the best estimates of the future, but they're not perfect. You're never going to model exactly what happens, but if you do the best job that you can do, it will be a useful piece of information that will help manage the line of business. The next speaker is going to be Paul Janus.

**MR. PAUL JANUS:** My position at Bankers has given me many opportunities to deal with projections in many practical applications. The company was for sale three times and sold twice with countless bidders during those episodes. We have made annual projections for budget/plan purposes. More recently we have done gross premium valuations for the purpose of cash-flow testing and reserve destrengthening. We have also done long-term projections to convince lenders that our cash flow was adequate to repay loans. Projections are also used in the creation of purchase GAAP assumptions. The present value of future profits is the key consideration in purchase GAAP accounting.

In the last four years:

- Bankers was purchased by Consecos, or more accurately, a partnership headed by Consecos. The previous owner (ICH Corporation) remained a partner.
- Consecos then took Bankers public.
- Consecos then purchased the ICH interest.
- Consecos then tried to sell Bankers, in part, to finance another acquisition. This attempt failed to get adequate offers.
- Consecos then decided to buy back the public shares and made an offer to shareholders. This offer was rejected by the board as inadequate based on the advice of consulting actuaries.
- Consecos was able to buy most of the shares on the open market at a price lower than what was offered.
- Consecos now has made an offer to the remaining shareholders.

That's seven different purchase situations, four of which actually involved the purchase of Bankers shares by Consecos. Each of these separate purchases gave rise to a separate purchase price and purchase GAAP accounting. The valuation actuary had an incredibly difficult job to do.

Each of the purposes required different approaches to setting assumptions. It was often easy to vary assumptions so as to create very different results. Sometimes this was not intentional. In fact I have considered calling this speech "Mistakes I Have Made." A few seemingly minor assumption changes have made large differences in the final result.

First, let me express my view on cash-flow testing for health insurance plans that have reserved the right to increase prices and that have short-term claim liabilities. I believe that you will almost always find plausible assumptions that will produce a positive cash flow. The primary exception is when a block of business is in a substantial loss position. Therefore I believe that cash-flow testing for these types of products should be viewed as an expression of what must be done to maintain a positive cash flow rather than a call for greater reserves or surplus. I know assumptions are expected to be "conservative," but I'm not sure what conservative means when choosing a rate increase assumption.

One of the ways to go wrong in setting assumptions is for the assumptions to be internally inconsistent. How can this happen? This can happen by setting your assumptions without a solid set of central principles. This often happens when you look at experience on each factor and extrapolate independently into the future. An example is projecting long-term claim trends by assuming that the average trend of the last two years is appropriate for the next ten, while also assuming that expense ratios will continue to decline (in your very well-run company) at the rate you have experienced over the last several years. Why are these inconsistent? In my view it is because they probably have different underlying inflation assumptions.

### **Types of Assumptions**

Here are various types of assumptions that you must use and some of the results of varying these assumptions:

General inflation rate -- This is probably not used anywhere in your projection directly but is needed as an anchor for most of your other assumptions in a long-term projection.

Claim cost trends -- Long-term projections should have ultimate trends that have a consistent relationship with your inflation assumption; that is, it should move closer to the inflation rate as time progresses. It is important to understand, if your database that's used to develop current trends produces a trend that reflects the aging of the insured, underwriting selection or antiselection upon lapse or not. These are factors that are easy to overlook. I believe, if it is possible, these factors should be taken into account separately, but it may not be easy to do. You must at least be aware

of what is implicitly included your database in order to avoid duplicating some of the same factors elsewhere. Higher claim cost trends can have a substantial positive impact on value if one assumes, as most would, that the company would request and implement rate increases to at least offset these trends.

*Morbidity levels or claim cost tables* -- While it is ideal to have age and duration-specific claim cost tables for each insurance benefit, it is a practical impossibility for most situations and if you have morbidity tables that are close you will be lucky. At best you may be able to develop an actual-to-expected ratio to some proxy table. However, you may find it necessary to start with an aggregate average claim cost per policyholder. Sometimes you will have only loss ratios available to you.

*Rate increase assumptions* -- The most obvious assumption to make is that you will ask for an increase equal to the trends not anticipated in the original pricing. However there are many things to consider. First, if you are currently behind pricing expectations, should you try to get a rate increase that immediately catches up or take a more gradual approach to increased profits or solvency. Have your companies original expectations changed for that product. Perhaps it is possible to lower the claims ratio and still maintain the business in force. If you expect to file certain rate increases, how much will stick? Not every rate increase is likely to be approved as requested, but, if your company is alert and active in working with the states, a high percentage will likely be implemented.

Implementation will be delayed due to the usual practice of applying rate changes on the next premium due date. Premium will also be lost due to a tendency for higher priced policies to lapse at a higher rate. For some plans, higher deaths will cause the average premium to decline. In some cases benefits may be reduced as well, but there is a tendency for well people to lapse and sick people to persist. Maybe you should ask for a higher rate increase in the first place to offset all this. If you make a mathematical calculation that price increases will offset benefit increases (for example, by keeping loss ratios constant), you are implicitly assuming you will ask for high enough rate increases to offset these effects. The values thereby created will only exist if everybody is aware of the pricing

strategy behind these assumptions. Clearly rate increases, persistency factors and claim trends are all interrelated.

*Persistency* --Theoretically lapse assumptions should be made independently of mortality, especially for senior products. This may only be appropriate though if you are able to determine lapse rates by age. Voluntary lapse rate may be declining by age. Lapses should be measured by number of policies not premium dollars. Voluntary lapses are also affected by rate increases or a change in the administrator or owner of the business (often assisted by agents who have no loyalty to the new owner). They can also be affected by a cutback in services such as terminating the agency force. Deaths are not. Voluntary lapses may differ widely by company. This is not expected of deaths. If it is not possible to have separate lapse and death rates, you should at least be aware that using a constant combined rate for all ages implies declining voluntary lapse rates by age. At very high ages this may lead to a "combined rate" that's less than expected deaths.

*Expenses* -- This is perhaps the most interesting issue of all. Typically expenses are divided into percentage of premium expenses such as commissions and per policy or claim expenses for administrative functions. However, it is never clear how overhead should be treated. Some apportion it to the unit cost. Some treat it as a percentage of premium. I favor unit costs per policy assuming you will adjust those costs by an inflation rate. When rate increases are present, using percentage of premium can cause your overhead dollars to grow at a rate that your management would not agree with. Some companies may also take an aggressive stance on cost cutting or productivity improvements and believe their costs will grow at less than the rate of inflation. This is unlikely to continue forever. In many applications, overhead should be projected separately from any specific block of business. If you are buying a block you should only consider the marginal increase in overhead costs which might in fact be zero.

This introduces the concept of buyer versus seller cost assumptions. Does your company expect higher or lower costs when buying a block of business or a new company? There will be an increase in service costs for policies about which your staff is unfamiliar and for which the number of service requests may be greater. This should be considered a part of the cost of acquiring the business along

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with other conversion costs and deducted from the values. Does management want to give the seller cost savings that the buyer believes will occur when he takes over the business? This is often a point of negotiation. It is important that the negotiator know what your assumption was when you produced the values and the effect of alternate assumptions. These can have very large impacts on the value assigned. Unfortunately many negotiators don't listen to the actuaries, or perhaps they don't understand all the issues involved. This often leads to bad deals.

One last point is to read your commission contracts carefully so that you know exactly what the circumstances are that give rise to the percentages quoted in the commission rate schedules. Often the actuary is given a sheet of paper quoting the rates only. Of particular importance is whether or not commissions are paid on rate increases. This makes a huge difference. Values can be understated by half if you miss this.

*Interest rates* -- These should bear a relationship to the expected inflation rate and to the expected duration of the cash flow. On a closed block of business with short-term claim lags, you may have negative cash flows early and therefore a relatively short-term interest rate assumption is appropriate.

*Reserves* -- I believe that minimum statutory reserves should be used for appraisal purposes, and the difference between the actual reserves and the minimum reserves at the time of the valuation should be added to the value. You are implicitly assuming that you will destrengthen to the minimum. For this purpose, I am assuming the minimum reserve is adequate for cash-flow testing. Of course, in a gross premium valuation you make no assumption as to reserves, and you would match the gross premium reserve against your established reserve. Actual reserves should be used for planning purposes. I realize that it is not always easy to know what minimum reserves are or will be in the future for health insurance, since companies must now comply with each state's minimum reserve standard. You should probably use your companies practical solution to the problem, but be aware of the possibility of an opportunity to reduce reserves. Sometimes you are aware of upcoming reserve regulations. Unfortunately it is very difficult to predict when or if individual states will pass regulations. Some regulations for health insurance that we felt were imminent still haven't been

passed. If you are valuing a business, it is very important that your CFO be informed of the effects of potential changes in reserve methods.

I also think that risk-based capital should be treated as if it were a reserve in a valuation. Not all would agree with that, and you must remember to deduct that beginning risk-based capital from surplus. You also must treat this as a reserve when determining asset transfers.

Discount rates -- This rate, in theory, should maintain a relationship with your interest rate assumption, taking into account the perceived risk involved. In practice this is often a matter of negotiation between the parties. Also, in theory, the rate should increase relative to the interest rate assumption as time progresses. In practice you will have trouble explaining this to anybody and there is probably a level rate that will produce an equivalent result. Limiting your projection to a 10- or 20-year time frame is equivalent to using a very high discount rate for years beyond the projection period. There is potentially great value at the end of 10 or 20 years, but you may not believe the assumptions are very credible.

Taxes -- DAC taxes should be treated as an expense. In an analysis of a closed block of business this will result in an increase in value. However, in some transactions, a new DAC tax can be created. Similarly the tax effect of any difference between statutory and tax reserves should be treated as an expense. Normal income taxes would usually be ignored in a valuation or applied to the value at the end. Be careful not to tax effect the "tax items" included in expenses.

The ability to make minor changes in the persistency, rate increase or trend factors and create major changes in value is of great importance. I will try to illustrate with a simple model.

- Inflation rate: 3.5%
- Claim trends: 7% + 3% for aging + 1% antiselection = 11%
- Current premium per policy: \$1,000
- Current claim per policy: \$650
- Rate increases per year including aging: 12%; 99% effective; three-month implementation delay

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- Lapse and death rates: 12%
- Expenses: 20% of premium (commissions) plus \$50 per policy
- Discount rate: 12%
- No assumption as to investment income, taxes or reserves

The present value of profits per policy is \$594. Let's change the assumptions slightly.

- Rate increase: 12.5%
- Lapse and death rates: 11%

The present value of profits per policy is now \$709 or 19.3% higher. It seems to me that, if I put two people at two different desks looking at the same data, they could come up with these two sets of assumptions. It might be as simple as one person decided to use last year's data while the other used the average of the last three years. Now \$30 per share became almost \$36.

Let's go back to the original set of assumptions. We've given the valuation to our CFO and he's ready to talk to the president in the morning. He has packed his briefcase and is on his way home when our attorneys finally release the commission contract. The guy next door comes running in and says, "Hey, commissions are only paid on the original premium, not on the rate increase." You recalculate. The new present value is \$1,036 or 74% higher than the number you just gave your CFO. How good is your relationship with your CFO?

There are many examples of creative value changing or just plain mistakes. I wish you all a great deal of good luck and success in your future projections. Our next speaker will be Brian Reid.

**MR. BRIAN S. REID:** I'm going to focus my comments today on projections for disability income (DI) and long-term care. These products require longer-term projections for your actuarial analysis. I'm going to have a heavier emphasis on disability, since my experience is a bit more current in that line. I want to cover three topics: (1) the types of projections that you perform for disability and long-term care; (2) some ideas on model construction; and (3) some ideas on developing morbidity assumptions based on your company's experience.

## HEALTH FINANCIAL PROJECTIONS

Before I get going, I want to say that I'm going to present these ideas from a few different perspectives. Through my career I've used a lot of homegrown actuarial models. I've also used two commercial systems, and now I represent one of those systems. So I've done a lot of model building work, a lot of projection work, and now I get to work with many of my clients and take a look at how they've designed their models and put structures together. I have learned a lot from that. My goal is to give you some ideas and some thoughts that I hope will help you next time you put together a new model or you start thinking about working on your current models.

For types of projections, I've split them up into pricing and in force, and for the in force I split them further into various management projections, such as regulatory cash-flow testing and appraisal value work. I include pricing, because for DI and long-term care, pricing is a long-term projection. I will refer to the three pricing job types that we have in PTS, but you're going to see that those types are the natural progression of any pricing exercise, no matter what system you're using.

What I mean by micropricing is you start with a single policy; work on features, premiums, and profitability; expand that to the different cells you're going to write business in; and look for a range of profitability that's acceptable. That range depends on your company's tolerance for business mix risk. I've seen some companies where 14% and 16% bracket the acceptable returns, and others where greater than zero and less than 50 works out just fine.

You're going to move then to model office pricing, where you're looking at an aggregate profitability result based on an assumed mix of business. It's here where, if you're including overhead expenses and fixed expenses that have been allocated, your expected production is a very important assumption.

That takes you to macropricing where you're trying to look at different price and production points to solve for your optimal profitability. I always explain macropricing as a tool to solve that age old conflict between marketing and actuarial. Marketing says, give us a lower price and we'll sell a lot more and we'll make up that negative profitability in volume. Actuarial says no, no, no, we have to

raise that price and make a lot of money selling nothing. We all know the right answer is somewhere in between, and macropricing is the best tool to help you find that point.

Let's discuss the terms *standard* or *iterative*. By standard I mean the trial-and-error process, which is most common. You can, however, design models to iterate certain variables to hit profit targets. For DI and long-term care, I'd say the most common variable that people would use is premium, but you can use other variables, too. My favorite one is commissions when you're working on a pricing project. It's a lot of fun to build the ultimate product, with all the features that the field needs, the best competitive premium structure that they absolutely need to sell it, and you solve for the commissions you can afford to hit your profit target. You'll find that the DI policy with the 1% commission is just not that great of a policy after all, and the field is going to be ready, willing, and able to help you work on that design and bring it into a more reasonable box and have it be a more well-rounded product.

For in-force modeling, I want to make some comments about model construction. I've learned a lot about that recently. Before I do, I need to make a distinction between what I call a model and a projection. By model, I mean a representation of some segment of business at a point in time. It's in the model that you're going to store all your product-specific assumptions, design features, and the experience assumptions that you've set based on those features. It's the project where you're taking that model and projecting it forward over some additional assumptions and using various filters and reports to generate the results you're looking for.

Now in my mind the goal is to have one model and various projections. There is no need to recreate a model that represents a block of in-force business. But in order to do that, you have a few considerations for the design. I think the first and most important is modular design. For example, say you create a disability income model, and your model simply lumps all the business together. The first time you present results, the follow-up request is going to be to split it out by noncancelable, cancelable, and guaranteed renewable business. You're going to have to tear your model apart, split it up, and bring it back. Then they're going to say, "Well now I want to look at guaranteed renewable and those four products. What if we raise the rates on these two?"

Instead of going through that in the middle of your modeling process, you should take a look at the lowest level of detail you're going to be expected to provide and build modules. Then stack those up to create the higher order of models that you're going to be looking at in aggregate. You're going to save yourself a lot of work down the road.

Another point I want to make about model construction is what I call data redundancy and trying to minimize that. There's no need for product specific data to exist in more than one place. You should be able to design your model to be able to share common data. The benefits of that kind of design are three-fold. First of all, you're going to minimize your input time and your storage space. Second, you are going to make a much more user friendly model, so that when you want to change things, you only have to change them in one location. Third, you're ensuring consistency across the model by having data shared from one central source.

The last thing on in-force modeling I wanted to talk about was granularity, the level of detail that you're going down to, as you compress this huge in-force block into a reasonable model. It's something that people spend a great deal of time with, trying to balance accuracy with size and unacceptable run times.

For DI and long-term care, you're usually going to start that compression by rating factor, by combining elimination periods, benefit periods, classes, and so on. Then move to issue-year compression where, like Max said, recent issue years you're typically going to model individually, but then as you get to older issue years or less significant issue years, you can lump them together into larger bands. That works fine for your active lines, but I'd say that, for your disabled lines or folks or claim, you are going to want to model them individually and use all the detail that you have for an accurate projection of future benefits.

I now have a list of management projections to make a point. You should be able to perform all of these different projections from a single in-force model. These management projections include planning, forecasting, sensitivity analysis, asset/liability management, and spontaneous requests.

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For filters, we have statutory, GAAP, tax, and internal. Then you must consider the desired results, e.g., cash flows, earnings, loss ratios, monthly or annual flows, and what kind of summary levels you are looking at, going back to that modular design. Using different combinations of the filters and results, you should be able to perform all the different projections right from a single model. To end my in-force modeling comments, I just wanted to mention cash-flow testing and appraisal value. I'm assuming you're appraising your own business, not another block for acquisition. You should be able to perform both tasks for your current in-force model for cash-flow testing. You're going to vary the projection assumptions, but we'll think of them as the scenarios that you're projecting the model across. For appraisal value, simply take into account any macroconsiderations that might have an impact on the overall value of your business.

I wanted to spend the last part of my presentation talking about assumption development, specifically morbidity. It's definitely the single most important assumption you're going to set for your DI or your long-term-care model. What I'm going to assume is that you're working for a company that does not have enough experience to be able to develop your own independent incidence or termination rates. Like Paul said, that's usually the case. There are very few companies with that much experience. So I'll assume instead that you're looking to start with a standard table and make some adjustments to that table to reflect your company's experience.

The example I'm going to use is a modification of the 1985 Commissioners Disability Table. I have to say right now for legal purposes that all the numbers I'm discussing are made up, and are not meant to imply anything whatsoever. The process will start with an actual-to-expected study. I'm not going to go into methodology. There are many different methodologies, but suffice it to say that you're typically going to look at your actual-to-expected results in aggregate and then break it down; looking at individual risk factors, like sex, class, etc., separately, and then bring it all the way down as far as you can, hopefully down to the individual cell levels. So for every combination of those risk factors that you consider significant, take a look at your actual-to-expected ratio.

I'm going to start with incidence rates. Your first consideration has to be, are you looking at single or multiple decrements? If it's multiple decrements, are you going to model that as a single incidence

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rate? Again, I'm going to assume at this point that the goal is to have a set of adjustment factors that varies by cell and by duration from issue. We all know that there are a lot of select and antiselect influences on disability and long-term care today. You're definitely going to want that reflected in your incidence rates. The assumption is you don't have enough data to make measurements of credible actual-to-expected ratios broken down by every risk characteristic and duration. So I'm just going to propose an approximation method to allow you to measure your actual-to-expected ratios by duration and then separately by risk factor combination. Then combine the two for an overall adjustment.

There are two points I want to make. First, you need to do a little bit of weighting, and I point out that you want to weight by expected claims, not exposed monthly benefit. Second, you want to make sure you don't duplicate the adjustment. I will explain what I mean. Consider an example of some antiselect actual-to-expected ratios by duration. Using the weights by duration, my overall incidence experience in this example would be 104% of that standard table. Then I move over to the risk factor side, and for this particular cell or combination of these four risk characteristics I'm going to assume my actual-to-expected ratio is 110%. Now I want to combine those two adjustments. I propose a method where you crossmultiply your durational adjustment by your adjustment for risk factors. You need to then divide by your overall weighted average adjustment, 104%, to come up with the total factor scale on the right-hand side. If you don't do that, you're double counting. What you end up with is a set of adjustment factors that brings this cell back to the 110% ratio you measured, but scales that by duration on an overall basis.

Now, of course, I have to point out this is not perfect. We all know that there is some interactive effect of actual-to-expected ratios by duration and risk factor. If you don't have the ability to measure that because you don't have enough claim experience, this will get you an overall set of incidence rates that's accurate by cell and accurate in total by duration. You're just not getting that small interaction at the combined point.

I wanted to spend a quick moment talking about another approximation method I've seen that initially may seem somewhat accurate. I want to point out that it isn't. Measure your actual-to-expected

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ratios by individual risk characteristics. So, first look at elimination period by itself, then just sex, then just occupation class, and then take a look at these ratios and crossmultiply them and come up with an overall adjustment for that particular cell.

I've done the same thing with my weight factors to supposedly represent the percentage of my total business represented by this cell. I'm here to tell you this does not really work. I don't have time to prove it, but anybody who's interested in that, I have a spreadsheet on my laptop that you can take a look at, that actually shows you the variance. It's definitely possible that this 79% factor could be 100% or 55%, and you will not, if you weight these factors back with these weights, come back to your total actual-to-expected ratio that you measured with your experience.

I've seen this method used, and I wanted to point it out. As I said I thought this was a pretty sound approach, but it really isn't. Then I continued the example by taking that overall inaccurate risk adjustment, combining it with my duration adjustment, but without the division by the weighted average. I've totally overstated my incidence rates.

I want to talk about termination rates. Again I have to assume that you don't have enough claim experience to measure actual-to-expected ratios by every claim duration, by every risk factor. I hope you don't have that much in claim experience. The method I would then propose is to ignore the impact on your termination rates by risk factors and make an overall adjustment by duration. In the context of an example for the Commissioners' Disability Table, you would modify your base termination rates and reapply the multiplier factors. For those of you who are familiar with that table, that will get you some variation by risk factors, but it's only replicating what was intended by the original table itself. If you have significant variance by risk factors beyond that, that's your call as to whether this method is appropriate or not and whether you have the experience to come up with credible adjustments.

To illustrate this with an example, consider a small piece of the durational termination rate table for base termination rates. I have some examples of actual-to-expected ratios at each duration, and I can then develop new termination rates. Then I can present value those back using my original and my

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newly adjusted termination rates by elimination period. I can then develop a ratio of my new claim costs to my original claim costs from the standard table. They vary by elimination period because you're starting your present value calculation at a different point.

In summary, what I've just proposed here is an approach where you can take your company's experience and use it to modify a standard table. Your incidence rates can be adjusted upward or downward in aggregate for your experience and then also adjusted by risk factor or by cell and by duration. Then you make an overall adjustment on your termination rates to ratio the whole claim cost upward or downward. Typically, it seems to always be upward.

**MR. DAVID E. OLSHO:** Paul, you mentioned that sometimes what seemed to be insignificant changes in assumptions have dramatic effects, and you illustrated it. What are the implications of that in the work that we're doing? I have my thoughts. I'd like to hear yours, too.

**MR. JANUS:** I think what's very important is for you to do sensitivity analysis, and to share it with the people who are going to use the projections. I think it's also very important to discuss it with a number of people. I'm talking about peer review, and what you're doing with your specific assumption. Consider the rate increase assumptions, for example. My simplified version only changed by 1/2 a point, and this created a premium per policy of about \$9,000 in the 20th year. It's probable that, if you think about it long enough, the people who are left to pay that premium will have a tough time doing so. Maybe the persistency rate, the antiselection rate, and some of the other rates are not properly stated, and that's why I said earlier, if you make a long-term rate increase assumption, your lapse rates will actually go up by age because they've had the policy for 20 or 30 years and they can't afford it anymore. So there should probably be some grading in those assumptions to take some of the sting out of it. Knowing what you're doing is the most important thing that I can emphasize; and then you must share those variations. Someone must make a judgment. You said you had some thoughts of your own.

**MR. OLSHO:** My thoughts are pretty much along the lines that we do need, in terms of valuation actuary work, to make sure that we're applying appropriate margins, so that we are sure that our

reserves are going to be adequate. Again, that seems like, if we know that certain assumptions are very sensitive or the results are very sensitive for those assumptions, we probably need to be keeping careful track of our experience and modifying those assumptions as necessary, based on experience. So that points you toward what is important to study and look at.

**MR. JAY:** Are there other questions or comments? I have a question that I'll throw out to the audience in general and to Brian. This has to do with the long-tail coverage of disability. Our practice in cash-flow testing is to assume that the disability line is not an interest-sensitive product and doesn't have anything that particularly varies with changes in the economy and interest rates. Beyond that, their assets and liabilities are reasonably well matched, at least by duration. If interest rates fall, we have a reinvestment risk, and we determine how much rates can fall before we have a problem. We write a paragraph in our report for the actuarial opinion explaining what we did. I've heard that other companies have done more elaborate cash-flow testing. It's conceivable that the rates of disablement vary with some economic index and that interest rates also vary with that same index. You could have a correlation between disablement rates and interest rates that would get you into multiscenario type testing. Do any of you have experience in doing something more than we do? Brian, of companies that you worked for or worked with, have others done more than simple tests on disability projections?

**MR. REID:** I would say that in my experience so far they've been quite simplistic. On your statement about economic conditions, I really do feel that is more a driver of experience and a variance in your projection. Perhaps just a few basis points will result in a few hundred basis point change in your earnings on the underlying reserves. To me that was always one of the sensitivity tests. I'm assuming an 8% return forever. What if it's 4%? What if it's 12%? It would be interesting to see some sort of correlation. You really don't have that much of a disintermediation risk for disability, but if you did have higher-than-average lapsation and a very high interest rate environment, and therefore you sell your bonds at a loss, what kind of impact will that have, and will that interest rate environment drive some sort of recessionary type of situation? How would it all fit together, and would it be some sort of compounding effect?

**MR. JANUS:** We do a lot of long-term-care business, and it has similar characteristics to disability income, although it may be that the slope of claim costs is even greater than it is for disability income. So certainly, as you go out into the projection, you're going to have years where your cash flow is negative. It doesn't mean you were wrong, it just means your reserves are now being run down. We've done some sensitivity analysis on the level of interest rates, but we have not tried to do anything on the potential of selling bonds or having to take bonds off at a loss at that point in time. I believe it's the kind of thing that ought to be done. I think long-term care is a product that we're all learning about, and I suspect that there is some risk there.

