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Session 80PD
Income Products: Pricing (PART 2)

Track: Product Development

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Panelists: DOUGLAS C. DOLL
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Summary: This session focuses on the financial issues related to income products. A panel of experts discusses pricing, investment, and risk management in underwriting payout annuities.

MR. KEN MCCULLUM: Income products are clearly a hot topic in the industry. Experts believe demograhpics portend a bright future for these products. In this year's annual meeting, we created a three-part session on income products.

The first session discussed consumer issues with income products. This session, Part 2, will discuss income product pricing. The third session will take an in-depth look at a well established and highly specialized income annuity market, the structured settlement market.

For this session, we have a three-person panel. I'm extremely grateful to both Doug and Steve for donating their time and considerable talents to this presentation.

Doug Doll is from Tillinghast-Towers Perrin in Atlanta. He's been an oft-quoted and published member of the profession for years. Steve Habegger is from Lincoln Re. Originally, he was in annuity product development, then moved on to reinsurance where he's done both pricing and sales.

My name is Ken McCullum. I'm with Hartford Life and my responsibilities include running our institutional products area where we have some specialized payout

annuity products. The first thing I want to do is provide a very high level overview of a payout annuity product. A lot of this is very basic, but I just want to make sure that we're all working from the same perspective.

The product is a single premium product; the consumer pays upfront, one time for the transaction. The benefit the consumer receives in exchange for that premium comes in a variety of formats. The most common form today is the fixed single premium immediate annuity (SPIA) product. Those benefits are typically level. They can also be increasing at some percentage; 2-3 percent a year is common, providing for a cost of living adjustment in the design.

There are also variable payout annuity products. This product form typically adjusts the benefits on some periodic basis, around an animal known as the assumed interest rate. The essence of it is, to the extent the investment returns on the underlying funds exceed the assumed interest rate, the benefits go up. To the extent that they are less than the assumed interest rate, the benefits go down.

A hybrid approach would be an indexed benefit. Here, the benefits will increase or decrease, tied to some index performance. The CPI is an index that has a lot of consumer appeal. You might also see an S&P 500-type index. The annuity benefits can be certain, meaning that they'll be paid to someone, regardless of annuitant longevity. In these products, a beneficiary is designated to receive the benefits in the event that the named annuitant is not alive. The benefits can be life-contingent, which means that payment of the benefits is dependent upon the annuitant actually being alive on a given date. Benefits can also be joint and survivor, meaning that there could be multiple annuitants on the product, typically a husband and wife. The benefit can be reduced if a particular annuitant predeceases the other annuitant, or it can be just on either annuitant dying first, or it can stay level as long as either survives. There are other product features in the marketplace, including a cash refund, where the difference between the premium paid for the annuity and the annuity benefits paid to date, are paid as a lump sum death benefit. Also, there can be commutation of future payments. That's being done in a variety of ways. Also, there are a host of other benefits being introduced by carriers in a rapidly evolving marketplace.

That is a short description of income annuity products, as I know them. I have broken the market for these products into two segments. The first is an institutional marketplace. Sometimes it's also thought of as a group marketplace. The perspective on group versus individual, I think, depends on the audience. It often implies different distribution models with different acquisition costs associated with those models, in terms of economies of scale of getting a lot of consumers in a group setting or getting a single consumer in an individual setting.

The group markets that I most commonly think of today are the pension plans. Defined benefit (DB) plans may buy payout annuities to satisfy retiree obligations or to terminate the entire pension plan. There was a session earlier that discussed

those terminal funding arrangements. There is also the defined contribution (DC) plan where the plan sponsor can offer a payout annuity to retiring participants. From another perspective on group versus individual, it looks more like an individual setting. Instead of the plan sponsor making the decision, the plan sponsor may be offering the product, but the participant will be deciding whether or not to buy and what product choices they want to make to complete their retirement income phase planning.

Another institutional market is the structured settlement market. In the next session in this series, we'll discuss that marketplace in more detail. On the retail side, or the individual markets as I think of them, there's qualified and nonqualified money and very different tax considerations for those two types. There are broker-driven models and direct-distribution models. There's also a huge potential market that's just starting to emerge with annuitizations of deferred annuities, which would look a lot like the retail market from my vantage point.

We have broken this session into three pieces, focusing on three categories of key financial drivers in the pricing of payout annuities. The first is the investment risk, which Doug is going to talk about. I believe that's the single biggest economic driver of a payout annuity—how you manage the investments and deal with the asset/liability management issues. The second aspect of pricing is the longevity risk, which is very different from the mortality risks that our industry is much more used to dealing with. Here an insurer is taking on a population where they're now looking at how long the annuitant is going to live, but your risk is that the population's mortality would improve or beat your assumptions. Your opportunities are that they would be inside of those assumptions or die younger than you might have expected. The rest of payout annuity pricing is what I'll call everything else, and I'll talk about that for a few moments.

To set the framework for how an insurance company might look at the profitability of a payout annuity, the key profit measure that I've seen in practice is a statutory internal rate of return or a GAAP ROE measure of the expected profitability of the future of that product. There's typically a close relationship between the return on investment on the statutory capital basis and the GAAP ROE. The EPR actual projected future statutory profits are zero. The GAAP ROE will be similar and depend, to some extent, on the accounting convention that a company follows.

Another measure that's very common to look at is return on assets. Again, there are subtleties in different ways that companies might calculate this measure. It's defined, typically, as profits divided by assets, but what you'll include in those profits and assets could vary. For example, it may or may not include a consideration of benchmark surplus. Profit margins can be looked at in two different ways, either as a percent of premium or, again, at some present value at some discount rate of future profits divided by the single premium that you've collected to see what sort of a margin you think the business offers. Another margin measure is the investment spread—to look at an implied credited rate on the product versus

your assumed earned rate and see how much of a differential there is. I believe this margin drives your earnings and defines the core profitability of the product.

In terms of the risks that go along with the product, there are asset risks that Doug's going to talk about. I think that's the biggest risk one faces in this marketplace. There are liability risks on the longevity piece. Steve will talk about those. There are also expenses and expense management. This is a unique product in that the asset base that you're working off of, from a theoretical perspective anyway, is rapidly declining as you're paying out benefits. How policyholder maintenance expense looks relative to that asset base over time and what affects inflation and such might have on it is a substantial risk that needs to be looked at in this pricing. There may also be policyholder behavior risk.

Let's look at the product form and the different types of risks that are implied between the fixed, the variable, and the indexed annuity. For the fixed and the indexed, you're really looking at the investment guarantees that you've made. Again, based on all of your assumptions, what's the effective rate that you're crediting to your policyholders? What do you think your likelihood or your probability is of being able to exceed that required return with your assets? The other difficulties, particularly with an inflation-protected annuity or a CPI-linked annuity, are how are you going to match assets to that liability? There's no good way to do that. The only securities that we can find that readily do that are the treasury "TIPS" notes. There's a limited supply and very spotty durations available of those securities. Reinvestment in those securities is also an uncertainty.

On the variable products, there's a great deal of revenue volatility when you think of it from a fee perspective, as that asset base will fluctuate with equity market returns. All of us in the deferred annuity business have become very familiar with the fact that this volatility can go both up and, now apparently, down as well. It was also discussed in the earlier session that there is even more of a risk in this product, because it's co-linked with the longevity risk. To the extent that a block of lives is living longer than expected, this volatility of the returns has a double effect of both the fee uncertainty with it and the potential increase in liability and the additional reserve strengthening that one might have to do. To the extent that there's an upside in the returns if there's greater longevity, you have compounded the problem. To the extent that there's a downside in the returns from what you've expected, you'll collect less fees off the asset base than you may have expected. So, the variable payout annuity has some very unique risk considerations that go along with it.

One of the things that I like to do first is to understand the consumer value proposition. I want to take a brief look at a macro view of competition, which is, in essence, to compare the economics of the payout annuity product to the self-insured option that today most folks who reach retirement appear to be choosing.

What I've done is modeled a sample case: a 70-year old male who had a $250,000 premium and a 10-year certain and life annuity. I'm going to work off of that sample case with some very high-level assumptions to try to understand the economic proposition. We'll also refer to that case for some other profitability perspectives. I took a very, very simple view of that case and then looked at the effects of product costs. I started with the notion that if the product costs nothing, it's a terrific deal for the consumer, the risk pooling. But, in fact, the product does cost something to deliver to the consumer and so I have to figure out what that cost means. I had to figure out whether or not the consumer's going to win the bet; in essence, the longevity bet that he or she has made against the insurance company. I don't think that's really the appropriate way to look at the product, but it's a very easy way to convey it. I think it's a great risk transfer, and it shouldn't be viewed as some win, some lose, but that is the nature of insurance contracts. The lawyers tell me that we sell aleatory contracts, which don't offer fair value for all. Some get more than others do. So, what does it take from a consumer perspective to win that back?

I start with all else being equal, which is probably never true in the consumer's minds, because of everything else that goes with getting into an insurance transaction. If I neutralize the investment perspective and I say, okay, I now have this longevity protection and I'm going to add product costs, what's that going to cost me? For every one percent of premium cost that I build into my product, that means I have to beat my life expectancy by roughly a quarter of a year to win the bet. Paying that one percent looks good if I've beaten the life expectancy table by more than a quarter of a year.

Another way to look at that would be from a percentage of the reserve or percentage of percentage assets basis. Every 25 basis points of cost that's in the product requires me to live roughly one-third of a year beyond expected to win. Taking that to our sample case then, and using that same mentality again, assuming everything else is equal and looking at the cost that we built into that product, which was somewhere in the neighborhood of 150-200 basis points of costs, that sample annuitant of the 70-year old with a 10-year certain has roughly a 35-40 percent chance based on our assumptions of mortality of winning the longevity bet. Now this means that the insurance company has a pretty good chance of covering its expenses and meeting its profit margins, which would be expected. But on an individual basis, I believe that's fantastic consumer value. However, it is very poorly understood. Over a third of the population expected to win the longevity bet is terrific consumer value.

There are some other considerations when pricing these products. First, I would notice policyholder behavior assumptions. As the product market has evolved, there has been a great deal of optionality to the liabilities put in. There is commutation ability, perhaps, optional benefit selections, and asset allocation options in the variable product, which may change over time. You have to really think through all the things that the annuitant could do.

One of the new product forms that I heard described in an earlier session has the ability for the annuitant to receive a commutation of life-contingent benefits. Most insurers only allow commutation of certain benefits. I think that when you look at that and you think if it were a savvy individual on his deathbed, he is always going to exercise that commutation option. A person is not always going to know that he or she is on their deathbed, but that requires a great deal of insight as to how the insured population is going to behave.

In addition, the marketplace allows rate shopping. When it comes to coordination with the investment risk, pricing needs to consider how you keep your rates fresh. We know that investment markets can be very bumpy. If you are stale in your rates, you will either get no business or you will get a lot of business.

In our sample case, we've built in five percent of premium to cover acquisition expense. One of the things you have to consider is how to amortize the recovery of those acquisition expenses. I think there's a range of possibilities here. At one extreme, you can view it as a front-end load and an immediate recovery of those acquisition expenses. Typically, that may be the most efficient way of creating consumer value. The other end of the spectrum would be to amortize it over the life of the product. I think a lot of us may find that the accounting rules that our companies employ require us to look at it more in that regard. With the very long duration of these liabilities, that acquisition expense amortization can become a very costly drain to the product.

Pricing for maintenance costs requires us to look out far into the future. Today, there are limited options in terms of the systems for payout annuities. I think there are a number of companies that are using homegrown systems. What are the costs going to be of maintaining that technology over time? How big a block do you need to develop for that to be a break-even proposition? It's something you need to look at. What effects could inflation have on your assumptions? How expensive is it to track annuitant longevity?

The difference in policy size, as well as the difference in inflation rate, can have a sizable difference in the economic prospects. Another thing that can be significant, especially in the small-size part of the market, is whether or not the benefits are going to be paid in an actual check or if they're going to be electronically transferred to an account. Companies will see, typically, quite a difference in the cost of these two modes. The electronic fund transfer (EFT) modes have gained acceptance, but continue to be something that only some percentage of your population is taking. Frequency or mode of payment could also have a significant impact on your pricing consideration.

As I mentioned before, pricing is quite sensitive to the average size. The sensitivity tests illustrate the difference between a $50,000 premium and a $250,000 premium. It's very hard to know what kind of size we might see in this marketplace. There are a lot of hypotheses that people will do a variety of asset

allocation models, and that some of their retirement assets will go to the payout annuity products. They may also choose, over time, to diversify amongst carriers. So, even though the individuals may be putting a lot of money into this type of protection, what an insurance product receives may be a small percentage of that total.

Further, the statutory reserve considerations and how you manage those in pricing and product management are pretty significant. The valuation interest rate that applies to payout annuities is a unique formula. It's a Moody's bond rolling 12-month average and it's a July of prior year to June of current year period. So, for any given calendar year for the first six months, you have uncertainty as to what the valuation interest rate is that you're going to have to use for that year. It will be more and more certain as each month goes by. For the last six months of the year, you have certainty of what the valuation interest rate is going to be. For 2001, it's 6.75, and for 2002, it's projected to be 6.5 percent. You can have a lot of volatility over time between what you think you're going to earn and what that fixed valuation interest rate is. The dynamics of that will cause your pricing measures to move inconsistently, depending on your profit measures, objectives, and constraints. The return on asset measure will be very different from the internal rate of return (IRR) measure as you have those disjoints between the statutory valuation rate and your earned rate. Simply put, there will be occasions in which you'll have a great deal of statutory reserve strain and there will be occasions in which you can almost have no statutory reserve strain, as the earned interest rates move away from the statutory valuation rate.

Pricing for the valuation mortality tables also require expertise. The group tables roll forward dynamically with each calendar year of issue. The individual table is now a static table. But in applying both the valuation interest rate and the valuation mortality table, you have to have a clear definition of what the policy issued rate (year) is. That can be particularly challenging around yearend, especially when there's going to be a significant move in the valuation standards from one year to the next. You need to be able to clearly determine what you want to do, and then actually accomplish that in practice.

Pricing also has some tax considerations. There's the applicable federal rate (AFR), which is based on a 60^{th} month as opposed to a 12-month rolling average of interest rates, so it lags the valuation interest rate. In the payout annuity marketplace, tax reserves are currently highly efficient. The AFR is well below the statutory valuation rate. I think it's around six percent. You're not allowed to take an extra tax deduction. You're capped at the statutory reserves, but they are fully deductible, at least on the interest rate basis. The other tax considerations are premium taxes, which vary by state. There are a handful of states that do apply premium taxes. Also, there is deferred acquisition cost (DAC) tax, which is 1.75 percent of premium for annuity premiums. In qualified markets, there might be an exemption from the DAC tax.

There are also considerations for managing an in-force block after you've priced it to make sure that you can actually obtain and succeed in your pricing objectives. The first are financial reporting considerations and the ability to look at this block and track gain and loss. It's something that is going to have to be developed in the industry. The mortality gain and loss, which today is not a real well-developed science, as well as the investment rate gain and loss (versus what you had expected) need to be considered. The ability to do experience studies to better differentiate and distinguish inside those aggregate measures where the sources of gain and loss are coming from must also be developed. This information will be needed to make appropriate pricing adjustments. All the sorts of things we're used to doing in established markets are going to be required here. I don't think there's a great deal of industry data available yet, or well-established best practices in the industry as to how we're going to go about doing this.

From a service perspective, one of the unique things that this product requires is that you track the mortality of those annuitants so that you stop paying benefits when they die. That's something that we're used to—people coming to us and telling us that we owe them a benefit. One of the thoughts in this marketplace is that putting in some form of a nominal death benefit may help us in our ability to effectively do this. But you will have to have a process in place to verify that these annuitants are alive. They do have the ability to move around on you and they may move to different countries over time and that can make this job even more difficult.

From a tax-reporting perspective, you have some unique requirements. You have to know whether it's qualified or nonqualified money. Then you have to be able to operate the exclusion ratio. In pre-sale, let folks know what that's going to be. In post-sale, actually report out what portion of each benefit they're receiving is taxable. You must be prepared to deal with the fact that the exclusion ratio changes for those folks who do win the longevity bet and get past life expectancy. Suddenly, they have a much higher taxable percentage. Their after-tax income on a level benefit product will drop.

The service requirements on a variable payout product require you to be able to track investment performance relative to the AIR and probably be able to track different AIRs by policy. They also require some way of doing asset rebalancing, and perhaps even asset-based commissions. This becomes difficult in this marketplace to some extent because there's not an obvious asset base off of which those calculations are made. These products don't have a readily identifiable account value. We have something called a reserve, which appears to be quite a disconnect from the money they put into the policy. So figuring out how you're going to communicate to the policyholders what monies they can move around and how that investment redistribution is going to work over time is something that companies will have to figure out. They also need to figure out whether they synthetically create an account value, provide the reserve values, or just try to put it in some sort of a percentage basis. Then, to the extent that the marketplace

offers commutations, especially if those are market value adjusted commutations, you'll have to have the system and service capabilities to actually perform those calculations over time and track the market value interest rates that those are based off of.

I have tried to present a number of thoughts of the other pricing considerations. The two biggest drivers in this marketplace are clearly the investment and the longevity risk. We'll talk about those in more detail. But if I leave you with nothing else, there are three points that I want to make sure I've shared. The first is the marketplace in which you're offering the product will have a significant impact on your pricing assumptions. Both your mortality assumptions and your expense assumptions and even beyond that, I think, some of the other assumptions about how the business model is going to work. So really, it's vital that you understand the marketplace that you're in to effectively price this business.

The second is that your pricing objectives won't move consistently as the environment changes. If you're focused on a particular objective, but constrained by another objective as things change, as interest rates change, or whatever else changes, you may see that one measure looks particularly bad or particularly good in the change and the other doesn't move in a corresponding fashion. So if you look at a breadth of measures, you'll have to readjust those over time. Probably the simplest application of this is if you've taken an approach in which you want to price the product to achieve a certain IRR goal. Then your approach to providing those rates is to calculate an effective investment spread and apply that in the pricing. That won't work over time as things change in the environment and interest rates move. You will no longer achieve the same IRR with the same investment spread as the difference between the valuation rate and the earned rate moves.

The final thought is that the unfortunate reality in this marketplace is, although we offer terrific consumer value in our products, it's not well appreciated and not well understood. There's been a lot of interest in that issue and I think there's been a lot of progress in putting forth the intellectual arguments, but it still comes down to the emotional trust and faith that this product offers fair value. It's going to require us to find effective ways to communicate to audiences other than actuaries what the longevity and investment risks are—not only that we take on, but that they individually put off onto us. We need to communicate why it's not just a bet against the insurance company, but it's truly an appropriate and necessary risk-planning tool for consumers. On top of that, I do believe that the mechanics of the exclusion ratio make the after-tax comparisons in this marketplace horribly difficult to work through. Hopefully, we can find a way as an industry to promote a cleaner process for that. The product needs a tax-advantaged benefit so consumers will be more inclined to transfer these longevity and investment risks to insurance companies and allow our industry to provide this value to the masses.

MR. STEVEN P. HABEGGER: I'm going to start my presentation with a little warning. This type of risk, longevity risk, is new to Lincoln Re. I think it is really new to most reinsurers. It's not a risk that's been reinsured. We spend a lot of time on the mortality side of things—doing research and coming up with assumptions and, as a result of that, I'm a little biased. I may say something like better mortality when, what I really mean, is lower mortality. And, obviously, it means the exact opposite on the annuity side.

I want to touch a little bit on the mortality impact of the product markets that Ken already went over. On the individual side, here's one of my biases; amazingly, there's no underwriting information. We just don't even know what to do. You have the age and amount and the type of annuity, but other than that you really don't have any information. The policyholder has all kinds of information about his or her health status. You have none. This is going to lead to self-selection. Healthier people are going to be more likely to buy a life annuity and the experience that the industry has fully bears that out.

On the group side, you get a little bit more information. You probably have an industry class that might be able to be used in setting your mortality assumption. For terminal-funded pensions, as Ken talked about, we anticipate we'll have a very similar mortality due to group business. The structured settlements are where we get our medical information. You're able to underwrite this business and it's really a special case in comparison to the other ones. You need medical experts in order to come up with what you think the mortality expectations are going to be given the person's medical history.

I'll give a quick overview of the mortality experience that's available to the industry. On the group side, you have the Group Annuity Reserving (GAR) 1994 Table and Group Annuity Mortality (GAM) Table 1994. This has experience from 1986 to 1990 in it. It's projected forward to 1994. On the individual side, the annuity 2000 table was put together for valuation purposes. There really was a lack of credible new experience and so, for the most part, it's based off the 1983 basic Individual Annuitant Mortality (IAM) table and projected forward to 2000. The Return Premium (RP) 2000 table replaced the 1984 table. It includes experience from 1984 to 1994. It does give some valuable information with regard to differences by active employees, healthy retirees, and disabled retirees. The SOA publishes industry experience studies and reports from time-to-time.

The specific risk factors will have some that apply to certain products and others that won't apply to certain products. One example is retirement date. There's definite evidence in the experience that early retirement dates have worse mortality experience. We attribute this to people having deteriorating health and being forced to retire. United Kingdom group experience shows the exact same thing, which is annuity-type thinking along the individual versus group lines. The difference with individuals is that you've got more self-selection involved. There are also socioeconomic differences. Higher socioeconomic classes will, typically, be involved

more with the individual annuity. On the amount side, there's very strong evidence that there is lower mortality for larger amount annuities. This shows up in group experience, Canadian experience, and the RP experience.

On the industry side, there are definite differences between blue- and white-collar workers. We also took a look at differences by Standard Industrial Classification (SIC) code. There wasn't very consistent experience there, so getting down to that level may not make sense. You also need to be careful, though. There is a high correlation between collar, income, and amount of annuity. So, if you're factoring in a large amount annuity, you don't want to double count things if you're factoring in an industry and it happens to be a white-collar industry.

There typically isn't any mortality pricing differential between single versus joint. However, there's definite experience in the industry that shows married people live longer and better experience on joint policies. However, you need to be careful. The annuitant has all the medical information. You have none of it. They will make choices, so the differences that you may see in that may not really be able to be realized when you reflect the pricing differential between the two products.

Refunding versus nonrefunding is also an interesting case. You would expect the nonrefunding to have lower mortality, as healthier people are more likely to go for the nonrefund. Actual experience is the exact opposite of that, so we've just kind of chosen to ignore that and not make any mortality differential between refunding and nonrefunding.

Bruce A. Carnes and S. Jay Olshansky are Ph.D.s Dr. Carnes is a demographer. Dr. Olshansky is a biologist at the University of Chicago. After hearing them speak at the 2000 SOA annual meeting in Chicago, I really got the bug on where mortality's going. They just talked about base, where you start out, but with longevity risk you really need to pay a lot of attention to mortality improvement and where mortality's going. Dr. Carnes and Dr. Olshansky have spent a lot of time on that and really gave an excellent presentation in Chicago. Just to give credit where credit is due, if you want a quick overview of it, I'd recommend their book that just came out in 2000, called the *The Quest for Immortality: Science at the Frontiers of Aging.*

As good actuaries, if we want to figure out what is going to happen in the future, where do we look first? We look at the history. So start off with historical information from 1900 to 1954. There were vast, vast improvements in mortality. Infant mortality went way down. We had a lot of public sanitation improvement during that time and many viral diseases were eliminated during that time. For the most part, these improvements were concentrated at the younger ages. These are numbers you've probably heard many times before. In the early 1900s, male life expectancy was 46 years, female life expectancy was 49 years. By 1990, that life expectancy at birth for males has gone up to 71 years. The life expectancy for females has gone up to 79 years. Almost all or the majority of that improvement came from this earlier period and, for the most part, it's a one-time improvement

that you can have happen. Once you get everybody living into their 50s and above, and you can't continue to improve infant mortality, you can't continue to improve young mortality for the people that are living. So it really puts a limitation on how much future improvement you can have in life expectancy at birth.

The period from 1900 to 1954 saw a lot of improvement in the younger ages. The period from 1954 to 1968 is another kind of year breakdown. There were very slow improvements for females, and male mortality actually went up during that period. The period from 1968 to 1982 is kind of where everybody focuses on. We had vast improvement in cardiovascular disease and death. For the most part, all this improvement was concentrated in what longevity or immediate annuity issuers are most worried about, the ages of 60 and above.

You will have one age group improving, another age group not improving or getting worse, and by year that will vary as well. The data is fluctuating greatly. The average annual improvement for males over this century is about 0.5 percent and the maximum decline for the older ages occurred in the 1968 to 1990 period where it was all cardiovascular disease improvement.

One other fact that I found interesting in regard to death rates for people 60 and over is that one out of every three years the mortality has actually gone up for the age 60 and above over this period, even during this cardiovascular improvement period. Once every three years the mortality goes up rather than improving. So as you think about improvement, you like to look at averages and just continue to project it out, but it's really fluctuating around.

Another item that's maintained itself through this entire period is the mortality rate doubling time. Essentially, that's the amount of time it takes for the mortality rate at age 35 to double. That mortality rate doubling time has remained constant at around 8-9 years throughout all this time of fluctuating improvement and vast improvements at some ages. Basically, if you're 40 years old at 1948 your mortality rate is doubled. At 70 years old, by 1978-79 your mortality rate is doubled. That has maintained itself. You can use that as a check against just projecting things out, which is the next item I want to talk about.

A two percent per year annual mortality improvement is commonly used by demographers. One aspect of it is, by the year 2090 if you continue to use the two percent improvement on out, every age, every year, you're going to end up with a life expectancy at birth of 100 for males. Really the only way you can justify the two percent adjustment is by looking at very recent experience, which is basically through the cardiovascular disease improvement time period. If you look over the longer period that level of improvement has only happened at very select ages for very limited periods of time. It will go to a different age and they make medical or public safety advances; viral diseases get eliminated and you have improvement there. So, basically, Carnes and Olshansky say you can't do it this way. Basically,

you need to really understand the biology of the human organism if you want to project out into the future.

One model that has been used to do that is risk factor modification. Essentially, changing your behavior in order to, hopefully, live longer. Examples of that would be change in diet, cholesterol drugs, exercise, smoking, etc. These are all behavioral factors that you can change. You can think about this model as different levers. You have a different lever for each bodily system including the heart system, the liver system, lung system, and things like that. The weakest system, the weakest link in that is what's going to determine when you die. It's not the best system; it's the weakest one. It's much easier to accelerate than to decelerate. If you start smoking, mortality goes up. That's really accelerating the use, the lifespan of your lungs and other systems. Another thing that this lever model helps you think about is how you can accelerate anyone and death is going to come earlier. To really make death come later, you're going to have to move all of them down at the same time, essentially, and there's a common conceptual flaw.

Risk factor modification is something that you see in the news all the time. Eat bran, try various diet modifications and there will be an impact on your mortality. There's a very common conceptual flaw made in the news media all the time. They make claims for decelerators, for pulling these levers back, which are really the elimination of somebody pushing the accelerator up. The vast improvement that we've seen in smoking isn't something that you can continue to use to push down. That was a lever that was pushed way up and now it's getting pulled back. Another example of that, as many of you may have heard, is a low-calorie diet among lab rats, extending their longevity. Well, essentially, what's really happened there is your typical lab rat has a very short lifespan because they've caged him up and fed him well and taken care of him. That's not the typical diet lifestyle of a rat. So, when they restrict their diet what they're really doing is bringing them back to what they normally would have. Being in a lab and getting fed well is pushing up the accelerator. They're, essentially, obese, overeating rats and they have a shorter lifespan.

Another model, the Cause Elimination Model, says there are all these various causes of death. Medical science is going to continue to improve on each of those and start to reduce these causes of death. They'll add a model that takes into account all of these things. As things emerge, you can test different scenarios as far as partial cure of cancer or a specific type of cancer and things like that. They've built kind of a rudimentary system for that. You need to take in all the problems associated with this model. There's a lot of interaction between diseases. If you improve cancer and you improve another disease, you can't just add the improvement of those two things. There's a lot of interaction. There are also vast differences by age and gender as far as cause of death and what various medical advances are going to have. New causes will emerge. Alzheimer's wasn't even known about if you go back in time. As we've reduced the cardiovascular disease prevalence, cancer has increased. Those people have lived longer.

Genetics are another warning. I think with genetics there are reasons for pessimism and reasons for optimism. I'd certainly like to think that genetics will allow people to live longer, but after listening to Carnes and Olshansky, I've kind of given up on it. One reason for optimism is we've really made pretty remarkable progress in extending longevity, in extending people's lives with very little information about genetics. That's my only optimistic item.

On the pessimistic side, many or most of the ailments of older ages have a genetic basis and there's no genetic program through evolution for survival. Basically, once you're outside of your sexual prime, where you're reproducing and putting your genes on into the future, once you've lived beyond that time it doesn't matter if you've got some special gene that's going to allow you to live longer. There's no favorable selection for that. You've already passed them on. And this is also evident in other species. Humans have already extended their time span. People are living into their 60s and 70s and are able to take care of grandchildren and things like that. Other species don't have that. Basically, once you're outside of that sexual prime, the reproductive period and caring for your offspring, other species are done. So we've already had a lot of improvement and to continue to anticipate a lot more improvement is very unlikely.

There's also just the inevitable and constant accumulation of damage to the genetic makeup of the human. There's no evidence that anybody's got any solution to that. The sun and whatever other radioactive things are out there just continue to beat away at the human and, ultimately, that's the main cause of cancer. Another aspect specific to humans, the aging in humans appears to be an interaction of many genes. In some species, they found a single gene that might extend the species life a little ways. With humans, it appears to be many different genes and different interactions. We come now to one of my favorite new phrases, which is antagonistic pleiotropy. Pleiotropy basically means different genes are going to do different things at different times in the organism's life. Antagonistic means early on they may do something very important, very needed to the development of the organism. Later on they may do something that's not good and there's a lot of thought that that's exactly what's gone on in Alzheimer's. That you're not going to be able to go back early on in a person's life and you find he or she got an Alzheimer's gene. You're not going to be able to eliminate that because that person needs it for regular development. There's certainly been a lot of speculation about reemergence of other infectious and parasitic diseases.

Let's quickly go over some international experience. We looked at Canadian and U.K. data and used that to augment the U.S. relationships. For the most part, they're very, very consistent. You do need to be careful to understand the differences in tax and benefit plans in the different countries. One example of that is in Canada, given the portability between individual and group and the differences between individual and group have largely disappeared. Another thing to think about in lesser-developed countries where the life expectancy may not be to the

level it is in the United States is you probably want to project higher mortality improvement in the future than what you would in the United States, Canada, U.K.

One interesting thing to think about is: Is the payout annuity a hedge against life risk? Most companies in this business are in both sides of this. It's simple to look at it. You think, well, I make money if people live longer on life insurance. I lose money if people live longer in the payout annuity business. Those two things offset the idea that I can just string right along and I've got everything hedged. That brings up a few issues. One is the guarantee. On the annuity side, it's essentially a two-way guarantee. The policyholder has given up all his money. He can't lapse. We're building in some changes for that, but for the most part it's a two-way guarantee. The annuitant is in it for life and the life insurance company is in it for life. On the life insurance side, it's really a one-way guarantee. The policyholder can surrender at any point in time. If you think about mortality improving, what's happened in the past? What companies have lowered cost of insurance (COIs) or especially in the term market you've really seen rates come down. Well, if you want to try and conserve your business by lowering the COIs in your product, you've essentially spent your hedge. You can't spend it in both places. One thing that that's going to do is make the duration of the annuity contracts much longer than the duration of the life contract. So the ratio may be 5:1, just for example, that you need much more life business to offset the end of new business to whatever extent that's possible.

Some other problems are the age distribution. The average annuitant is much older than the average life insurance holder. Future improvements, in particular, are going to vary in their effect by age. Different ages are going to improve faster, slower, and at different times. Obviously, the impact on annuities' first life is going to be different because of the age distribution. One other problem is as experience emerges there's going to be random fluctuation and you're going to have to be able to, or attempt to, separate out the random fluctuations versus the underlying trend.

One good thing about the hedge between these two things, at least from a reinsurer's perspective, and from a direct writer's perspective, is that it's very good to have a good understanding of the two. It's very easy on the annuitant side to be conservative in your improvement projections, but if you've justified those you've got to apply those on the life side. Now you're being aggressive on the life side. So, by forcing yourself to reconcile, there's still going to be conservatism. There's going to be a gap between the two if you want to price responsibly, but you do need to be able to justify while you've got those differences.

MR. DOUGLAS C. DOLL: While Steve was talking about the different factors applying to mortality and that you couldn't simply add them together, I was mindful. I recently went to a Web site of a large insurer that had a life expectancy calculator on it. It had questions on there like your weight, family history, exercise, whether you wear seat belts or not, and so forth. I put in the most favorable answer to every question and my life expectancy was about 100, so I thought that

was neat. So I put in the most negative response to every single question and it said I died four years ago, so I think they need a little more refinement in that calculation.

I intend to spend most of my time on fixed payout annuities, both the traditional immediate level payouts and structured annuities. But also, I'm going to talk a little bit about the investment aspects of variable payout annuities. For structured annuities, we can also learn some of the investment aspects from the pension closeout business, which has similar characteristics. I'll talk a little bit about those as well.

Mortality and interest are the two key assumptions, as Ken mentioned, for pricing fixed and immediate annuities. It might be helpful to compare interest versus mortality. Which is more important? I like to view both of these as discount rates. In other words, the value of a life contingent payment a year from now is the amount of the benefit. It's discounted for mortality and then it is discounted at the interest rate. The effective discount rates due to mortality by attained age using the 1994 GAM table are interesting. At the young ages, the discount for mortality below age 60 is at one percent or less. The discount due to interest is very significant relative to mortality. When you get to the higher ages the mortality discount becomes larger. If you're looking at a lifetime annuity at age 65 or 70, it gets a little bit squishy as to which is more important, the mortality or the interest.

But we do have those sensitivity tests on the profit analysis that we did and just based on that, the impact of higher or lower mortality is fairly significant. I like to consider the return on assets (ROA) profitability sensitivity. At 10 basis points of investment, yield is equal to about 6 basis points of ROA, which makes sense when you think about the after-tax of 10 basis points is just over six basis points. The difference between higher or lower mortality in these profit tests was equivalent to 30 or 40 basis points and that's the improvement factor assumptions. If you look at the 120 percent mortality or the 80 percent mortality, we're talking about something equivalent to a very large amount of interest. So interest is important, but I would submit that mortality is very important, too.

In preparation for this session, I first reviewed past meeting records to see how this topic has been addressed in the past. There's not a whole lot available, I found. I found one session on product development considerations for immediate annuities and that was from *The Record* in 1991. However, the discussion on investment aspects proved to be predictive of the current situation. Ten years ago it was reported that, traditionally, a single long-term rate was chosen and used to discount liabilities. More recently—and remember this is more recently in 1991—two or more rates were used to try to emulate the shape of the yield curve. A then-recent innovation was to discount using treasury spot rates and all of these variations, growth investment interest rates, were derived and then margins were subtracted for expenses, risk, and profit.

An alternative approach called the cost of funds approach was described. Now, remember, this is 10 years ago. This was described as being, perhaps, unique at that time. Unlike the traditional approach in which you first determine your gross yield and subtract required margins to get a net yield, the cost of funds approach takes a bottom-up approach. You determined the spread to treasuries needed to sell the product, which is acceptable to both the pricing actuary and the investment department. The investment managers are then measured on how well they perform relative to the spread and the product people are measured against how well they can price and sell versus that target.

Ten years later there has been an evolution away from the traditional approach and toward the use of yield curve to spot rates. A few companies are using the cost of funds approach. The latter approaches are more common for the structured settlement and pension closeout business, which is probably due to their larger dollar amounts. I mean there's really a difference between a company that's selling $500 million of structured settlements business a year versus a company that's selling, say, $50 million of immediate payout annuities per year. The larger volume for a few companies in the structured settlement and pension closeout businesses give them more incentive to be a little more sophisticated on how they do their interest rates. One change that has occurred in the last 10 years is a change away from the treasury rate curve and toward the swap curve, and I'm going to talk a little bit more about that later.

I spoke to several companies about the methodologies that they use to determine interest rates. There are a variety of methodologies being used. For many companies, there's a clear distinction between normal lifetime payout annuities and longer-duration payout annuities. Again, these would be companies, say, selling both structured settlement annuities and fixed payout or normal annuitization products. Normal annuitization products are characterized by a reasonably short duration, say, typically about five years, taking into account that a lot of these annuities are not lifetime annuities. They're 5- and –10-year certain payouts. Nearly all the cash flows occur within 30 years.

For example, for a male aged 65, 10 years certain and life for a $1,000 monthly annuity, the initial reserve would be $126,000, but by the end of year 30 it's $4,000. The present value of that $4,000 would only be $500, so it's like $1 over $250 as of the initial reserve. Therefore, for these lifetime annuities and the fixed 5- to 10-year certain annuities, it is reasonable to find an investment strategy that closely matches the liabilities.

Companies generally test their investment strategies against an assumed mix of business, but then to translate that into an interest rate assumption used for pricing the business we see a variety of forms being used. There are four forms I've seen being used. The most common method seems to be when they actually take the projected liability cash flows and match them against a spot rate curve. Other methods that companies have used include calculating the duration of the liability

and taking that spot or that point against the spot rate curve. Another company indicated they do use spot rates for the shorter-term contracts. They're using average portfolio interest rates for longer-term contracts. Another company had two, if you will, proxy rates of interest, one for the shorter-term contracts and one for the longer-term contracts.

Most companies indicated that they were not calculating convexity, although this implicitly needs to be taken into account for discounting if they were discounting each cash flow using spot rates. Convexity also enters into the picture for the companies who are stochastically modeling their assumed portfolio business against their investment of assets.

I think we're going to see a greater use of spot rates for payout annuities, even more so than we see now as companies compete more for these products. One reason I think so is that after several years of a fairly flat yield curve, the yield curve is now much steeper.

To give an indication of how sensitive annuity interest rates are when there is a steep yield curve, I calculated the yield rate for a male, 10-year certain in life for issue ages of 65 and 70. It's a fairly similar pattern for both issue ages 65 and 70. But one thing I will note is at the 30-year cash flow there is a bump up. Just for simplicity of calculation, I took the ending reserve at the end of 30 years and added it to the year 30 cash flow. I did find, though, that there was significance in duration of these two cash flows. The age 65 had a duration of 7.4 years and a duration of the age 70 was only 6.4 years, so there was a whole year difference in the duration.

I used an asset mix of 60 percent single-A rated bonds and 40 percent BBB bonds, and used the corporate bond spread from the J. P. Morgan Credit Metrics Internet site. Since the credit spreads increase with duration, the credit yield curve is even more steep than the treasury curve. I saw a portfolio of bonds that exactly matched the cash flows. The earned rate for issue age 70 before allowance for defaults and investment expense was 6.85 percent. But then if I went back and I did the same calculation for issue age 65, again matching cash flows, I got an interest rate of 7.111 percent, a difference of 26 basis points. So a company that was using the same interest rate to price both age issue 65 and issue 70 could be off by as much as 26 basis points.

Let's look at a couple of the other methods. If I look at the bond that had the same duration as my liability and looked at that bond's yield, it was 6.54 percent, so I would have been off by 31 basis points. If I just looked at the duration of the liability and took the point off the spot rate curve that matched the same duration I'd get 6.32 percent. I would have been off by 53 basis points. So the methodology can actually have a large impact on what interest rate you end up with.

What kind of assets are companies investing in? This is applicable for both the regular payout annuities and for the longer-term payout annuities like the structured settlements. A large majority of these assets are corporate bonds. Liquidity is not an issue with these fixed liability cash flows, so a large portion of these can be private placement. Commercial mortgages are the other significant kind of asset with typical percentage in the 5-20 range, but one company indicated as high as 40 percent. Other assets represent a small portion of the totals. Some, but not all, companies indicate that they have no equities or high-yield bonds. For the longer-term products there might be various kinds of equity positions such as convertible bonds, private placements with equity kickers, and real estate with equity kickers. With regard to the fixed-income asset quality, the majority of the assets would be NAIC Class One, which is A or AAAs. A significant amount would be NAIC Class Two, which would be BBB.

I'm turning now to longer-term payout annuities, namely structured settlements and pension closeouts. The matching of large early cash flows becomes a lot more difficult. A typical portfolio duration might be 10-14 years and there can be significant cash flows beyond 30 years, which represents a reinvestment risk, even if duration can be matched.

As the maturity lengthens, the durations flatten out such that even 30-year bonds have a duration of only about 12 years. So how can you lengthen duration? Well, one possibility is with zero coupon strips, but the yields are not very attractive. Derivatives can also be used, although these are management intensive and don't seem to be used much. One method is to use debt in the early durations to leverage your asset cash flows to the later durations. External debt may not be practical, but you can loan cash flows to other lines of business. Some companies have indicated that this is what they're doing.

None of this fully addresses the reinvestment risk beyond 30 years, however, so we find that companies typically assume a conservative earned rate beyond this period. Speaking to few companies about the methodology they used to arrive at an earned interest assumption for structured settlements and pension closeout business, one reported the development of a single rate for 20 years, a lower rate for years 21-30, and then even a lower rate for year 31 and later. The second one used a single rate for 30 years and then a lower assumed earned rate thereafter. Another company actually modeled for "each type" and performed an asset/liability projection with the assumed mix of assets and liability cash flows and an assumed reinvestment rate to project out the whole series of future earned rates.

Victor Modugno has expertise in 30-year Treasury rules and defined benefit plans. His conclusion is that the 30-year Treasury is no longer a good benchmark for long-term rates. He uses a 30-year swap rate where he's saying an FNMA index should be used. As research for his paper, Vic performed a survey of 10 companies pricing methodology for pension closeout business. The most common response for the investment component was to give a liability duration or projected cash flow to the

investment department to obtain a gross earned rate, which is then used to discount the cash flows for the entire case. One thing we do not know is how the investment department arrived at that rate, so it could be an equivalent rate derived from sophisticated analysis. Only two companies indicated they used spot rates and the same two companies indicated that they used transfer pricing. A few companies said they looked at cost of funds. Unlike the 1991 presentation that I referred to earlier, they based the cost of funds from London Interbank Offered Rate (LIBOR) rather than the Treasury curve, using swaps to get the 30-year curve rate. These swap curve rates are beginning to replace the Treasury curve as the benchmark for analysis. The reason is that there are less 30-year Treasuries as the U.S. debt reduces and the Treasury rates have become more volatile and less related to corporate bond spreads. As noted, swaps are based on LIBOR, which has a credit quality equivalent to a short-term AA rate. Swap rates are now published in the Federal Reserve Statistical Release now available on their Web site.

Carrying out the variable payout annuities can be difficult. The first reaction is that these are protected from investment considerations. The basic benefit does not involve the insurance company having to decide what assets to purchase, but it's kind of already noted the company's income stream comes from the asset charges, mainly the mortality and expense (M&E) charge. Therefore, the company is subject to risk as the underlying account value grows at rates different than assumed. Deferred variable annuity writers, of course, have already discovered just how bad that can be.

Stochastic analysis should be performed to analyze this risk. For purposes of this presentation, I instead chose to refer to the results of the Academy's Variable Annuity Guaranteed Living Benefits (VAGLB) Task Force, which is developing an actuarial guideline covering variable annuities with living death benefits. This guideline would apply to any floor guarantees on payout annuities. One of the options for determining reserves is that the company would perform stochastic analysis, but the guideline would not prescribe the scenarios that should be used, but instead would describe calibration points. Those stochastic scenarios would have to be at least as conservative as those calibration points. The cumulative growth over time at a plus and minus one standard deviation yields a wide range of results over time over a not very wide probability distribution.

I would like to go over the long-term profit implications. For male age 70, 10 years certain and life, assuming an eight percent return, net of investment expense, but before the M&E charge, the return on assets was 48 basis points. Using a plus or minus three percent return, which is roughly equivalent to the 10-year range that the VAGLB Guideline is proposing, the return on assets ranges from 32-66 basis points, which is significant. Perhaps it's not as dramatic as you might have expected and it doesn't highlight the results; however, year-by-year fluctuations in earnings can happen. More dramatic results can be obtained if you are willing to consider lower probability scenarios or even consider what's happened over the last two years. This is why we see some companies considering such tools as dynamic

hedging, not only for their guarantees in equity-based products, but also for the base product itself.

Speaking of guarantees, we are seeing more guarantees of minimum payments in variable immediate annuities. These guarantees are typically eight percent each with 85-100 percent of the initial payment. The charges for these can exceed 100 basis points. Companies typically restrict the investment options to eliminate the riskiest funds. On deferred variable annuities, the typical pricing methodology is to use an actuarial method, where realistic stochastic scenarios are tested, and the price is based either on the mean cost or a cost at some higher percentile such as 80-90 percent. The cost of required capital also might be a factor if the company chooses to hold capital for that risk. These guarantees might be reinsured, although the availability and cost of reinsurance has worsened in recent years. One reason for this is that the hedging cost is frequently higher than the actuarial cost because capital markets would be using risk-neutral scenarios. The implied volatility that is in the capital markets is also larger than they have been historical.

FROM THE FLOOR: Steve, you had mentioned that there are no pricing consideration differences between joint and single. In Canada, we're looking at the differences of the longer payout periods. You also mentioned that there are other experience studies. I've seen Charles Trowbridge's report in the 1994 *Transactions*. Are there any other experience studies that are published?

MR. HABEGGER: I was mainly referring more to life insurance experience studies that have been done on married people.

FROM THE FLOOR: The work I've done so far has just been on population data for that and anything else is anecdotal.